Appendix E
Greenhouse gas assessment

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HVO Continuation Project Amendment

Greenhouse gas assessment

Prepared for HV Operations Pty Ltd

August 2025

HVO Continuation Project Amendment

Greenhouse gas assessment

HV Operations Pty Ltd

H190408 RP1

August 2025

Version	Date	Prepared by	Reviewed by	Comments
1	2 July 2025	P. Boulter	B. McLennan	Draft for client review
2	9 July 2025	P. Boulter	B. McLennan	Draft for expert peer review
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5 August 2025

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Executive Summary

ES1 Background

Hunter Valley Operations (HVO) is an open-cut coal mining complex, located 24 kilometres north-west of Singleton in the Hunter Valley region of New South Wales (NSW). HV Operations Pty Ltd is seeking approval to amend two separate development applications (SSD-11826681 and SSD-11826621) for the HVO Continuation Project ('the Amendment').

This report presents a greenhouse gas (GHG) assessment for the HVO Continuation Project, as proposed to be amended by the Amendment ('the Amended Project'). The GHG assessment supports the application for the Amendment, and has been compiled in accordance with the *NSW Guide for Large Emitters*, published by the NSW Environment Protection Authority (EPA). For this purpose, the Amended Project is treated as a modification to the existing approved operations at the HVO Complex.

ES2 GHG assessment boundary and emission sources

In this report, the GHG assessment boundary for the Amended Project has been treated *conceptually*, in terms of the emission sources that were included and excluded.

The scope 1 emission sources included were on-site liquid fuel (diesel) combustion associated with construction and operation, fugitive emissions associated with coal extraction, blasting using explosives, and on-site land use changes.

For scope 2 emissions, the relevant source was the purchase of grid electricity for on-site use in the coal preparation plant (CPP), electric mining equipment and other electrical applications (lighting, office air conditioning, etc).

For upstream scope 3 emissions, the sources included were the extraction, production and transport of diesel, the purchase of grid electricity, embodied emissions associated with construction materials, and the use of diesel in the transport of materials to the HVO Complex site.

For downstream scope 3 emissions, the sources included were the transport of product coal from the HVO Complex to the Port of Newcastle by rail, the transport of product coal from the Port of Newcastle to overseas markets by sea, thermal coal combustion (for power generation), and coking coal combustion (for steel production, either domestically or overseas).

Several potential GHG sources were excluded from the assessment. Where a particular source was excluded, this was either because it was not relevant, activity data for it were not readily available, or its emissions were unlikely to be material (<1% of total emissions over the life of the Amendment).

ES3 Gross emissions from the Amended Project

In terms of gross GHG emissions from the Amended Project:

- Scope 1 and scope 2 emissions
    - The Amended Project met the EPA's definition of a large emitter, and therefore the procedure in the *NSW Guide for Large Emitters* has been followed in the GHG assessment.

- As current mining operations are approved / capable of continuing to the end of 2026, the scope 1 and 2 emissions from the Amended Project would represent incremental emissions relative to the existing project. The incremental scope 1 and scope 2 emissions would reduce with time, being around 1,125 kilotonnes of carbon dioxide equivalent (kt CO_2-e)/year in 2027, and 184 kt CO_2-e/year by 2045. The reduction would be due to decreases in production volume and fugitive emissions, and the impacts of decarbonisation of the electricity grid.

- Over the life of the Amended Project, the aggregated scope 1 and scope 2 emissions of the Amended Project would be 15,104 kt CO_2-e and 215 kt CO_2-e, respectively.

- For scope 1 emissions, the most significant sources would be diesel consumption (58%) fugitive emissions (39%). These sources have been targeted for avoidance and reduction, by applying the EPA mitigation hierarchy.

- The average scope 1 emission intensity over the life of the Amended Project would be 0.0352 tonnes of carbon dioxide equivalent (t CO_2-e) per tonne of run-of-mine (ROM) coal. This value is low relative to other Australian coal operations in 2023-24 and lower than the default industry intensity under the Safeguard Mechanism.

• Scope 3 emissions

- Scope 3 emissions would be much larger than scope 1 and scope 2 emissions. The aggregated scope 3 emission over the life of the Amended Project would be around 800 Mt CO_2-e.

- Product coal combustion for power generation would be responsible for around 87% of scope 3 emissions, with coal combustion for steel production accounting for most of the remainder (12%).

ES4 Selection of mitigation measures

The selection of mitigation measures, and their application in the emission calculations, is summarised below.

• Scope 1 and scope 2 emissions

- The approach to the selection of mitigation measures has followed the mitigation hierarchy in the *NSW Guide for Large Emitters*.

- The Amendment

  ▪ The Amendment itself would result in significantly lower emissions than the original HVO Continuation Project. This would mainly be achieved by avoiding coal extraction within gas Domain 1 at HVO North, reducing mining at HVO South, reducing the annual production rates across the complex, reducing the period over which mining would occur, and reducing diesel consumption through optimised haulage.

- Planned mitigation measures

  ▪ The scope 1 emission estimates for the Amended Project reflect the current operational practices at HVO in relation to maximising energy efficiency and minimising diesel consumption (e.g. optimisation of haul routes and ramp gradients, payload management, energy-efficient equipment).

        - The scope 1 emission estimates also reflect the avoidance of fugitive emissions, primarily at gas Domain 1, due to the changes in the mine design from the original HVO Continuation Project.

        - Measures for scope 2 emissions include optimisation of CPP operation and electrical mining equipment and decarbonisation of the NSW electricity grid.

    - Evaluation of additional mitigation measures

        - HV Operations Pty Ltd routinely evaluates existing measures and emerging emission-reduction technologies for potential future implementation at the HVO Complex, such as alternative fuels, electric-powered equipment and renewable energy. Mitigation measures are assessed using a range of criteria, including estimated costs, emission-reduction potential and the practicability of deployment.

        - At present, none of the assessed initiatives are considered practicable or feasible for implementation. Every three years, HV Operations Pty Ltd will review technologies and mitigation measures, including whether they are reasonable and feasible to implement.

        - HV Operations Pty Ltd will investigate the feasibility and effectiveness of gas pre-drainage. This will involve a trial of gas drainage in areas identified with high potential. The design of the trial will be developed in consultation with relevant stakeholders and to the satisfaction of the NSW Planning Secretary.

        - Due to the inherent uncertainty in both technical and economic outcomes of such assessment, the potential effects of these measures on GHG emissions cannot yet be accurately quantified.

- Scope 3 emissions

    - HV Operations Pty Ltd anticipates that future export destinations for HVO Complex coal will continue to follow similar patterns as historic sales. The primary countries that HVO Complex coal has been exported to all have Nationally Determined Contributions (NDCs) under the Paris Agreement (or have followed international standards recognised by the United Nations Framework Convention on Climate Change and published their own NDCs document in support of the Paris Agreement).

ES5 Emissions with mitigation measures

- Mitigation measures relating to existing operational practices, as applied in the Amended Project

    - The benefits of mitigation measures relating to fuel efficiency and electricity consumption could not be reliably quantified, as establishing the counterfactual scenario would be hypothetical and subjective.

- Mitigation measures relating to the changes between the original and amended HVO Continuation Project

    - Significant reductions in emissions are expected with the Amendment, particularly in the years from around 2039 onwards. Compared with the original HVO Continuation Project, total scope 1 and 2 emissions would decrease by 11,487 kt CO_2-e over the life of the Amended Project. The major driver of these reductions would be the avoidance of fugitive emissions in gas Domain 1.

- Mitigation measures relating to the Safeguard Mechanism and NSW *Net Zero Future (Climate Change) Act 2023* (the Net Zero Future Act)
    - The Amended Project would continue to emit above the Safeguard Mechanism threshold of 100,000 t CO_2-e per year throughout its life. As a Safeguard facility, the Amended Project would be subject to the declining emissions trajectory required by the Safeguard Mechanism.
    - HV Operations Pty Ltd proposes that the emissions from the Amended Project would be managed in a way that is consistent with the company's obligations under the Safeguard Mechanism (i.e. the decline rate for emissions under the Safeguard Mechanism baseline).
    - HV Operations Pty Ltd also proposes to implement measures that go beyond its Safeguard Mechanism obligations by making additional, voluntary contribution towards the NSW emission-reduction targets to reflect consideration of the Net Zero Future Act.
    - Over the life of the Amended Project, the aggregated net scope 1 emissions with the Safeguard Mechanisms baseline would be 9,510 kt CO_2-e, and with the combined Safeguard Mechanism and NSW decline rate would be 7,965 kt CO_2-e
    - Over the life of the Amended Project, compliance with the Safeguard Mechanism baseline would reduce scope 1 GHG emissions by 5,595 kt CO_2-e, and compliance with the combined Safeguard Mechanism and NSW decline rate would reduce GHG emissions by 7,139 kt CO_2-e.
    - The mitigated emissions for the Amended Project would be the net emissions for the combined Safeguard Mechanism and NSW decline rate.

ES6 Emission benchmarking and goal setting

- Safeguard Mechanism obligations
    - Emission reductions
        - As noted above, emissions from the Amended Project would reduce according to the Safeguard Mechanism baseline and the additional, voluntary contribution towards the NSW emission-reduction targets.
    - Emissions intensity
        - The gross scope 1 emissions intensity of the Amended Project (0.0351 t CO_2-e per tonne of ROM coal) is materially lower than the industry average emissions intensity in the Safeguard Mechanism (0.0653 t CO_2-e per tonne of ROM coal), and is expected to decrease over life of the Amended Project.
        - Applying the Safeguard Mechanism with the additional NSW decline rate, the net emission intensity would be significantly lower: down to around 0.006 t CO_2-e per tonne of ROM coal by 2045, which is an order of magnitude below the industry average benchmark.

- Comparison with NSW emissions
    - The Amended Project would be a relatively small contributor to GHG emissions in NSW. For example, for the combined Safeguard Mechanism and NSW decline trajectory, it would represent between 0.25% and 0.81% (depending on the year) of state-wide emissions in the NSW current policy case.
    - In percentage terms, the Amended Project would follow a lower emissions trajectory than the NSW current policy scenario. In other words, net emissions for the Amendment (including the Safeguard Mechanism and additional NSW decline rate) are projected to reduce at a greater rate (5.1% per year on average) than those for the state (4.4% per year on average). The Amended Project therefore supports NSW efforts to decarbonise.
- Emission goals
    - For the Amended Project, the emission-reduction goals are effectively stated in the combined Safeguard Mechanism baseline and additional voluntary emission reductions to help NSW to achieve its emission-reduction target. HV Operations Pty Ltd is committed to achieving the combined decline rate on a net basis and adjusted for ROM coal production.

ES7 Offsets strategy

HV Operations Pty Ltd will thoroughly consider and assess the feasibility of a range of mitigation measures to avoid or reduce emissions wherever reasonable and feasible.

HV Operations Pty Ltd anticipates that, in the short term, the primary approach to achieving the net emission-reduction targets will involve the use of carbon offsets and Safeguard Mechanism Credits (SMCs). Any carbon offsets and SMCs surrendered will be fully compliant with the requirements of the Safeguard Mechanism. This approach aligns with both the NSW EPA's expectations and the Safeguard Mechanism framework, with HV Operations Pty Ltd having committed to prioritising direct emission reductions where feasible, before relying on offsets.

ES8 Independent expert review

As the Amended Project would have scope 1 and scope 2 emissions exceeding 100,000 t CO2-e per year during its operational life, the GHG assessment has been verified by an independent expert reviewer (Zephyr Environmental).

ES9 Climate change considerations

The locality of the Amended Project, the Hunter region, is susceptible to certain climate change impacts, particularly those associated with heat, water scarcity, and bushfire risk.

These risks are not unique to the Hunter region but are influenced by its environmental and economic profile.

The Amended Project will contribute to global GHG emissions. However, this contribution will be very small as a proportion of global GHG emissions and is not sufficient to materially affect the extent or timing of climate change impacts in the locality, which are driven by global cumulative emissions. It is also not possible to conclude that the Amended Project's GHG emissions will lead to a net increase in global emissions, and therefore contribute to an increase in global temperatures, as this outcome is dependent on multiple factors external to the Amended Project.

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1 Introduction

1.1 Background

Hunter Valley Operations (HVO) is a well-established multi-pit, open-cut coal mining complex, located approximately 24 kilometres (km) north-west of Singleton in the Hunter Valley region of New South Wales (NSW). The regional context of the HVO Complex is shown in Figure 1.1. The HVO Complex is owned by subsidiary companies of Yancoal and Glencore, as participants in the unincorporated HVO Joint Venture. HV Operations Pty Ltd is the appointed manager of the Joint Venture.

HV Operations Pty Ltd is seeking approval to amend two separate development applications (SSD-11826681 and SSD-11826621) for the HVO Continuation Project ('the Amendment') from the NSW Minister for Planning, or delegate, under clause 37 of the NSW *Environmental Planning and assessment Regulation 2021*.

This report presents a greenhouse gas (GHG) assessment for the HVO Continuation Project, as proposed to be amended by the Amendment ('the Amended Project'), which has been compiled in accordance with the *NSW Guide for Large Emitters* (NSW EPA 2025). The report is based upon GHG calculations conducted by Airen (2025).

1.2 Project summary

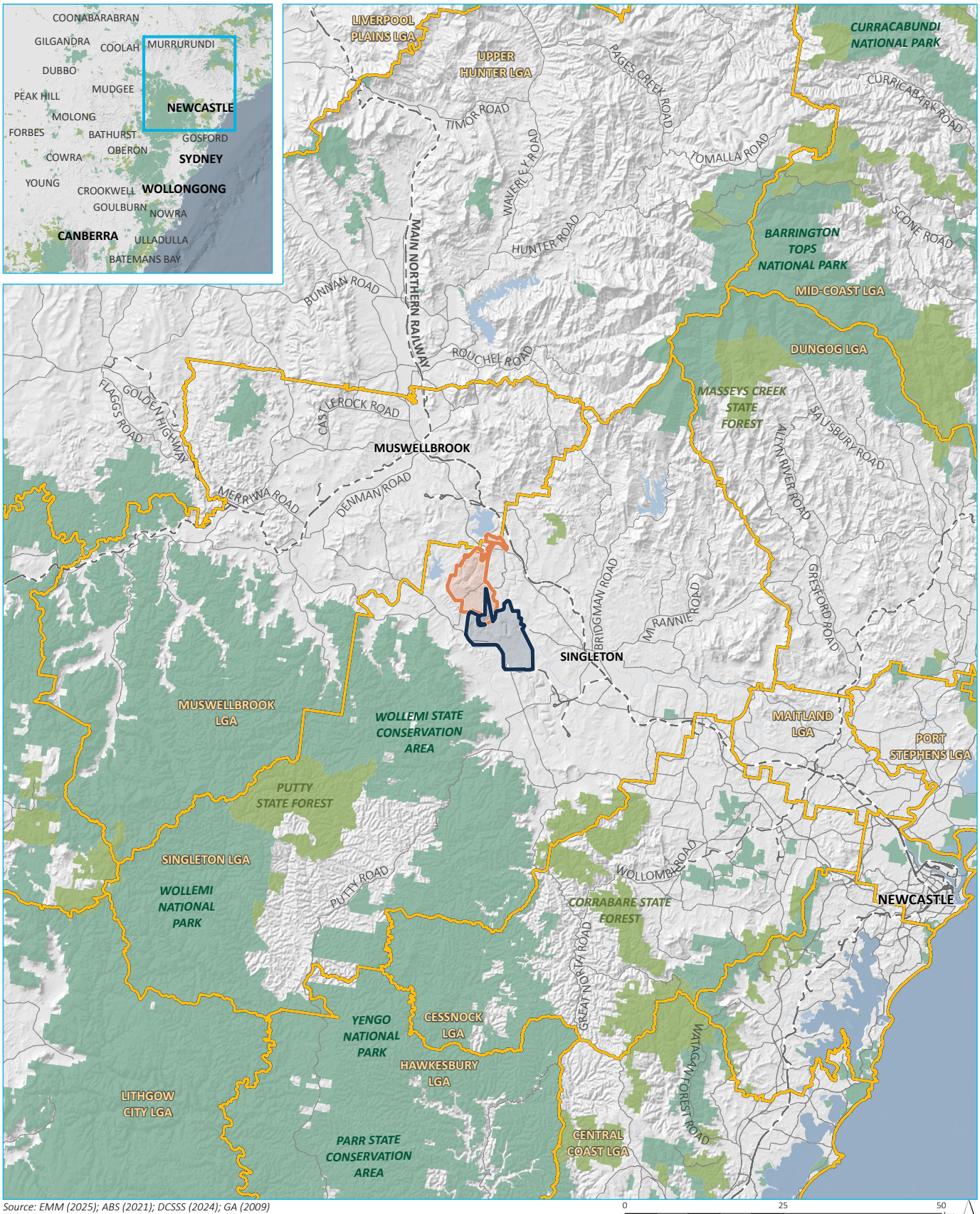
1.2.1 Approved operations

The HVO Complex consists of two mine sites, separated by the Hunter River: HVO North and HVO South. While the two mine sites are approved under separate development consents, they are operated as one complex with fully integrated environmental management systems.

HVO North operates under Development Consent DA 450-10-2003, issued by the NSW Minister for Infrastructure and Planning in 2004. This allows extraction of up to 22 million tonnes per annum (Mtpa) of run-of-mine (ROM) coal until 31 December 2026. 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 Newdell Load Point and Hunter Valley train loading facilities are also at HVO North.

HVO South operates under Project Approval (PA) 06_0261, issued by the NSW Minister for Planning in 2009. PA 06_0261 allows extraction of up to 20 Mtpa of ROM coal until 24 March 2030. Although HVO South is approved to 2030, due to its reliance on the infrastructure of HVO North, it is unable to operate beyond the expiry date of the HVO North approval in 2026. HVO South comprises the approved mining areas of Riverview Pit, Cheshunt Pit, Riverview South-East Extension and South Lemington Pits 1 and 2, as well as the MIA, and the Lemington CPP and rail loop (approved but not constructed).

The key components of the currently approved HVO Complex are illustrated in Figure 1.2.



Source: EMM (2025); ABS (2021); DCSSS (2024); GA (2009)

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KEY

- Existing HVO North development consent boundary (DA 450-10-2003)
- Existing HVO South project approval boundary (PA 06_0261)

Existing environment

- Rail line
- Major road
- Named watercourse
- Named waterbody
- NPWS reserve
- State forest
- Local government area

INSET KEY

- NPWS reserve
- State forest

Regional locality

HVO Continuation Project - Amendment
Greenhouse gas assessment
Figure 1.1

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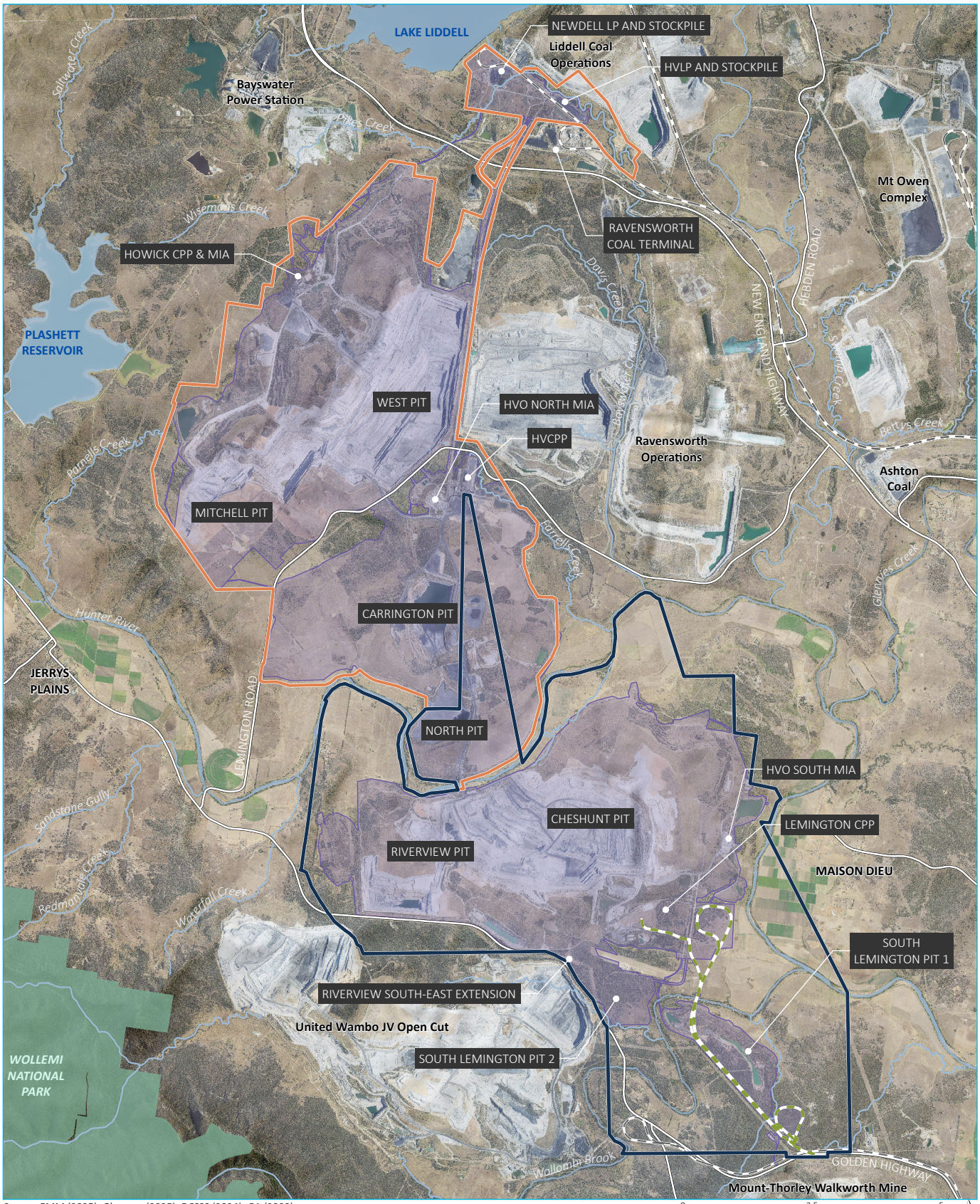

Source: EMM (2025); Glencore (2025); DCSSS (2024); GA (2009)

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KEY

- Existing HVO North development consent boundary (DA 450-10-2003)
- Existing HVO South project approval boundary (PA 06_0261)
- Existing and approved disturbance area
- South Lemington Rail Loop and haul route (approved, not yet constructed)

Existing environment

- Rail line
- Major road
- Named watercourse
- Named waterbody
- NPWS reserve

Existing and approved operations

HVO Continuation Project - Amendment
Greenhouse gas assessment
Figure 1.2

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1.2.2 Original HVO Continuation Project

The HVO Continuation Project in the form originally proposed in SSD-11826681 and SSD-11826621 (referred to in this report as the 'original HVO Continuation Project') would broadly have involved the continuation of mining at HVO North and HVO South, beyond the current approved mining completion dates of 2026 and 2030, to 2050 and 2045 respectively.

Given that the two mine sites operate as one complex, one environmental impact statement (EIS) was prepared for the original HVO Continuation Project (EMM 2022). This supported the two State significant development (SSD) applications, being:

- SSD-11826681 – HVO North Open Cut Coal Continuation Project
- SSD-11826621 – HVO South Open Cut Coal Continuation Project.

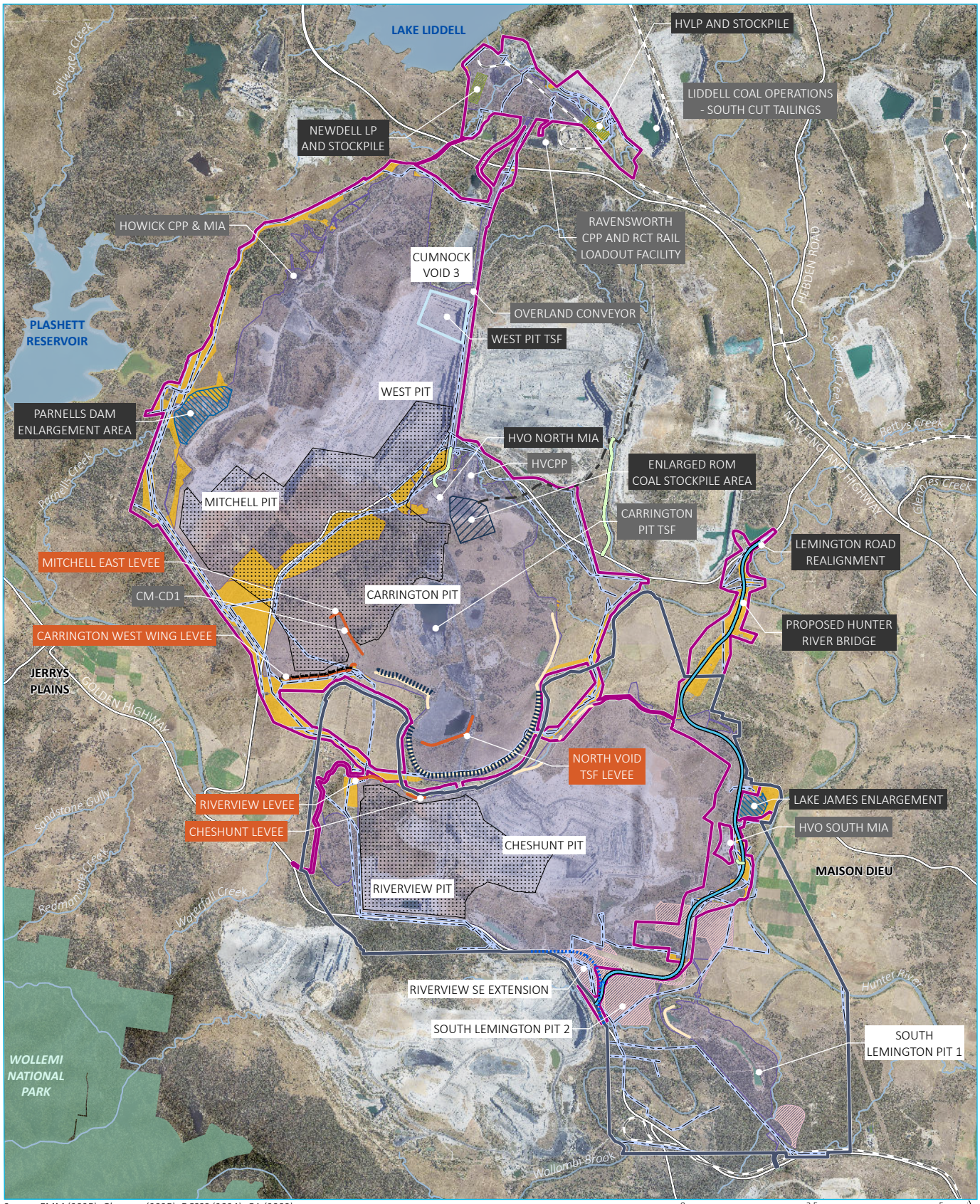
The EIS was prepared in accordance with the Secretary's Environmental Assessment Requirements (SEARs) issued for HVO North and HVO South on 11 March 2021, and the *State Significant Development Guidelines* (NSW DPIE 2022). The EIS was placed on public exhibition in 2023. To respond to matters raised during the public exhibition period, a Submissions Report (EMM 2023a) was prepared, along with an amendment report (EMM 2023b) outlining proposed amendments to HVO North. In response to additional requests for information, further amendments to the original HVO Continuation Project are now proposed (see below).

1.2.3 HVO Continuation Project Amendment

HV Operations Pty Ltd has completed a detailed review of the original HVO Continuation Project, and is now seeking to amend it in the following ways:

- reduce the mine plan to avoid coal extraction within gas Domain 1 at HVO North, and reduce the total ROM coal extraction by approximately 220 million tonnes (Mt)
- maintain the current approved maximum annual production from HVO North of 22 Mtpa, but reduce the approved maximum annual production from HVO South from 20 Mtpa to 13 Mtpa
- reduce the maximum annual production for the HVO Complex to 26 Mtpa from the current theoretical maximum production of 42 Mtpa, or 35 Mtpa with the proposed reduced production limit for HVO South
- reduce the proposed life of mining operations at HVO North by five years, from the end of 2050 to the end of 2045
- reduce the proposed life of mining operations at HVO South by three years, from the end of 2045 to the end of 2042
- expand the HVO North ROM coal stockpile to improve coal management
- temporarily transport product coal by truck from the Howick Coal Preparation Plant (CPP) to the Liddell stockpile for transport to market via the Liddell coal handling and train loading facilities during upgrades of the Newdell Load Point (LP)
- remove approval for the construction and operation of the Lemington CPP and associated rail facilities, which is currently approved, but not constructed, under the HVO South approval
- establish a levee (Mitchell East Levee) to provide flood protection for the final void in Mitchell Pit.

The existing layout of the HVO Complex, and the layout of the Project Amendment, are illustrated in Figure 1.3.



Source: EMM (2025); Glencore (2025); DCSSS (2024); GA (2009)

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KEY

- Amended proposed HVO North development consent boundary
- Proposed HVO South development consent boundary
- Existing and approved disturbance area
- Additional disturbance area
- Previous approved area not retained
- Existing low permeability barrier wall
- Existing levee

Proposed HVO continuation project element

- Approved barrier wall (not yet constructed)
- Alternative Golden Highway alignment
- Lemington Road realignment
- Levee
- Mine access road
- Proposed haul route to Ravensworth Operations
- Transmission line
- Dam enlargement
- Mining area
- Product stockpile
- ROM coal stockpile area
- West Pit TSF

Existing environment

- Rail line
- Major road
- Named watercourse
- Named waterbody
- NPWS reserve

Label format

- Existing item
- Levee
- Project related item

HVO Complex conceptual layout

HVO Continuation Project - Amendment
Greenhouse gas assessment
Figure 1.3

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1.3 Purpose of this report

This GHG assessment has been compiled by EMM to support the application for the Amendment and assessment of the Amended Project.

The *NSW Guide for Large Emitters* (NSW EPA 2025) defines the criteria for identifying whether a given project is a large emitter of GHGs. Based on these criteria, EMM concluded that the Amended Project would be a large emitter (see Section 3.1.2), and the GHG assessment therefore follows the steps in the *NSW Guide for Large Emitters*, with the Amended Project being treated as a **modification to the existing approved operations** at the HVO Complex (i.e. primarily an extension of time of the existing operations).

Note

Although not explicitly required by the *NSW Guide for Large Emitters*, the GHG assessment has also considered the incremental changes in emission from the EIS Submissions Report for the original HVO Continuation Project to the Amended Project, to demonstrate the magnitude of emissions avoidance that has been achieved with the Amended Project.

1.4 Report structure

The remainder of this report is structured as follows:

- Chapter 2 outlines the key legislative and policy assessment requirements for GHGs.
- Chapter 3 provides an assessment of the GHG emissions from the Amendment, following the stepwise approach described in the *NSW Guide for Large Emitters*.
- Chapter 4 provides the summary and conclusions of the assessment.

There are some minor differences between the structure of this report and the structure defined in Appendix D of the *NSW Guide for Large Emitters*. Therefore, the content of the report is cross-referenced to the *NSW Guide for Large Emitters* in Table 1.1.

Table 1.1 Correspondence between this report and the requirements of the *NSW Guide for Large Emitters*

EPA level 1		EPA level 2		EPA level 3		Comments	Addressed in EMM report
No.	**Heading**	**No.**	**Heading**	**No.**	**Heading**		
-	Executive summary	-	-	-	-	Provide a brief description of the project (including the name, proponent, location, project life, project stages etc.).	Section ES1
						Describe the assessment boundary, emissions sources included and the key emissions sources.	Section ES2
						Describe the results from the GHG emissions assessment, including: • scope 1, 2 and 3 emissions estimates in tonnes of CO_2-e per year (average annual for both maximum capacity and planned operational throughput) • key mitigation measures • emission goals and commitment to continuous improvement to ensure they can be achieved (minimum 5 yearly).	Section ES3; section ES4; section ES6
						Describe project's Safeguard Mechanism or NGER reporting obligations if applicable.	Section ES6
1	Introduction	-	-	-	-	Describe the project and specify whether it is a new development or modification.	Section 1.2; section 1.3
						Specify the triggers for the project being classified as a large emitter.	Section 3.1.2
						Identify the IPCC sectors and subsectors of the project emissions.	Section 3.2.2
						Describe the relevant stages of the project and include the period in years for each stage.	Section 3.2.3; section 3.2.4
2	Legislative and policy context	-	-	-	-	Provide an overview of the legislative and policy context as it related to GHG emissions assessment, mitigation and reporting.	Section 2
						This should include the *Climate Change (Net Zero Future) Act 2023*, *Net Zero Plan Stage 1:2020–2030*, *Protection of the Environment Administration Act 1991*, *Protection of the Environment Operations Act 1997* and other relevant legislation and policies, including anticipated NGER and Safeguard Mechanism requirements (if applicable).	Section 2; section 3.5.3

EPA level 1		EPA level 2		EPA level 3		Comments	Addressed in EMM report
No.	**Heading**	**No.**	**Heading**	**No.**	**Heading**		
3	*Missing from Appendix D of the NSW Guide for Large Emitters*						
4	GHG emissions assessment	4.1	Assessment boundary	-	-	Describe the GHG assessment boundary clearly indicating sources to be included and excluded.	Section 3.2
		4.2	Emissions scenarios	-	-	Describe the 'project only' scenario for new developments and projects involving modifications, and the 'business-as-usual' and 'modified-business' scenarios for modification projects.	Section 3.2.5
		4.3	Emissions sources (and emissions from any existing operations)	-	-	List GHG emissions sources within the project assessment boundary.	Section 3.2.1
						Address the scope 1, 2 and 3 emissions sources (consider using a figure to illustrate the emissions sources within the boundary).	Figure 3.1
						Prioritise sources for mitigation and, if required, referencing initial emission estimates excluding mitigations to inform prioritisation.	Section 3.3.4
						For projects involving a modification, provide information on scope 1 and 2 emissions from existing operations, including: • inventoried emissions by source • mitigation measures and offset strategies being implemented • any obligations under the Safeguard Mechanism • current and planned emission goals.	Section 3.3; section 3.4; section 3.5; section 3.6
		4.4	Mitigation measures	-	-	Provide a description of measures to be implemented to avoid and reduce the project's scope 1, scope 2 and scope 3 emissions. For scope 1 and 2 mitigation measures, include the following details from the assessment of mitigation measures: a) whether the planned measures represent the full range of best-practice design, technology and management measures that could be implemented b) the feasibility and likely effectiveness of these measures, including risk mitigation and performance measures to be implemented c) a comparison of the project's emissions and emissions intensity per unit production benchmarked against other comparable projects, best practice, and industry sector standards/milestones where they exist d) where best practice is not proposed to be adopted, provide a robust, verifiable justification.	Section 3.4; section 3.5
						Include reference to the mitigation hierarchy.	Section 3.4
						Include a reference to considering the cost of abatement.	Section 3.4

EPA level 1		EPA level 2		EPA level 3		Comments	Addressed in EMM report
No.	Heading	No.	Heading	No.	Heading		
						Provide the uncertainties in the effectiveness of GHG mitigation measures and contingency actions to ensure level of performance.	Section 3.4.1
						When quantifying emission reductions for the project: • describe how you will record and store data for evaluating performance • include the criteria you will use to determine whether additional measures need to be implemented, such as the contingency measures identified above, should the mitigation measures not achieve the desired level of performance.	
						For projects with scope 1 and 2 emissions exceeding 100,000 tonnes of CO_2-e per year at any time over the operational life of the project, mitigation assessments must be verified by an independent expert review. You must provide evidence that the review has been conducted by an independent and suitably credentialled reviewer.	Annexure E
		4.5	Assessment methodology	-	-	Document emission estimation methods applied.	Annexure A
						Describe the underlying assumptions and data used to develop the emissions estimates.	Annexure A; Annexure B
		4.6	Emissions estimate	4.6.1	Scope 1 and scope 2 emissions estimate	Provide the underlying activity data, emissions factors and emissions intensities (all data that will allow the emissions estimates to be replicated).	Annexure A; Annexure B
						Describe, in tabulated form, scope 1 and 2 emissions for each financial year over the project life, based on maximum capacity and planned operational throughput for each stage of the project and each scenario (as designed).	Section 3.3.3
						Describe the scope 1 and 2 emissions intensity per unit of production or activity.	Section 3.3.3
				4.6.2	Scope 3 emissions estimate	Describe the underlying assumptions used to develop the emissions estimates.	Annexure A; Annexure B
						Provide the underlying activity data, emissions factors and emissions intensities (all data that will allow the emissions estimates to be replicated).	Annexure A; Annexure B
						Describe in tabulated form, scope 3 emissions for each financial year over the project life.	Section 3.3.3
				4.6.3	Independent expert review outcome	Describe the outcome from the independent expert review (if applicable) and attach a copy of the review report to the GHG assessment report.	Section 3.8; Annexure E

EPA level 1		EPA level 2		EPA level 3		Comments	Addressed in EMM report
No.	Heading	No.	Heading	No.	Heading		
5	Emission benchmarking and goal setting	5.1	Reporting obligations	5.1.1	Safeguard	If applicable, provide information relevant to Safeguard Mechanism reporting. Do this for the life of the project. You should include: a) any expected individual facility baseline determinations b) how the project's proposed emission goals align with any expected decline rate for the individual facility baseline c) any sectoral baseline d) how the project's proposed emissions will impact on the sectoral baseline e) how the project's estimated scope 1 emissions intensity per unit production compares to any relevant emissions intensity specified in the National Greenhouse and Energy Reporting (Safeguard Mechanism) rules.	Section 3.6
						If projected emissions exceed Safeguard Mechanism obligations, state how the project's emissions compare with NSW legislated emission reduction goals.	Section 3.6
				5.1.2	Electricity firming infrastructure	If applicable, for the life of the project, describe the obligations for electricity firming infrastructure, including how the project's proposed emission goals align with obligations under the *Electricity Infrastructure Investment Regulation 2021*, including the requirement for net zero emissions from 2036.	Not applicable
		5.2	Goals	-	-	Describe scope 1 emissions goals (long-term and interim), scope 2 emission goals, and consider scope 3 goals.	Section 3.6
		5.3	Emissions trajectory	-	-	Consider developing a graphical figure which shows the project's estimated emissions trajectory taking into account emission goals.	Figure 3.16
6	Offset strategy	-	-	-	-	Provide an estimate of the number of offsets planned to be used for the project.	Section 3.7
						Describe the domestic offsets considered for the project in order to meet the project's emission goals.	Section 3.7
						Describe how the offsets meet the offset integrity principles in the Commonwealth *Carbon Credits (Carbon Farming Initiative) Act 2011.*	Section 3.7
7	Conclusion	-	-	-	-	Describe the results from the GHG emissions assessment including: • scope 1, 2 and 3 emissions estimates • emissions goals.	Section 4
	References	-	-	-	-	Include references to all sources described and used in the assessment.	Section 0

EPA level 1		EPA level 2		EPA level 3		Comments	Addressed in EMM report
No.	Heading	No.	Heading	No.	Heading		
	Appendices	-	-	-	-	Activity and emissions data to be attached as an annexure. Emissions are to be provided for all scenarios.	Annexure A; Annexure B; Annexure C; Annexure D
						For projects exceeding 100,000 tonnes CO_2-e per year, attach documentation and findings from the independent expert review, including evidence that the review was undertaken by a suitably qualified reviewer.	Annexure E

2 Legislative and policy context

This chapter of the report introduces the main GHGs that are the focus of legislation and policy, and the concept of emission scopes. The chapter also summarises the legislative and policy context as it relates to the assessment, mitigation and reporting of GHG emissions. The chapter includes the international context, the Australian context and the NSW context.

2.1 Greenhouse gases and emission scopes

2.1.1 Greenhouse gases

When sunlight strikes the earth's surface, some of it emitted back toward space as infrared radiation (heat). The term 'greenhouse gases' refers to gases that absorb this infrared radiation and trap its heat in the atmosphere. This process – the greenhouse effect – contributes to global warming and climate change.

The GHGs addressed under the Commonwealth *National Greenhouse and Energy Reporting Act 2007* (NGER Act – see Section 2.3.2) are summarised in Table 2.1. The most important gases in relation to coal mining are usually carbon dioxide (CO_2) and methane (CH_4). Coal mines are a minor source of nitrous oxide (N_2O) and sulfur hexafluoride (SF_6).

Table 2.1 Greenhouse gases and characteristics

Greenhouse gas	Characteristics	Global warming potential (GWP)[a]	Atmospheric lifetime (years)[a]
Carbon dioxide (CO_2)	The most abundant GHG in the atmosphere. At coal mines CO_2 is primarily released during fuel combustion.	1	N/A[b]
Methane (CH_4)	Released from coal seams during mining, and from post-mining activities (e.g. coal stockpiles), as well as fuel combustion.	28	12
Nitrous oxide (N_2O)	Released during fuel combustion at coal mines.	265	121
Sulfur hexafluoride (SF_6)	Used as an insulator in electrical switchgear at coal mines.	23,500	3,200
Hydrofluorocarbons (HFCs)	Commonly used as refrigerant gases in cooling systems. Coal mines are a not a significant source.	Dependent on HFC type	Dependent on HFC type
Perfluorocarbons (PFCs)	Used in a range of applications including solvents and insulators. Coal mines are a not a significant source.	Dependent on PFC type	Dependent on PFC type

Notes

(a) From Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (AR5).

(b) No single atmospheric lifetime can be given for carbon dioxide because it moves throughout the earth system at differing rates.

Given that the various GHGs have different global warming potentials (GWPs), it is convenient to express emissions using a common unit. For this purpose, the term 'carbon dioxide equivalent' (CO_2-e) has been defined. For any mass and type of GHG, CO_2-e signifies the mass of CO_2 which would have the equivalent global warming impact. CO_2-e emissions are calculated based on the GWPs of specific gases adopted by the Parties to the United Nations Framework Convention on Climate Change (UNFCCC) and its Kyoto Protocol. In this assessment, GHG emissions are presented in terms of CO_2-e.

2.1.2 Emission scopes

For accounting and reporting purposes, GHG emissions are referred to as 'direct' or 'indirect', and defined according to three 'scopes' (1, 2 and 3). Examples of scope 1, 2 and 3 emissions are provided in Figure 2.1.

The three scopes are defined as follows:

- Scope 1 relates to direct emissions from sources within the boundary of a given organisation (or project), and as a result of the organisation's activities. Scope 1 emissions are determined for the point of release (on-site). They include, for example, emissions from solid and liquid fuel combustion, fugitive emissions and leaks of SF_6.

- Scope 2 relates to indirect emissions associated with the purchase of electricity, steam, heat or cooling at a site. Scope 2 emissions are physically generated outside an organisation's boundaries, such as through the burning of fuel (e.g. coal, natural gas) at an external power station in the case of electricity, but they are included in an organisation's emissions as they are a result of its energy use.

- Scope 3 relates to all other indirect emissions (i.e. other than scope 2) which occur outside the boundary of an organisation but as a result of actions by the organisation, and are generated in the wider economy. Scope 3 emissions may occur upstream, such as during the extraction and production of fossil fuels, or downstream, such as from the transport of an organisation's product to customers.

This GHG assessment considers scope 1 and scope 2 emissions, as defined under the NGER Act, as well as scope 3 emissions, as defined within Australia's National Greenhouse Accounts for facility reporting (DCCEEW 2024a).

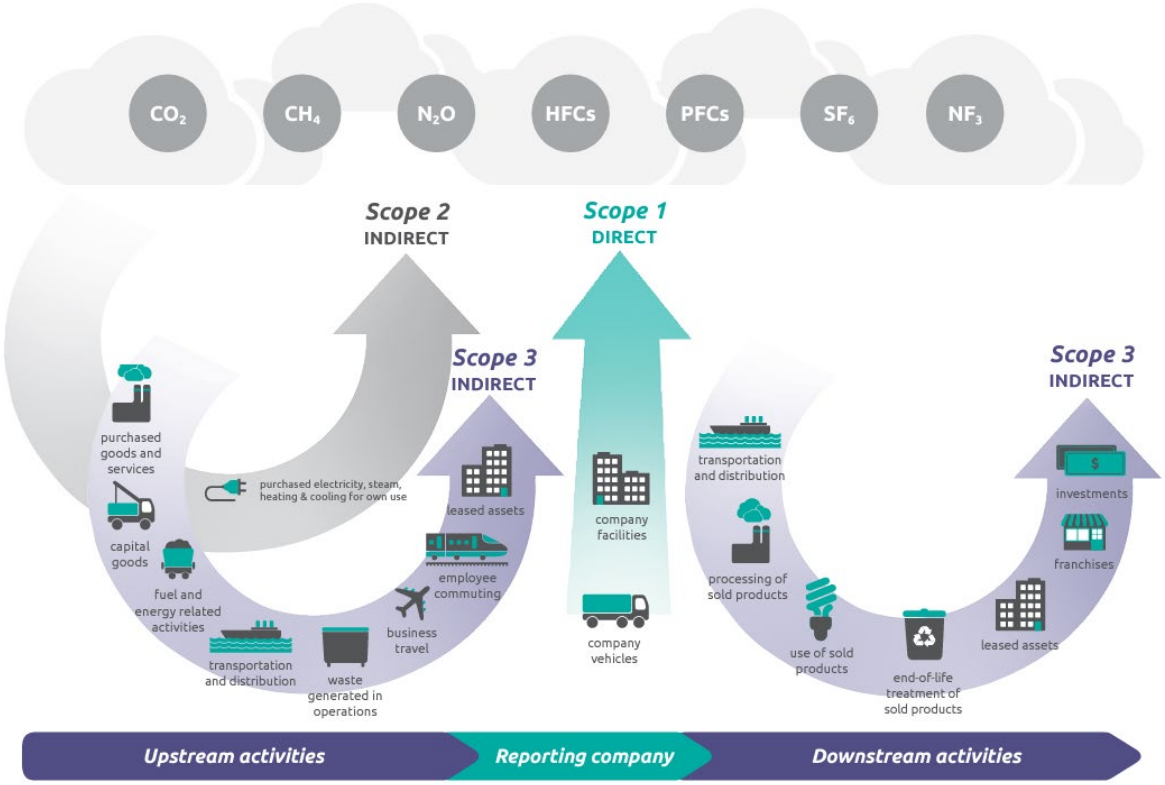

Figure 2.1 Overview of GHG emission scopes (WRI & WBCSD 2013)

2.2 International context

2.2.1 Intergovernmental Panel on Climate Change

The Intergovernmental Panel on Climate Change (IPCC) is the United Nations body for assessing the science in relation to climate change. The IPCC prepares comprehensive assessment reports about the state of scientific, technical and socio-economic knowledge on climate change, its impacts and future risks, and options for reducing the rate at which climate change is taking place. The first assessment report of the IPCC served as the basis for negotiating the UNFCCC. The IPCC released its Sixth Assessment Report (AR6) in 2022/2023. The IPCC also produces a variety of guidance documents and recommendation methodologies for compiling GHG emission inventories.

2.2.2 United Nations Framework Convention on Climate Change

The UNFCCC entered into force in March 2004, and provides the basis for concerted international action to mitigate climate change and to adapt to its impacts. With 198 Parties, the UNFCCC has nearly universal membership. The Conference of the Parties to the Convention (COP) is used to advance the implementation of the UNFCCC.

The objective of the UNFCCC is to stabilise GHG emissions 'at a level that would prevent dangerous anthropogenic interference with the climate system'. It states that 'such a level should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened, and to enable economic development to proceed in a sustainable manner'[1].

2.2.3 Paris Agreement

The Paris Agreement, which the Australian Government has signed, is a legally binding international treaty on climate change. It was adopted by the (then) 196 Parties to the UNFCCC at the 21st United Nations Climate Change Conference (COP21) in Paris, France in December 2015, and entered into force in November 2016. Its overarching goal is to hold the increase in the global average temperature to well below 2°C above pre-industrial levels, and pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels. Under the Paris Agreement, all parties are required to put forward GHG emission-reduction targets through Nationally Determined Contributions (NDCs). All parties are required to report on national emissions, with a review of targets every five years from 2020.

2.3 Australian Context

2.3.1 Climate Change Act 2022

The Commonwealth *Climate Change Act 2022* (CC Act) provides the legislative framework for implementing Australia's net-zero commitments under the Paris Agreement, and sets out Australia's GHG emission-reduction targets. Australia has committed to reducing its GHG emissions by 43% below 2005 levels by 2030, and achieving net-zero emissions by 2050. The CC Act also introduced a requirement for an annual climate change statement to parliament, supported by independent advice from the Climate Change Authority (CCA).

2.3.2 The National Greenhouse and Energy Reporting Act and Scheme

The NGER Act, administered by the Commonwealth Government, establishes a national framework (the NGER Scheme) for corporations to report GHG emissions, energy consumption and energy production. The framework covers the measurement, reporting and verification of GHG emissions.

[1] https://unfccc.int/process-and-meetings/the-convention/what-is-the-united-nations-framework-convention-on-climate-change

Companies that exceed the NGER Scheme thresholds[2] of 25,000 tonnes CO_2-e per year for a facility, or 50,000 tonnes CO_2-e per year for a corporation, are required to register and report annually on their scope 1 and scope 2 emissions to the Clean Energy Regulator (CER).

HVO currently reports annual GHG emissions under the NGER Scheme.

The NGER Act is underpinned by the Commonwealth *National Greenhouse and Energy Reporting Regulations 2008* and the *National Greenhouse and Energy Reporting (Measurement) Determination 2008* (the Measurement Determination). The Measurement Determination provides methods, criteria and measurement standards for calculating GHG emissions and energy data. It covers scope 1 and scope 2 emissions, energy production and consumption. It identifies several calculation methodologies to account for GHGs from specific sources relevant to coal mining, based primarily on the National Greenhouse Accounts (NGA) Factors.

2.3.3 The Safeguard Mechanism

The NGER Act also provides a framework for Australia's highest emitting facilities to manage and report on their GHG emissions. This framework is the Safeguard Mechanism[3], which was first legislated in 2014 and has been in place since 2016. Reforms to the Safeguard Mechanism took effect in 2023, to ensure that the facilities it covers will contribute to meeting Australia's GHG emission-reduction targets.

In general terms, the Safeguard Mechanism applies to facilities[4] with scope 1 emissions[5] of more than 100,000 tonnes of CO_2-e per year, known as Safeguard facilities. It sets legislated limits – known as baselines – on the GHG emissions of these facilities. These baselines decrease on a trajectory that is consistent with achieving Australia's GHG emission-reduction targets of 43% below 2005 levels by 2030, and net zero by 2050. The baselines will decrease at 4.9% per year from 2023 to 2030, followed by 3.285% per year thereafter.

If a Safeguard facility exceeds its baseline, then it must take actions to reduce its emissions, such as surrendering Australian Carbon Credit Units (ACCUs) or Safeguard Mechanism Credits (SMCs) equal to the excess emissions. Facilities that have emissions below their baselines may apply to receive SMCs.

In 2023-24 there were 219 Safeguard facilities. These facilities produced 31% of Australia's GHG emissions in that year (CER 2025).

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

2.4 NSW context

The overarching NSW Government legislation and policy documents on GHG emissions and climate that are broadly relevant to this study are summarised in Table 2.2.

The NSW Government policy on coal mining, which is also relevant to the study, is summarised in Table 2.3.

[2] The thresholds are also stated in terms of energy production/consumption.

[3] https://www.dcceew.gov.au/climate-change/emissions-reporting/national-greenhouse-energy-reporting-scheme/safeguard-mechanism

[4] Grid-connected electricity generators are treated separately.

[5] The threshold applies to actual (gross) emissions from a facility, and does not consider any offset or displaced emissions.

Table 2.2 NSW Government legislation and policy on GHG emissions and climate

Title	Description	Reference
NSW *Climate Change (Net Zero Future) Act 2023* (the Net Zero Future Act)	Establishes guiding principles for action to address climate change that consider the impacts, opportunities and need for action in NSW. Legislates NSW target reductions in GHG emissions of 50% of 2005 levels by 2030, 70% of 2005 levels by 2035, and net zero emissions by 2050. Sets an objective for NSW to be more resilient to a changing climate. Establishes an independent, expert Net Zero Commission to monitor, review, report on and advise on progress towards the targets.	-
NSW Climate Change Policy Framework	Sets out the NSW Government's long-term goals of achieving net-zero emissions by 2050, and making NSW more resilient and better adapted to a changing climate.	NSW OEH (2016)
Net Zero Plan Stage1: 2020–2030 (the Net Zero Plan)	Foundation for NSW's action on climate change. It outlines the NSW Government's plan to grow the economy, create jobs and reduce emissions during the 2020s.	NSW DPIE (2020)
Net Zero Plan Stage 1: 2020–2030 Implementation Update *Net Zero Plan Implementation Update 2022*	These provide updates on the key achievements of NSW Government under the Net Zero Plan, and commit NSW to reducing emissions by 50% below 2005 levels by 2030, and 70% below 2005 levels by 2035.	NSW DPIE (2021a) NSW OECC (2022)
NSW Climate Change Adaptation Strategy	Sets out the NSW Government's strategic approach for managing the impacts of climate change on the State.	NSW Government (2022)
NSW Waste and Sustainable Materials Strategy 2041	Sets out how NSW will transition to a circular economy over the next 20 years, including key reforms for reducing GHG emissions from materials (embedded carbon) and the waste sector.	NSW DPIE (2021b)
NSW Guide for Large Emitters	This defines the GHG assessment requirements for new projects and modifications to existing facilities that are likely to have 'large' emissions.	NSW EPA (2025)

Table 2.3 NSW Government policy on coal mining

Title	Description	Reference
Strategic Statement on Coal Exploration and Mining in NSW	Sets out the NSW Government approach to the global transition to a low-carbon future, consistent with Australia's ambition under the Paris Agreement, and how it is managing the impacts for coal-reliant communities. The Statement recognises that "Ending or reducing NSW thermal coal exports while there is still strong global demand would likely have little or no impact on global carbon emissions", and acknowledges the "currently limited practical substitutes" for coking coal.	NSW Government (2020)

The EPA is one of the primary environmental regulators for NSW. Although it has historically regulated some GHGs, the EPA has traditionally focussed on the local and regional impacts of projects and developments on health and the environment. It has recently expanded its focus to more explicitly regulate the causes and consequences of climate change in NSW. The EPA policy documents that are relevant to this study are summarised in Table 2.4.

Table 2.4 Key NSW EPA legislation and policy on GHG emissions and climate

Title	Description	Reference
NSW *Protection of the Environment Administration Act 1991*	Outlines the EPA's statutory objectives and duty to address climate change. Section 6 of the Act outlines the EPA's statutory objectives to protect the environment and human health. The key elements are: • to protect, restore and enhance the quality of the environment in NSW, having regard to the need to maintain ecologically sustainable development • to reduce the risks to human health and prevent the degradation of the environment, including by taking action in relation to climate change. Section 9 of the Act imposes a statutory duty on the EPA to develop environmental quality objectives, guidelines and policies to ensure environment protection. This includes protection of the environment from climate change.	-
NSW *Protection of the Environment Operations Act 1997* (POEO Act)	Sets out EPA's statutory powers and regulatory tools, including environment protection licensing. Schedule 1 of the Act sets out the types of activities that need a licence. The EPA is required to consider its statutory objectives (above) when exercising its licensing functions.	-
Climate Change Policy	Supports and builds upon NSW Government's climate change policies and initiatives. The main purpose is to address: • the EPA's statutory objectives to protect, restore and enhance the quality of the environment in NSW, and to reduce the risks to human health and prevent the degradation of the environment • the EPA's statutory duty to develop environmental quality objectives, guidelines and policies to ensure environment protection from climate change.	NSW EPA (2023a)
Climate Change Action Plan 2023–26	Designed to deliver the Climate Change Policy. The Action Plan sets out: • the specific actions the EPA will take over the three years that it covers • the regulatory action the EPA will consider over the medium to longer term, where an increased regulatory response may be required to support the NSW Government's climate change commitments and policies, including achieving net-zero emissions in NSW by 2050.	NSW EPA (2023b)
Strategic Plan 2024–29	Describes how the EPA will deliver stewardship for the environment to protect, restore and enhance the environment and human health. It sets out commitments to effective regulation and a focus on high quality environmental outcomes across all of EPA's work. The plan details objectives and outcomes for three key areas: • caring for country • driving action on climate change • enabling a safe circular economy.	NSW EPA (2024)
Waste Delivery Plan	Outlines the actions the EPA take to reduce the harmful impact of waste and drive behaviours that create a circular economy. The Waste Delivery Plan includes actions to reduce carbon emissions and building the resilience of the waste sector to climate change.	NSW EPA (2021)

3 GHG emissions assessment

3.1 Overview

The GHG assessment has been compiled in accordance with the *NSW Guide for Large Emitters* (NSW EPA 2025). This firstly involved categorising the Amended Project, identifying whether it would be a large emitter, and then following the required assessment steps.

As noted earlier, the two mine sites – HVO North and HVO South – operate as one complex, and a single EIS was prepared for the original HVO Continuation Project. This GHG assessment also therefore considers the complex as a single entity, with no distinction between the two sites, and is therefore applicable to the Amendment Report for both HVO North and HVO South.

3.1.1 Categorisation of project

The *NSW Guide for Large Emitters* distinguishes between two categories of project:

1. new proposals that are likely to have large emissions
2. proposed modifications to existing licensed premises that are likely to have large *additional* GHG emissions.

The Amended Project would be a modification to an existing project.

3.1.2 Large emitter status

The assessment requirements of the *NSW Guide for Large Emitters* apply to a given project if it is identified as a large emitter. NSW EPA considers a project to have large emissions if it meets three criteria. The application of these criteria to the project is shown in Table 3.1.

The third criterion actually requires the definition of assessment scenarios and the calculation of GHG emissions. The assessment scenarios followed on from the categorisation of the project, and they are defined in Section 3.2.5.

The results of the supporting GHG calculations for the Amendment and the Amended Project are presented in Section 3.3.3. The emission estimates excluded any carbon offsets. The threshold for large emitters of 25,000 t CO_2-e was projected to be exceeded in all years of operation.

Table 3.1 NSW EPA criteria for identifying large emitters

Criterion	Applicability to Amended Project
Does the project require development assessments and approvals under the EP&A Act?	Yes
Does the project involve one or more scheduled activities under Schedule 1 of the POEO Act and/or will be carried out at an existing licensed premises?	Yes
Is the project likely to emit (within the GHG assessment boundary) 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? [(a)]	Yes (see summary of emission calculations in Section 3.3.3)

Note

(a) For a modification, the threshold refers to an *additional* 25,000 t or more of scope 1 and 2 emissions in any financial year when the modification project becomes *operational*, over and above emissions from the existing licensed premises. The 25,000 t CO_2-e threshold applies to operational emissions only, to ensure that the GHG assessment requirements do not create a barrier for projects that will have low operational emissions but large construction emissions in the short-term.

3.1.3 Assessment steps

As the Amended Project has been identified as a large emitter, the GHG assessment followed the eight distinct steps in the *NSW Guide for Large Emitters*, as summarised below.

- **Step 1**: Describe the assessment boundary and scenarios
  - This involves describing the GHG assessment boundary established for the Amended Project, the project stages, the project timeframe and the scenarios included.
- **Step 2**: Characterise and prioritise sources of GHG emissions
  - This involves calculating annual emissions for all sources of scope 1, 2 and 3 emissions, and prioritising the sources for mitigation.

Notes

The *NSW Guide for Large Emitters* provides guidance on the calculation of GHG emissions at step 4. However, the prioritisation of emissions in step 2 actually requires emissions to be calculated earlier. Therefore, in this report it has been assumed that step 2 involves estimating emissions excluding planned mitigation (as discussed in section 4.2 of the of the *NSW Guide for Large Emitters*), and step 4 involves a *recalculation* of emissions following the identification of mitigation measures.

The *NSW Guide for Large Emitters* notes that in this step emissions may initially be estimated excluding mitigation. However, in the case of a coal mine there are a number of 'inherent' measures that are considered to represent best practice, such as minimising the length of haul routes, payload management and consideration of energy efficiency during procurement. These measures are commonly implemented as best practice in the mining sector, and have therefore been reflected (although not quantified explicitly in terms of their effects) at this step. A counterfactual case (i.e. without these measures) has not been considered, partly because it would not occur in practice, and partly because it could not be reliably characterised.

- **Step 3**: Select measures to avoid and reduce emissions
  - This step involves the identification and characterisation of mitigation measures, taking into account the EPA's mitigation hierarchy.
- **Step 4**: Estimate emissions with mitigation measures
  - This step involves recalculating emissions, considering any emissions avoidance and mitigation measures that will be implemented.
- **Step 5**: Emission benchmarking and goal setting
  - This step involves establishing long-term and interim emission-reduction goals for the project for scope 1 and scope 2 emissions, considering regulatory obligations (e.g. Safeguard Mechanism) and proposed mitigation. The goals should include efforts to reduce emissions leading towards net zero by 2050, and must consider the NSW interim net emission-reduction targets.
- **Step 6**: Offsets strategy
  - This step involves describing any carbon offset strategies to address residual project emissions that cannot be avoided or reduced.

- **Step 7**: Independent expert review
    - Projects with scope 1 and 2 emissions exceeding 100,000 t CO_2-e per year at any time over the operational life require mitigation assessments to be verified by an independent expert reviewer. This threshold would be exceeded in every year of operation for the Amended Project (see Section 3.3.3), and therefore an independent review was commissioned by HV Operations Pty Ltd.
- **Step 8**: GHG assessment report
    - This step involves the production of a GHG assessment report (i.e. this report). The report broadly follows the structure and content described in Appendix C of the *NSW Guide for Large Emitters*.

The application of these steps is described in more detail below.

3.2 Step 1: Assessment boundary

Step 1 in the *NSW EPA Guide for Large Emitters* involves defining the following for a given project:

- the emission sources
- the stages
- the timeframe
- the emission scenarios to be assessed.

These aspects are addressed below.

3.2.1 Emission sources

In this report, the GHG assessment boundary for the Amended Project has been treated *conceptually* in terms of emission sources, as shown in Figure 3.1. The figure shows the emission sources that were included, and those that were potentially relevant but excluded (the reasons for exclusion are explained later in this section).

The emission sources that were **included** in the assessment represented the most significant sources associated with the Amended Project.

For scope 1 emissions, the sources included were:

- On-site liquid fuel (diesel) combustion associated with:
    - Construction of the Amended Project.
    - Operation of the Amended Project. The Amended Project would feature conventional open-cut mining techniques, which are largely dependent of the use of diesel-powered equipment. Fossil fuel consumption associated with progressive mine rehabilitation was also included.
- Fugitive emissions associated with coal extraction, based on Method 2 (further details of which are provided in Annexure A). These also included on-site fugitive emissions for 'post-mining' activities such as the handling, stockpiling and processing of coal.
- Blasting using explosives.
- On-site land use changes. The Amended Project is not likely to result in significant land use change. The emissions associated with loss of the carbon sink due to the clearing of vegetation relating to construction (2027 only) were determined.

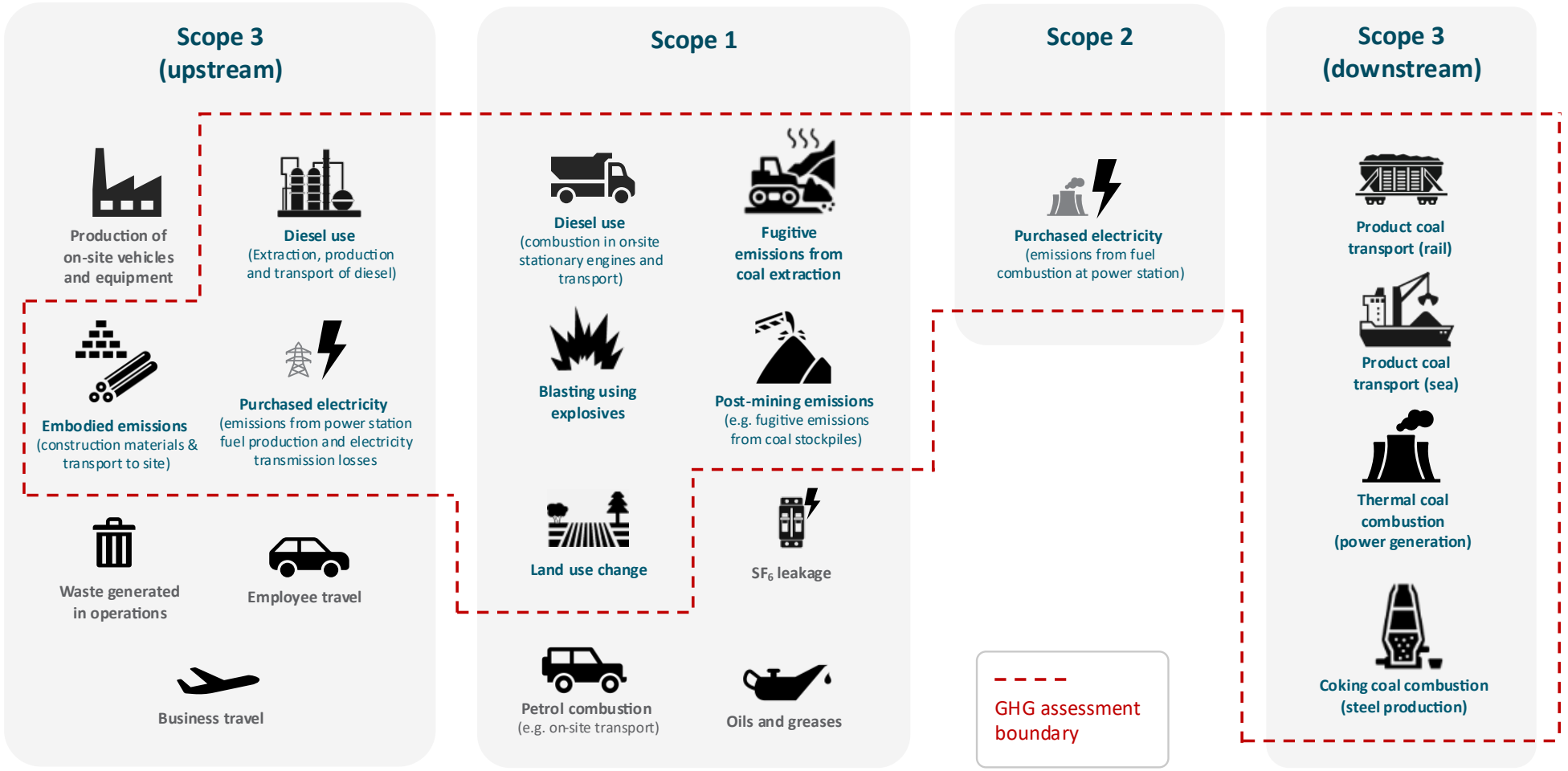

Figure 3.1 **GHG assessment boundary and emission sources**

For scope 2 emissions, the relevant source was the purchase of grid electricity for on-site use in the CPP, electric mining equipment and other electrical applications (lighting, office air conditioning, etc).

For upstream scope 3 emissions, the sources included were:

- The extraction, production and transport of the liquid fuel (diesel) consumed on-site.
- The purchase of grid electricity for on-site use. Here, scope 3 emissions are indirect emissions from the extraction, production and transport of the fuel burned during electricity generation, and the indirect emissions attributable to the electricity lost in delivery in the transmission and distribution network.
- Embodied emissions associated with construction materials, and the use of diesel in the transport of materials to the HVO Complex site. These emissions were allocated to 2027 only.

For downstream scope 3 emissions, the sources included were:

- The transport of product coal from the HVO Complex to the Port of Newcastle by rail.
- The transport of product coal from the Port of Newcastle to overseas markets by sea. For the purpose of the GHG calculation, these markets were assumed to be in Japan and China, with the distance to the largest end user (Japan; 8,000 km) being used in the calculations. Further details are provided in Section 3.4.2 and Annexure A (Section A.4).
- Thermal coal combustion (for power generation).
- Coking coal combustion (for steel production, either domestically or overseas).

Several potential GHG sources were **excluded** from the assessment, as identified in Table 3.2. Where a particular source was excluded from the assessment, this was either because it was not relevant, activity data for it were not readily available, or its emissions were unlikely to be material (i.e. they would have been low (<1% of total emissions) over the life of the Amendment to materially change the outcomes of the assessment or influence decision-making).

Table 3.2 Excluded GHG emission sources

Scope and source	Reason for exclusion
Scope 1	
Consumption of liquid fuels other than diesel (e.g. petrol)	Would not be used
Consumption of oils and greases	Would not be material
Leakage of SF_6	Would not be material[(a)]
Scope 3 (upstream)	
Consumption of liquid fuels other than diesel (e.g. petrol)	Would not be material
Consumption of oils and greases	Would not be material
Manufacture of mine vehicles and equipment	Data unavailable
Employee travel	Would not be material
Business travel	Would not be material
Waste generated during operation	Would not be material

Note

(a) Emissions are expected to be less than 1% of the overall inventory based on data reported in the last two NGERS submissions.

3.2.2 IPCC nomenclature

The *NSW EPA Guide for Large Emitters* also requires emission sources to be categorised according to IPCC sectors and sub-sectors, as applied in Australia's national emission projections. For this assessment, all scope 1 emission sources are categorised as follows:

- IPCC sector = stationary energy (excluding electricity generation)
- IPCC sub-sector = mining

3.2.3 Project stages

The *NSW Guide for Large Emitters* states that the GHG assessment must consider all relevant stages of the project (as appropriate), such as construction, operation, decommissioning, closure and post-closure. For the Amended Project, emissions during construction and operation were considered to be relevant (including the use of fossil fuels during progressive mine rehabilitation). Emissions for decommissioning, closure and post-closure activities would not be materially different to those associated with the HVO Complex as currently approved.

3.2.4 Project timeframe

The GHG assessment covers the calendar years from 2027 to 2050 (19 years). Although the final year of the Amended Project would be 2045, in some sections of the report the additional years to 2050 have been included to cover the life of the original HVO Continuation Project, and for consistency with the target year for net-zero emissions in NSW.

Note

In NSW (and Australia) the GHG reporting convention (including the *NSW Guide for Large Emitters*) is aligned with financial years. However, other aspects – such as approval dates, data collection and projections – are often aligned with calendar years. In this report, GHG are reported for calendar years to maintain consistency with the format of the original activity data, which is based on HVO's planning calendar. No adjustments to the data have been made to align them to financial years.

3.2.5 Emissions scenarios

Step 1 of the *NSW Guide for Large Emitters* also requires the definition of emission scenarios.

Given that the Amended Project would involve an extension of an existing approved operation, scope 1, scope 2 and scope 3 emissions were considered for the scenarios in Table 3.3. With respect to these scenarios:

- Scenario 1 represents the HVO Complex without the proposed project. In this scenario, emissions after 2026 would be zero.
- Scenario 2b represents the HVO Complex with the proposed Amendment Project.
- Scenario 3 represents the Amendment Project only (i.e. the difference between scenario 2b and scenario 1). As the emissions in Scenario 1 after 2026 are zero, emissions in Scenario 3 would be identical to those in Scenario 2b.

Scenario 2a has also been included in the assessment to demonstrate the reduction in emissions associated with the Amendment compared with the original HVO Continuation Project, primarily due to the avoidance of coal extraction in gas Domain 1. For this scenario, only total GHG emissions (by scope) are provided in Table 3.13.

The *NSW Guide for Large Emitters* requires that scope 1 and scope 2 emissions are estimated based on maximum capacity and planned operational throughput. However, for the Amended Project the assessment is based on planned operational throughput, which fluctuates over time due to various factors, including coal resource characteristics, mining methods and equipment specifications. Because of the complex and inter-dependent nature of resource extraction, it is not practical to develop a separate scenario based solely on hypothetical maximum extraction rates. A hypothetical maximum extraction scenario would be highly artificial and would not be deliverable given the mining deposit parameters and equipment constraints. The results therefore reflect a single (planned) operational condition.

Table 3.3 Emission scenarios

NSW EPA terminology		Terminology in GHG assessment	
		Scenario	Scenario description
Business-as-usual (BAU)	Represents the emissions that are expected to occur without the proposed project.	1	Represents the approved HVO Complex. The HVO North approval expires at the end of 2026. Due to its reliance on the infrastructure of HVO North, HVO South is also unable to operate beyond 2026. GHG emissions in this scenario would therefore be zero for the life of the Amended Project.
Modified business	Represents the emissions associated with existing operations and including the proposed project as designed.	2a	Represents emissions from the HVO Complex with the original HVO Continuation Project. As described in the Submissions Report for the EIS (EMM 2023a) and the Amendment Report (EMM 2023b).
		2b	Represents emissions from the HVO Complex with the Amended Project. It reflects a reduction in emissions compared with Scenario 2a, primarily due to the avoidance of coal extraction in gas Domain 1.
Project only	Represents emissions for the project only, in the context of total facility emissions. **NB**: This scenario determines whether or not a project is a large emitter.	3	Represents emissions from the Amended Project only. Determined as emissions in Scenario 2b minus emissions in Scenario 1. Given that the emissions in Scenario 1 are zero for the life of the Amended Project, Scenario 3 is equivalent to Scenario 2b.

3.3 Step 2: Calculation of GHG emissions and prioritisation (as designed)

Step 2 in the *NSW EPA Guide for Large Emitters* involves calculating gross GHG emissions for the project as designed, and then prioritising emission sources for mitigation.

3.3.1 Relevant greenhouse gases

The GHGs that are relevant to the assessment are CO_2, CH_4 and N_2O.

3.3.2 Calculation approach

Details of the GHG emission calculation methodology for the Amended Project are provided in Annexure A. Emissions in Scenario 3 were calculated as the difference between those in Scenario 2b and those in Scenario 1 (noting that emissions from Scenario 1 would be zero beyond 2026).

The estimation of GHG emissions was based primarily on the *National Greenhouse Accounts Factors Workbook* (NGAF) (DCCEW 2024). The calculations generally used the 'Method 1' approach from the Measurement Determination (e.g. emissions for fossil fuel consumption), with fugitive emissions being estimated using Method 2 in the gas assignment model for the HVO Complex (see Annexure B).

The supporting activity data (e.g. fuel consumption, electricity consumption) for Scenario 3 are given in Annexure C. Activity data were sourced mainly from HVO's mine planning process, which provides estimates of fugitive emissions, diesel usage, and electricity consumption, among other operational parameters.

As noted earlier, various mitigation measures are inherent to operation at coal mines, and are systematically implemented as best practice. These measures were effectively included as 'planned' measures.

3.3.3 Emission estimates

The results of the GHG emission calculations for Scenario 3 are summarised in the following sections. A breakdown of the emission results by year and by source is provided in Annexure D. For ease of presentation, the results for individual gases are not included.

The uncertainty in the emission estimates is underpinned by mine planning and geological parameters. The estimated emissions are likely to be conservative, as the calculations do not reflect potential measures for emissions reduction which may become practicable and feasible in the future, such as fleet electrification or alternative fuels.

i Scope 1 and scope 2 emissions

The scope 1 and scope 2 emissions in Scenario 3, and in each calendar year of the project life, are given in Table 3.4 and Figure 3.2. The project life emission totals are also provided.

As current mining operations are approved / capable of being undertaken to the end of 2026, the scope 1 and 2 emissions from the Amended Project represent incremental emissions relative to the existing project. However, the incremental scope 1 and scope 2 emissions would reduce with time, being around 1,125 kt CO_2-e/year in 2027, and 184 kt CO_2-e/year by 2045. The reduction would be due to decreases in production volume and fugitive emissions, and the impacts of decarbonisation of the electricity grid.

The aggregated scope 1 and scope 2 emissions over the project life would be 15,319 kt CO_2-e, of which almost 99% would be scope 1. On average, this would equate to 806 kt CO_2-e/year.

The NGER Act defines a facility threshold for combined scope 1 and scope 2 emissions of 25,000 t CO_2-e/year. The Amended Project is predicted to exceed this threshold. HV Operations Pty Ltd would therefore continue to have an obligation to report emissions from the HVO Complex under the NGER Act.

Table 3.4 Annual scope 1 and scope 2 emissions (Scenario 3)

Calendar year	GHG emissions (kt CO_2-e/year)		
	Scope 1	Scope 2	Scope 1 + scope 2
2027	1,082.4	42.2	1,124.6
2028	1,129.7	35.3	1,165.0
2029	1,103.8	23.2	1,127.0
2030	953.9	16.2	970.1
2031	814.6	15.8	830.4
2032	919.8	13.4	933.2
2033	883.6	9.4	893.0
2034	837.7	9.3	847.1
2035	932.2	7.4	939.7
2036	960.8	6.4	967.2

Calendar year	GHG emissions (kt CO_2-e/year)		
	Scope 1	Scope 2	Scope 1 + scope 2
2037	833.2	6.3	839.5
2038	803.6	6.5	810.1
2039	705.0	7.1	712.1
2040	766.1	3.5	769.6
2041	796.2	3.2	799.4
2042	743.5	3.4	747.0
2043	383.5	2.7	386.1
2044	271.6	2.1	273.7
2045	183.0	1.3	184.4
Average (kt CO_2-e/year)	**795.0**	**11.3**	**806.3**
Total (kt CO_2-e)	**15,104.2**	**214.9**	**15,319.1**

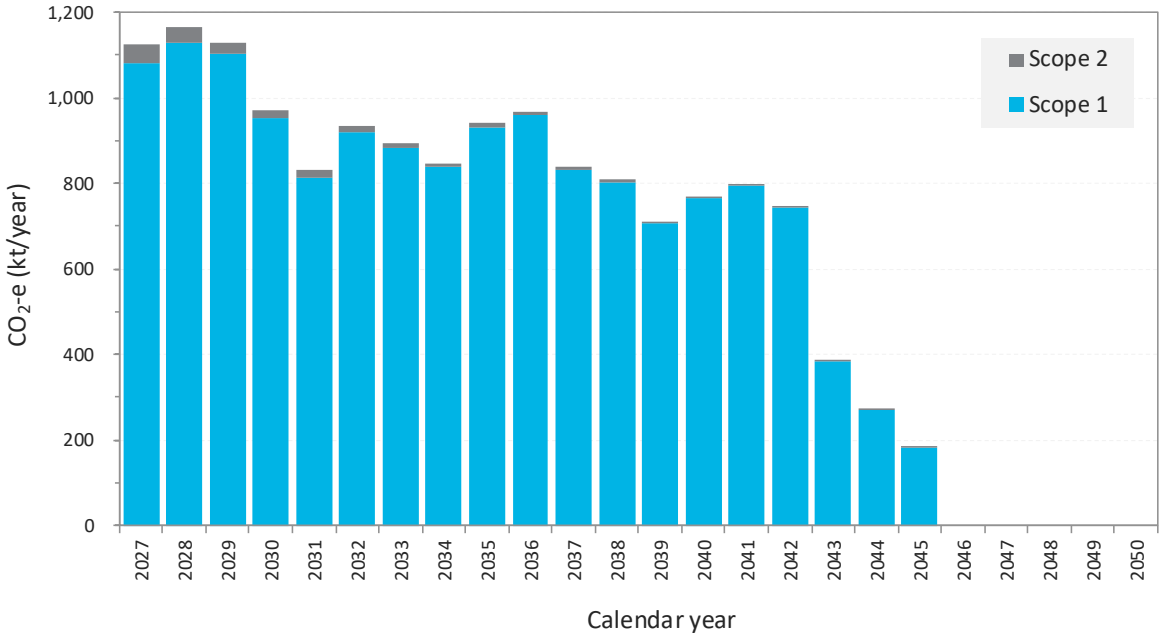

Figure 3.2 Annual scope 1 and scope 2 emissions (Scenario 3)

ii Scope 3 emissions

The scope 3 emissions in Scenario 3, and in each calendar year of the Amended Project, are given in Table 3.5 and Figure 3.3. Again, only the estimates for total CO_2-e are shown.

The scope 3 emissions would be much larger than the scope 1 and scope 2 emissions, and reflect the pattern in the product coal projection (see Annexure C). The scope 3 emissions associated with the combustion of coal mined by the Amended Project would account for approximately 98% of the total emissions of the Amendment.

As current mining operations are approved / capable of being undertaken to the end of 2026, the scope 3 emissions from the Amended Project would represent incremental emissions relative to the existing project. Emissions are directly proportional to coal production, and would increase from around 40,000 kt CO_2-e/year in 2027 to close to 50,000 kt CO_2-e/year in 2039, before reducing in magnitude when coal production declines. The aggregated scope 3 emissions over the life of the Amended Project are anticipated to be around 800 Mt CO_2-e.

Table 3.5 Annual scope 3 emissions (Scenario 3)

Calendar year	Scope 3 GHG emissions (kt CO_2-e/year)
2027	41,171
2028	40,611
2029	42,059
2030	40,197
2031	42,677
2032	42,729
2033	45,294
2034	44,048
2035	46,052
2036	46,142
2037	45,878
2038	46,727
2039	49,153
2040	47,761
2041	42,085
2042	47,143
2043	36,869
2044	28,784
2045	18,379
Average (kt CO_2-e/year)	**41,777**
Total (kt CO_2-e)	**793,763**

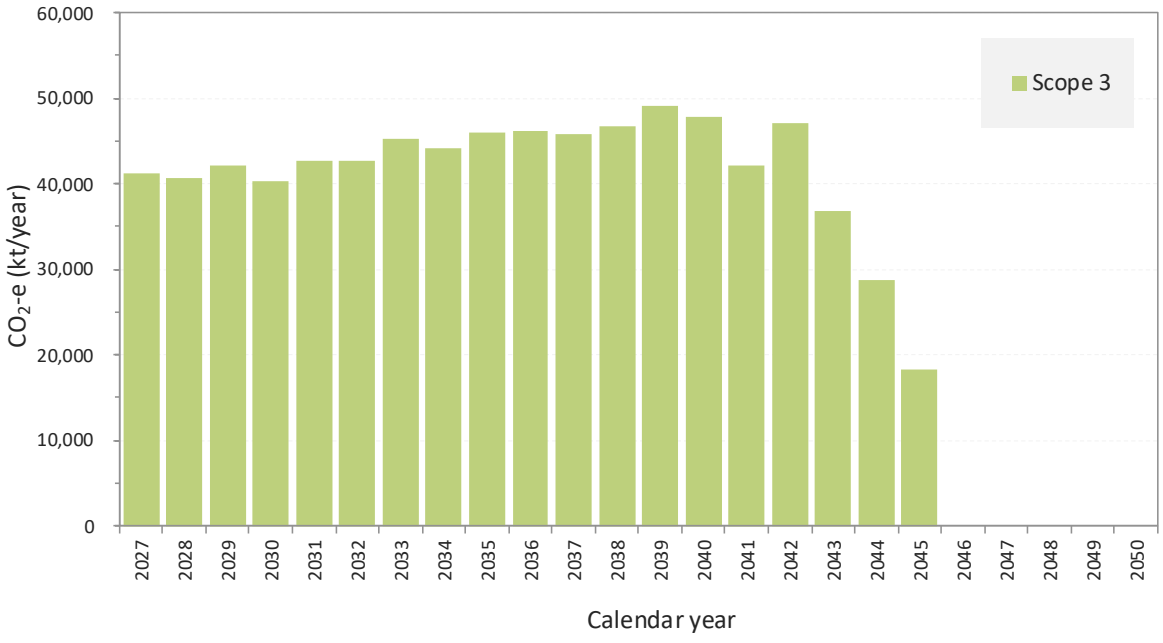

Figure 3.3 Annual scope 3 emissions (Scenario 3)

iii Emission intensity

The *NSW Guide for Large Emitters* also requires the calculation of scope 1 and scope 2 emissions intensity per unit of production or activity for the primary scheduled activity under Schedule 1 of the POEO Act. Production variables are also stated the *Safeguard Mechanism: Prescribed production variables and default emissions intensities* (DCCEEW 2024c). For open-cut coal mines, the production variable is ROM coal, and the emission intensity is stated as tonnes of CO_2-e per tonne of ROM coal.

The annual emission intensities for Scenario 3 are given in Table 3.6. The average scope 1 emission intensity over the life of the Amended Project would be 0.0352 tonnes of CO_2-e per tonne of ROM coal.

Table 3.6 Annual emission intensity (Scenario 3)

Calendar year	Emission intensity (t CO_2-e / t ROM coal)	
	Scope 1	Scope 2
2027	0.0501	0.0020
2028	0.0536	0.0017
2029	0.0490	0.0010
2030	0.0433	0.0007
2031	0.0354	0.0007
2032	0.0395	0.0006
2033	0.0362	0.0004
2034	0.0344	0.0004
2035	0.0379	0.0003
2036	0.0383	0.0003
2037	0.0332	0.0003
2038	0.0310	0.0003
2039	0.0272	0.0003
2040	0.0296	0.0001
2041	0.0338	0.0001
2042	0.0296	0.0001
2043	0.0187	0.0001
2044	0.0174	0.0001
2045	0.0186	0.0001
Average	**0.0352**	**0.0005**

3.3.4 Prioritisation of emission sources

i Scope 1 and scope 2 emissions

The contributions of the different sources to annual scope 1 and scope 2 emissions in Scenario 3 are shown in Figure 3.4. The largest contributors to scope 1 emissions would be diesel consumption and fugitive sources. Fugitive emissions would decrease greatly after 2042 due to: (i) the cessation of coal production at HVO South and (ii) mining activities occurring in the low-gas zone of HVO North.

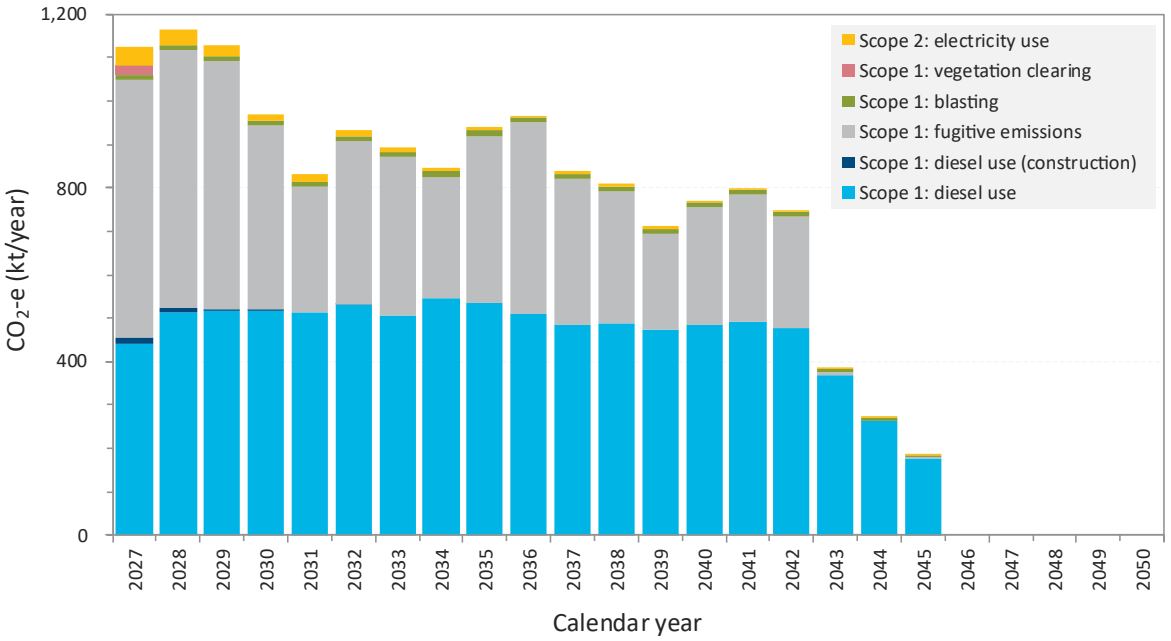

Figure 3.4 Contributions to scope 1 and scope 2 emissions (Scenario 3)

In Table 3.7, the sources of scope 1 and scope 2 emissions in Scenario 3 are ranked according to their contribution to emissions over the life of the Amended Project. On this basis, diesel consumption would be responsible for 58% of the total emissions, and fugitive emissions from coal extraction would be responsible for 39% of the total.

Table 3.7 Ranking of scope 1 and scope 2 sources based on project life emissions (Scenario 3)

Ranking	Source	Scope	Life of mine emissions (kt CO_2-e)	Contribution (%)
1	Diesel consumption	Scope 1	8,860.2	57.8%
2	Fugitive emissions from coal extraction	Scope 1	6,019.5	39.3%
3	Electricity consumption	Scope 2	214.9	1.4%
4	Blasting	Scope 1	200.7	1.3%
5	Vegetation clearing (loss of carbon sink)	Scope 1	23.8	0.2%

ii Scope 3 emissions

The contributions of the different sources to annual scope 3 emissions in Scenario 3 are shown in Figure 3.5. Product coal combustion would be responsible for the majority of scope 3 emissions.

Table 3.8 shows the ranking of sources for scope 3 emissions in Scenario 3, based emissions over the life of the Amended Project. Product coal combustion for power generation would be responsible for around 87% of emissions, with coal combustion for steel production accounting for most of the remainder (12%).

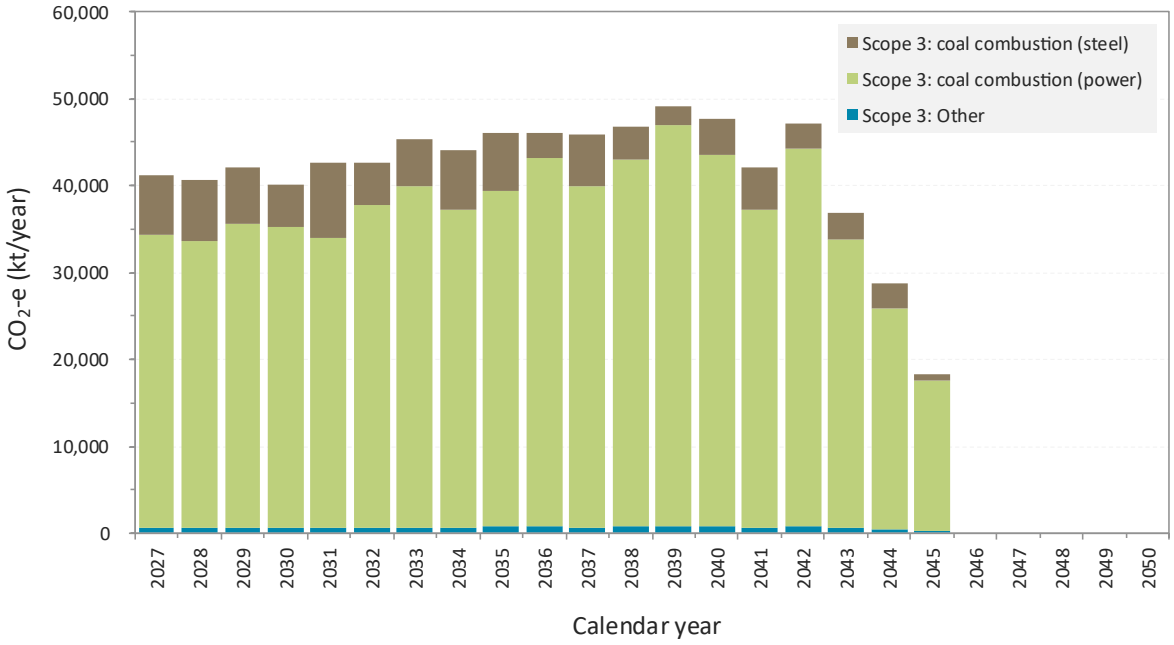

Figure 3.5 **Contributions to scope 3 emissions (Scenario 3)**

Table 3.8 **Ranking of scope 3 sources based on project life emissions (Scenario 3)**

Ranking	Source	Scope	Life of mine emissions (kt CO_2-e)	Contribution (%)
1	Product coal combustion (power generation)	Scope 3	690,050	86.9%
2	Product coal combustion (steel production)	Scope 3	91,245	11.5%
3	Product coal transport by sea (Port of Newcastle to Japan)	Scope 3	8,931	1.1%
4	Extraction, production & transport of liquid fuels: diesel	Scope 3	2,184	0.3%
5	Product coal transport by rail (HVO to Port of Newcastle)	Scope 3	1,318	0.2%
6	Embodied emissions	Scope 3	20.7	<0.1%
7	Electricity consumption	Scope 3	13.8	<0.1%

3.4 Step 3: Selection of mitigation measures

Step 3 of the *NSW Guide for Large Emitters* requires the selection of mitigation measures for emissions in the 'project only' scenario (Scenario 3), taking into account the EPA's mitigation hierarchy. This approach is summarised in Figure 3.6. Various mitigation measures were identified to avoid and reduce GHG emissions from the Amended Project, depending on the relative practicability and feasibility of these options, and the measures are described in the following sections. The mitigation hierarchy places most importance on avoiding GHG emissions, followed by reduction, substitution and offsetting. Offsetting is only seen as a 'last resort' after all reasonable avoidance, reduction and substitution measures have been taken, and is only to be considered for any residual emissions. It is understood that the EPA is developing a GHG mitigation guide for coal mines in NSW, although this was unavailable at the time of writing.

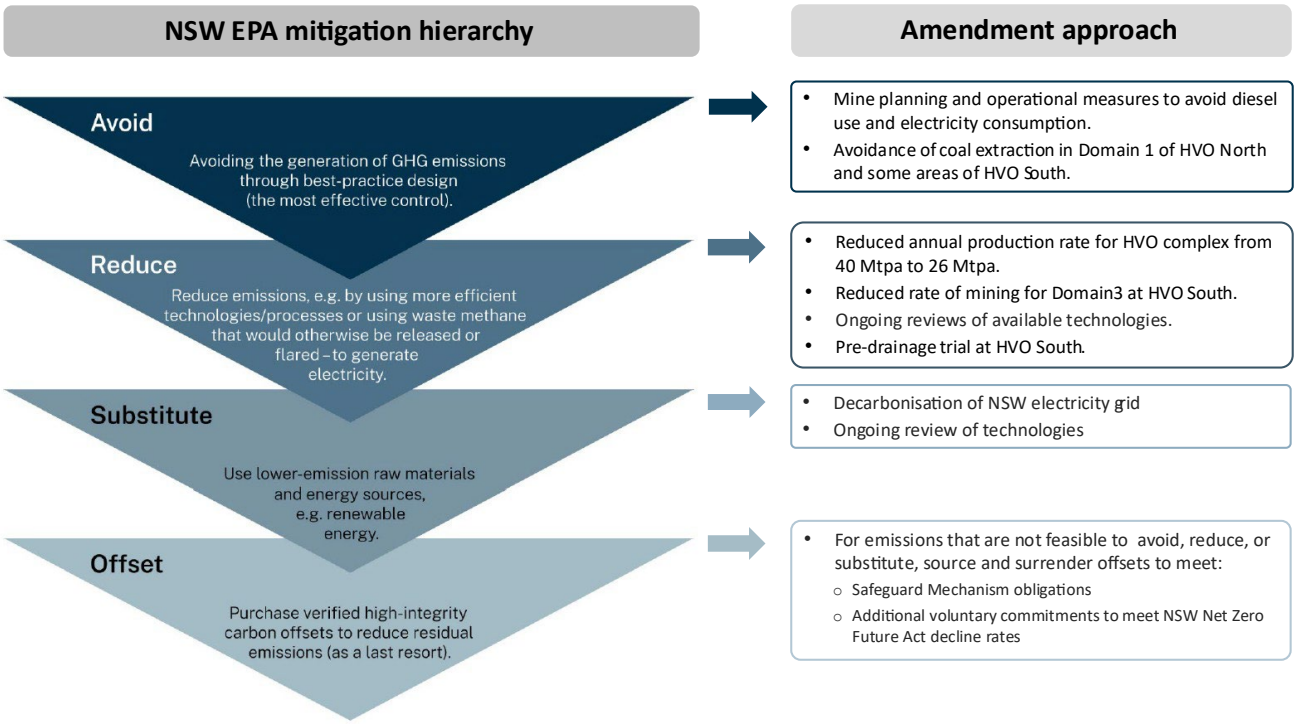

Figure 3.6 NSW EPA emission mitigation hierarchy and approach for the Amended Project

3.4.1 Scope 1 and scope 2 emissions

i The Amended Project

While it is acknowledged that the Amended Project would result in additional scope 1 and scope 2 GHG emissions, it does not *create* the demand for the coal that it would produce. The use of thermal coal for electricity generation remains a necessary source of energy in many countries – providing grid stability, supporting energy access and security, and contributing to socioeconomic development in many markets. HVO supports regulatory efforts to transition towards cleaner power generation and to reduce the underlying demand for fossil fuels. The Amended Project presents an opportunity to support anticipated global energy needs by progressing a brownfield coal investment at an existing and well-established mine, which is subject to the Safeguard Mechanism and its related contribution to Australia's emission-reduction targets and, if approved, would also be subject to additional voluntary commitments over and above the Safeguard Mechanism requirements, in line with NSW emission-reduction targets.

If the coal which is proposed to be extracted by the Amended Project is not mined at the HVO Complex, the demand for the product is likely to be met through coal mined elsewhere in the world, which would still be consumed for energy production and steelmaking, and produce GHG emissions which are potentially higher than the projected emissions from the Amended Project, depending on the quality of the alternative coal source.

The primary purpose of the Amendment is to reduce and mitigate the emissions that would otherwise have arisen as part of the original HVO Continuation Project. The Amendment would result in significantly lower emissions than the original HVO Continuation Project, particularly in the later years of proposed mining. In the original HVO Continuation Project, diesel consumption and fugitive emissions were materially higher than in the Amended Project. Fugitive emissions were forecast to increase in the latter years of the original HVO Continuation Project, when mining was planned to extend into the deeper coal seams within Domain 1. Scope 2 emissions due to electricity consumption were calculated to be relatively minor, at around 1% of total emissions (Airen 2025).

The Amendment primarily targets the avoidance and reduction of diesel and fugitive emissions, both in total and on an annual basis. This would mainly be achieved by:

- avoiding coal extraction within Domain 1 at HVO North
- reducing mining at HVO South, due primarily to the removal of some higher strip ratio coal from the mine plan
- reducing the annual production rates across the complex from a maximum theoretical value of 42 Mtpa ROM coal to 26 Mtpa ROM coal.
- reducing the period over which mining would occur by approximately five years
- reducing diesel consumption through reduced production and optimisation of haulage (e.g. reduced distances and gradients).

ii Planned mitigation measures

The emission estimates for the Amended Project reflect the current operational practices at HVO in relation to maximising energy efficiency and minimising diesel consumption. They also reflect the avoidance of fugitive emissions, primarily at Domain 1, due to the changes in the mine design from the original HVO Continuation Project. These mitigation measures are summarised in Table 3.9 and in the following paragraphs.

Table 3.9 Planned mitigation measures

Mitigation measure	Comments
Scope 1 – fossil fuel	
Optimisation of haul routes	Lengths of haul routes are optimised to minimise fuel use (and hence GHG emissions), as well as dust and noise emissions.
Optimisation of ramp gradients	Ramp gradients are optimised based on pit geometry.
Payload management and loading equipment productivity	Payload and equipment productivities are monitored and actively managed to maintain efficient haulage.
Fuel/energy-efficient haul trucks and other mobile plant	Fuel or energy efficiency is an important selection criterion when procuring mine vehicles and equipment. HVO will continue to consider efficiency during equipment procurement. This will include the optimisation of equipment/engine size according to operational needs.
Scheduling activities so that equipment use and vehicle operation are optimised	Scheduling the location and use of equipment and mobile plant is a routine part of mining operations. HVO prepares short-term, medium-term and long-term production plans to optimise production and fuel consumption.
Minimising idling	Equipment shuts down when not in use.
Scope 1 – fugitive sources	
Changes in mine design and planning, including the avoidance of Domain 1	Reduced rate and extent of mining, and the period over which mining would occur, compared with the original HVO Continuation Project.
Scope 2	
Optimisation of CPP operation and electrical mining equipment	The operation of the CPP and electrical mining equipment is optimised for energy efficiency.
Decarbonisation of the NSW electricity grid	Emissions from the purchase of grid electricity will decrease as the NSW grid decarbonises.

With respect to scope 1 emissions, the mitigation measures for fossil fuels are commonly implemented as best practice in the mining sector, and have been reflected in the emissions estimates. A counterfactual case (i.e. without these measures) has not been quantified, partly because it would not occur in practice, and partly because it could not be reliably characterised. The mitigation measures for fugitive emissions *have* been quantified, as the counterfactual case relevant to the Amendment is informed by the fugitive emission profile of the original HVO Continuation Project.

a Management of scope 1 emissions

Reducing emissions from diesel use

Fossil fuel emissions constitute a significant portion of HVO's Scope 1 emissions, and fossil fuel is also a significant cost driver. To address this, HVO implements a series of embedded operational practices aimed at reducing fossil fuel consumption and minimising associated emissions. These practices align with the mitigation hierarchy - avoiding, reducing, and substituting emissions, and are summarised as follows:

- Procurement policy
  - HVO's procurement policy typically includes the consideration of fuel efficiency as a criterion in equipment selection, thereby reducing fuel consumption and emissions. The replacement of the mine fleet is considered separately, and in more detail, below.
- Mine design, planning, and equipment selection

  HVO conducts annual life-of-mine (LOM) and budget planning processes, incorporating the following practices to minimise fossil fuel consumption:
  - Optimised mine layout: Designing the mine layout to enhance operational efficiency and selecting appropriate equipment for mining and haulage activities. This includes considering the use of electric draglines and electric rope shovels where feasible to optimise overburden removal.
  - Early rehabilitation scheduling: Planning for rehabilitation activities early in the mining process to minimise the need for future rehandle and/or hauling material over long distances and elevations beyond the pit workings.
  - Haulage destination planning: Planning the delivery of hauled material to minimise material handling, haul distance and elevation changes, thereby decreasing fuel consumption.
  - Haul route optimisation: Iteratively optimising haul routes to reduce equipment operating hours and, consequently, fuel consumption.
  - Loading efficiency: Operational monitoring through fleet dispatch systems, progressively examining and matching the interaction between loading units and trucks to minimise wastage, improve haul cycle times, and optimise the amount of material moved per equipment operating hour.
  - Payload optimisation: Planning and monitoring haulage performance to ensure that loading equipment capacity aligns with the haulage capacity of the fleet, maximising efficiency and reducing fuel usage.
- Equipment maintenance
  - The mobile equipment fleet and fixed plant are maintained in accordance with supplier specifications. Ad hoc maintenance is conducted when equipment monitoring systems identify anomalies, ensuring optimal performance and fuel efficiency.

- Equipment operation is carried out by competent personnel trained in the use of relevant equipment, including adherence to standard operating procedures. Training emphasises practices that maximise productivity and fuel efficiency.

- Haul road maintenance

  - Haul roads are designed to optimise energy efficiency, considering factors such as gradient and surface material.

  - Regular maintenance is performed to ensure that haul road gradients and rolling resistance are minimised. Remedial actions are undertaken based on operational monitoring to maintain optimal conditions.

- Performance monitoring and feedback

  - HVO conducts regular reporting of historical and actual performance as part of operational processes. This includes evaluations at intervals that range in frequency, including each shift, each week, each month and each year, as well as multi-year assessments.

  - HVO's performance is benchmarked against other Glencore operating sites to assess equipment performance and identify opportunities for improvement.

Fleet replacement

In addition to the above, HVO is a large mining operation with a large fleet of diesel haul trucks and supporting diesel mining equipment such as excavators, dozers, graders and water carts. HVO also utilises several electric shovels. Given the proposed life of the Amended Project there will be equipment replacement periodically throughout the mine life. As such, the replacement schedule for the HVO mining fleet needs to be considered to understand opportunities to implement new technologies that may reduce GHG emissions. It is reasonable to expect that – over the Project life to 2045 – technology will develop, and that equipment replaced later in the mine life may be more efficient and/or have lower GHG emissions than equipment currently available. This section considers the drivers for replacing the mining fleet, the anticipated fleet replacement opportunities at HVO to 2045, and the potential for technology development to reduce GHG emissions as fleet is replaced.

Drivers for fleet replacement

Mining equipment is replaced periodically throughout the mine life, and economics is the key driver for equipment replacement. Purchase of vehicles and equipment is comprehensively assessed, and a range of considerations are examined including developments in machine efficiency or productivity, machine capacity, life cycle costs, environmental performance and safety performance.

Replacing a machine, particularly if it is nearing a major expenditure point such as an engine change, with a new model that has improved operational productivity, larger capacity or better fuel efficiency, can make economic sense even though the full life of the machine, as anticipated when it was first purchased, has not yet been fulfilled. The economic benefit of replacing the machine can outweigh the cost of upgrading or maintaining the existing one.

The drivers for fleet replacements are always evolving. Whilst the economic model prepared for the Amended Project considers a fleet replacement schedule which is described below, it is expected that this will change. Changing economics, changing technology, and changing legislation can all drive changes to the equipment replacement forecast.

Forecast equipment replacement schedule

Figure 3.7 shows the forecast equipment replacements for the duration of the proposed mining schedule (note that this forecast is an indicative estimate only). It is based on the known assumptions at the time of preparation of this GHG assessment. It has been developed considering current expectations for chassis life, engine life, overhaul costs and new equipment purchase costs. It has not factored in developments in technology, either for productivity or efficiency, as they are not known with enough confidence to be considered in a mine schedule. Therefore, for all the reasons described above, the forecast will change over time.

A detailed discussion of the potential implementation of improved technology to reduce overall diesel emissions was provided in Section 4.2.7 of the Submissions Report (EMM 2023a). This section outlined the state of current technology for low-emissions mining equipment. It also discussed in detail the process by which HVO follows the technology readiness and commercial readiness levels of emerging technologies so that they can be assessed for implementation. This section demonstrates that there is significant work underway across industry and equipment manufacturers to develop technologies to reduce emissions from mining equipment, and HVO actively follows the progress of these technologies. For the emerging technologies discussed in Section 4.2.7, it will take time for them to develop to maturity and be commercially available at scale. There are currently no commercially available technologies that could be implemented – or be confidently forecast to be implemented – at HVO. Given this uncertainty, HVO's emissions forecasts do not include any potential future emission-reduction benefits from emerging technologies.

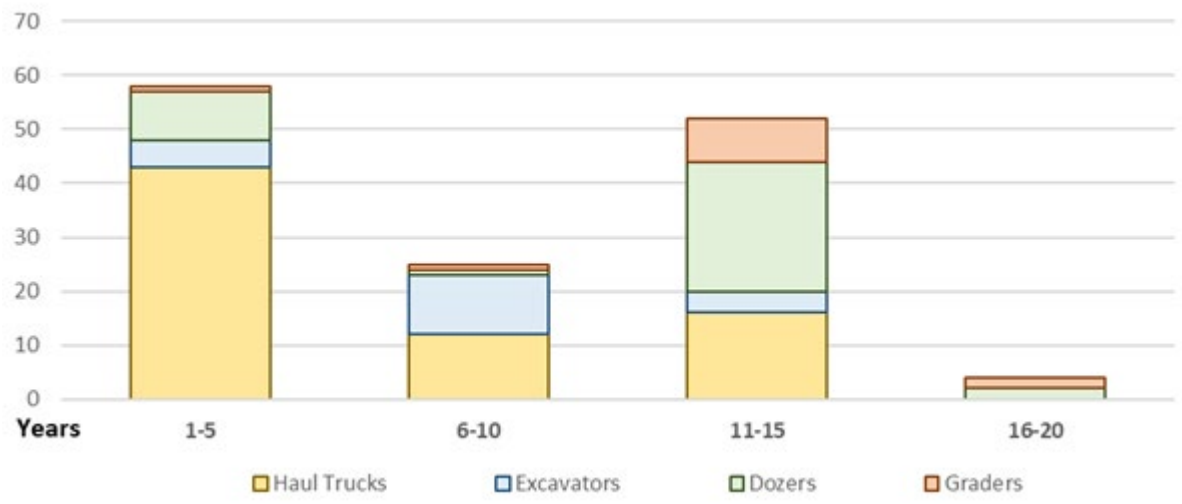

Figure 3.7 Indicative estimate of equipment purchase (year 1 is 2027)

Figure 3.7 demonstrates that there are considerable fleet replacement purchases scheduled throughout the life of the Amended Project. Each one of these purchases is an opportunity to upgrade to the latest technology to reduce emissions. The practicality and economic value of the technology at that time will be key considerations. Another key factor in the economic assessment of alternatives will be the cost of carbon (e.g. the cost of ACCUs). Additionally, as discussed previously, the productivity or efficiency value of new equipment could bring forward the anticipated equipment replacement timing.

Three-yearly review of technologies and abatement measures

HVO will continue to undertake regular reviews of technologies and abatement measures to reduce GHG emissions from the Amended Project, including whether these measures are reasonable and feasible to implement at HVO. These reviews will be undertaken every three years and will include consideration of the use of alternative fuels (including biofuels and hydrogen), and the transition to an electric-powered fleet, as these technologies advance and more information becomes available. Consistent with the above commitment, HVO will ensure to include discussion of the equipment replacement or upgrade opportunities as part of the periodic review process.

Equipment replacement is not the only pathway to reducing mining equipment emissions. Other pathways include:

- use of renewable/sustainable fuels – this is another opportunity to mitigate emissions and does not require replacement equipment. This is discussed further below.
- retrofit/upgrades of existing equipment is another opportunity.

HVO is currently studying conceptual opportunities to reduce diesel emissions from its mining fleet. All emerging technologies need to undergo significant testing and assessment as part of progressing their technological and commercial readiness for deployment.

b Management of scope 2 emissions

In relation to scope 2 emissions, the operation of the CPP and electrical mining equipment at the Amended Project would be optimised for energy efficiency. In addition, as the NSW electricity grid transitions to more firmed renewable energy sources, the scope 2 (and scope 3) emissions associated with electricity consumption of the Amended Project are expected to decrease. Again, the effects of these measures on emission have not been quantified relative to a counterfactual scenario.

iii Evaluation of additional mitigation measures

As part of broader business planning processes, HV Operations Pty Ltd evaluates existing ('off-the-shelf') measures, and emerging emission-reduction technologies for potential future implementation at the HVO Complex, such as alternative fuels and renewable energy. Mitigation measures are assessed using a range of criteria, including estimated costs, emission-reduction potential and the practicability of deployment. Some potential future measures for reducing emissions are discussed below.

a Reducing diesel emissions

Given that the off-road mining fleet is the largest consumer of diesel at the HVO Complex, information is provided below on the status of available technology and opportunities for reducing diesel emissions.

It is firstly worth mentioning two major initiatives. The Initiative for Cleaner, Safer Vehicles (ICSV) is a joint industry program that aims to speed up the development of emission-reduction technologies in mining equipment. The ICSV program is facilitated by the International Council on Mining and Metals (ICMM), and Glencore is a founding and active ICSV member. The Charging Interface Initiative e.V. (CharIN) is a not-for-profit global organisation in the field of charging systems for electric vehicles of all types around the world. It provides a community of technological collaborators, with more than 300 members and a foundation of eight years of work. Based on existing relationships and governance requirements, the ICMM and CharIN, with involvement of original equipment manufacturers (OEMs), are the industry bodies with the most influence to help achieve the emission-reduction objectives.

Through Glencore's association with the above initiatives, HV Operations Pty Ltd is in a strong position to stay abreast of technological developments in relation to GHG emissions from mining, and the progress of their implementation. Using the available information and Glencore's industry knowledge, Glencore undertook an assessment of the readiness of alternative technologies to diesel-powered equipment for the mining sector, and engaged Hatch Pty Ltd (ICSV Technical and Facilitation Support) to peer review this work. A summary of the findings is provided below.

The frameworks and methodology used by the Australian Renewable Energy Agency (ARENA) were used to assess readiness of technology for use in the mining sector by considering both the Technology Readiness Level (TRL), and Commercial Readiness Index (CRI) of the technology. These concepts are illustrated in Figure 3.8.

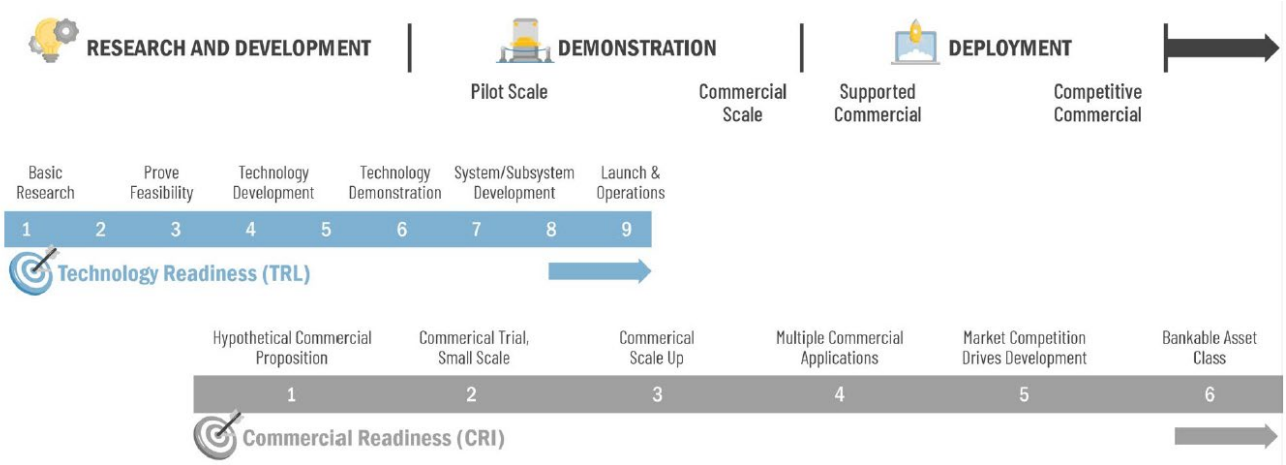

Figure 3.8 Technology Readiness Level and Commercial Readiness Index concepts

The review considered electric-powered equipment, as well as equipment powered by alternative fuels such as hydrogen, biofuels, ammonia and synthetic diesel. The findings as they apply to HVO are summarised below.

An overview of the potential technologies for powering surface mining equipment, currently typically powered by diesel, is shown in Figure 3.9. The figure shows the current TRL for a range of technologies that might be potentially suitable for the HVO Complex. The following technologies are currently at TRL 9:

- conventional diesel
- 20% biodiesel blends
- catenary-supplied electric power (sometimes referred to as 'trolley assist').

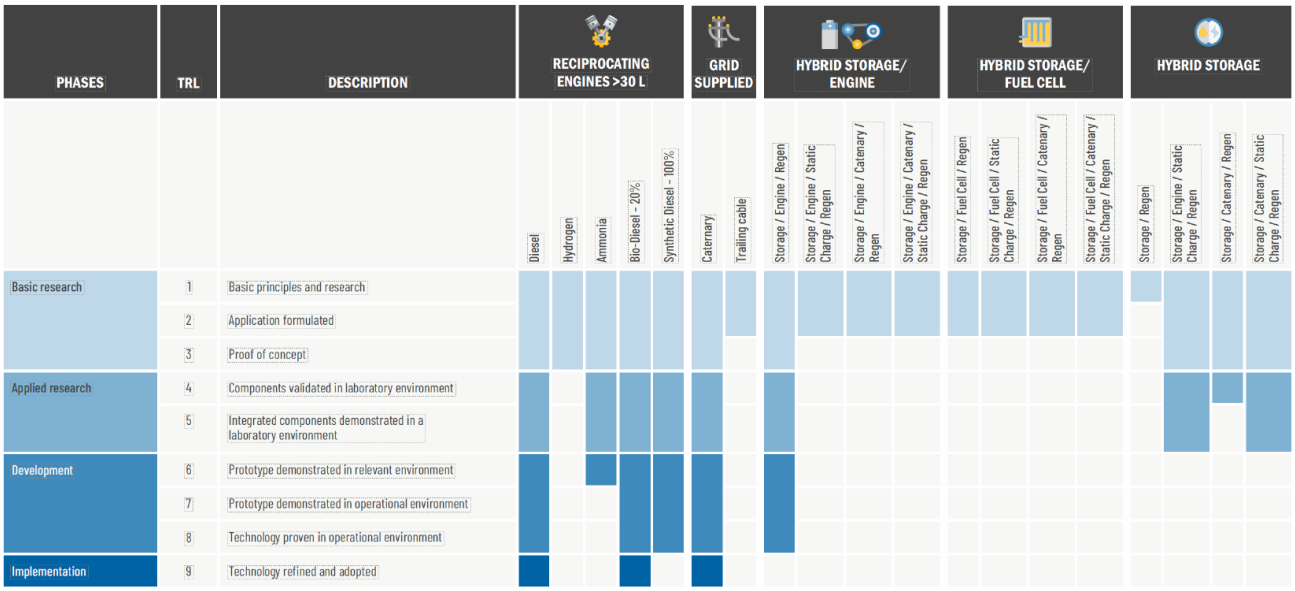

Figure 3.9 Potential technologies for powering surface mining equipment with current TRL

The second phase of assessment towards commercial adoption is the CRI. When considering the commercial readiness of the technologies at TRL 9, diesel is a fully adopted and commercially competitive fuel for mining equipment. As discussed below, 20% biodiesel and catenary power – while technologically ready – are not as advanced on a CRI basis and not as readily adopted.

Figure 3.9 also shows that, while technologies such as hybrid, fuel cell or battery power are developing and being adopted in smaller, non-mining equipment (such as road vehicles), they are not yet adequately developed for use in mining equipment.

b Electric-powered equipment

Several technologies exist for electrically powered equipment, including tethered cable electric machines, and high-capacity overhead catenary systems. As demonstrated in Figure 3.9, catenary system technology is well developed for trucks with an overhead mounted system, and electric tethered cable system for hydraulic face shovel configured excavators in hard rock mining applications. However, despite their advanced commercial readiness, there are a number of complexities and constraints to their implementation in a coal mining geological environment as discussed below.

High-capacity overhead catenary systems can be used to support diesel-electric truck fleets and potentially hybrid or battery powered fleets. Overhead catenary support for diesel-electric trucks is used in some limited non-coal instances globally. However, there is little opportunity to use this sort of system in the coal sector and at the HVO Complex in particular. This is mainly due to the progressive nature of mine advancement during coal extraction and the subsequent continual changing of the location of suitable haul ramps, which would necessitate continually moving the significant support infrastructure involved.

In relation to tethered (cabled) electric machines, it is noted that draglines, shovels and large-capacity drills are available, as shown in Figure 3.10, and are currently used, or have been previously been used, at HVO. The nature of the cabled connection renders them useful for specific, usually high volume, tasks only. As a multi-seam open cut with multiple thin seams of coal and interburden which require frequent relocation, a large number of smaller hydraulic excavators in backhoe configuration are required for efficient mining. These are available as electric cable supplied machines however are also too restrictive for the flexibility required at the HVO Complex. Similarly smaller drills that require flexibility of movement within the mine are more appropriate as diesel machines.

In summary, some equipment is utilised as electric cable supplied machines at HVO. However, the further use of electric equipment for all excavators and drills is constrained by practicality and efficiency. As excavators and drills are replaced, forecasts of their respective uses will be assessed including whether cable supply might be appropriate.

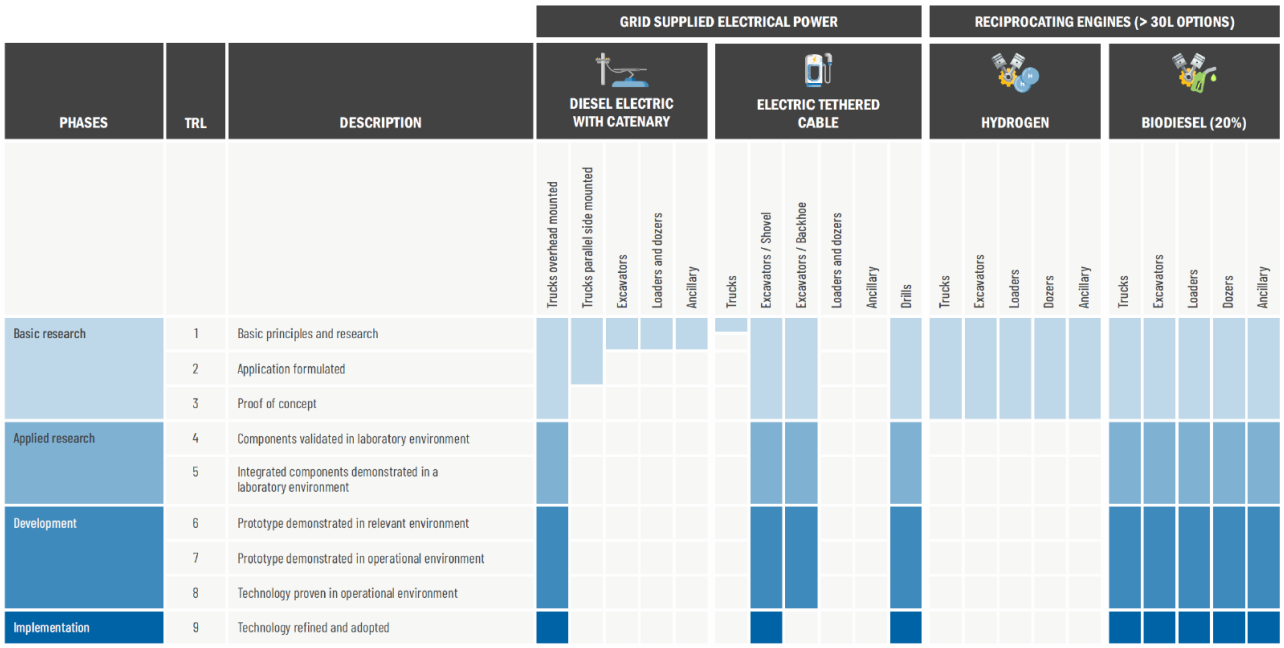

Figure 3.10 Mining equipment optionality with current TRL – grid supplied electrical power and alternate fuels

c Sustainable fuel

There are a range of sustainable fuel options which are commercially available as well as under development. Such fuels can be used in conventional internal combustion engines (ICE) across sectors including mining, road transport, rail, maritime, aviation, and as chemical feedstocks.

Sustainable fuels can be blended with fossil fuels to a blend limit (fatty acid methyl ester - FAME and ethanol) or to any ratio up to 100% (hydrogenated vegetable oil - HVO, synthetic), without requiring any technical adjustments to the vehicle. The use of 100% renewable diesel, such as HVO, in ICE vehicles could achieve a 100% reduction in Scope 1 emissions.

The use of sustainable fuels is expected to grow significantly over the next 20 years, decreasing fossil fuel consumption in hard-to-abate sectors, driven by regulatory mandates, particularly in the road transport and aviation sectors.

Currently, there are significant barriers to the use of sustainable fuels including cost and limited availability. Sustainable fuels also face issues of ethical provenance as their feedstocks may have the potential to displace food-growing activities and have land use impacts e.g. deforestation. Sustainable fuels also differ in their extent of application or the ability to 'drop-in' or substitute fossil fuel diesel use.

Glencore's coal operations have previously used biofuels in mining equipment (i.e. B20, which is a diesel fuel containing 20% biofuel). However, operations do not currently use this fuel due to both cost and availability.

As shown below, the use of hydrogen as a fuel in mining equipment does not currently meet TRL requirements for implementation and is therefore not yet an option for the industry. Further research and development is needed before this technology could be considered for use at an operation like HVO.

d Pre-drainage trial

Overview

HV Operations Pty Ltd has an extensive exploration database and significant knowledge of the sub-surface gas content, which has been used to inform the gas assignment model for the HVO complex (see Annexure B). A high-level summary of the gas content across the proposed coal extraction areas for the Amended Project is presented in Table 3.10.

As shown in the table, significant variation occurs across the mining areas, reflected in separate and distinct gas domains (see Annexure B).

Associated with the preparation of the Submission Report (EMM 2023a), HVO engaged CoalBed Energy Consultants Pty Ltd to undertake an initial study into the feasibility of pre-drainage capture of gas for the original HVO Continuation Project (CoalBed 2023). The following sections draw from information previously identified in CoalBed (2023), as relevant to the Amended Project.

Table 3.10 HVO fugitive gas assignment model

	Domain 2 - HVO North					Domain 3 - HVO South				
		ROM (Mt)	Gas (m^3/t)	CH_4 (%)	CO_2 (%)		ROM (Mt)	Gas (m^3/t)	CH_4 (%)	CO_2 (%)
LGZ/Z0**		280.5	0.25	0%	50%		16.5	0.57	32.6%	24.6%
Z1		26.5	2.08	84%	10%		17.1	1.11	55.6%	34.2%
Z2							18.1	2.47	76.6%	22.0%
Z3							39.0	5.73	57.3%	42.3%
Z4							31.4	6.57	45.5%	54.5%
20 m below floor		-	0.20	3.8%	22.2%		-	3.29	45.5%	54.5%

As shown in Table 3.10, the gas content of the coal seams generally increases with depth, with a gas-depleted surface zone down to around 180 m in Domain 2 and 90 m in Domain 3. This is typical in the Sydney basin, with the depleted zone commonly extending to a depth of 100-150 m. The data in Table 3.10 also show that there is a high variability between the domains and zones, which is also consistent with the inherent variability in Sydney basin coal seams.

In terms of gas composition:

- Domain 2 has little gas, and very little methane
- Domain 3 shows mixed methane and carbon dioxide in Zone 3 and 4.

The gas content and composition data at the HVO Complex suggest that there is varying potential for pre-drainage across the proposed mining area, as summarised below:

- Domain 2 has the least potential for pre-drainage, due to the low gas content
- Domain 3 may have potential for gas drainage within Zone 3 and Zone 4 over the deeper seams (~50%) of the deposit, with the proviso that the modelled CO_2 content is relatively high. This means that the drainage would be less beneficial in terms of the amount of methane extracted.

Figure 3.11 illustrates the ROM coal production in the identified gas zones at HVO, and Figure 3.12 shows the fugitive emissions (converted to tonnes of CO_2-e) by zone. Zones 3 and 4 of Domain 3 have a material contribution to the fugitive emissions profile throughout the project life and could form a potential target area for a pre-drainage trial.

Drilling for pre-drainage at the HVO Complex presents several challenges, which will be investigated as part of the development of a trial. These challenges, which will be considered in the context of developing technology, include the following:

- Interactions with ongoing and prior mining activities would require additional drilling considerations.
- The target seams are very likely to be under-saturated and have relatively low permeability.
- In relation to pre-drainage capture methods, multiple seam environments like at the HVO Complex tend to favour a vertical drilling approach. Low permeability (as anticipated at depth at the HVO Complex) means that some form of gas well stimulation may be required.
- Low gas saturation means that water may need to be produced and disposed of to produce gas.
- The concentration and the volume of the gas recovered would need to be assessed for abatement and utilisation purposes (e.g. flaring, power generation, disposal/storage).

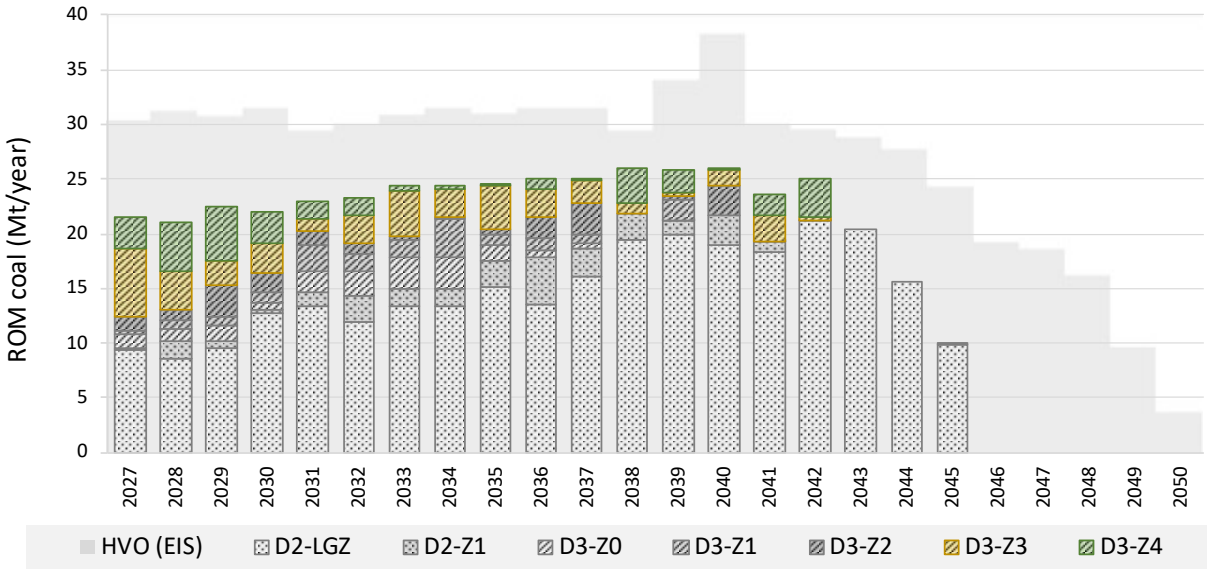

Figure 3.11 ROM coal production by zone

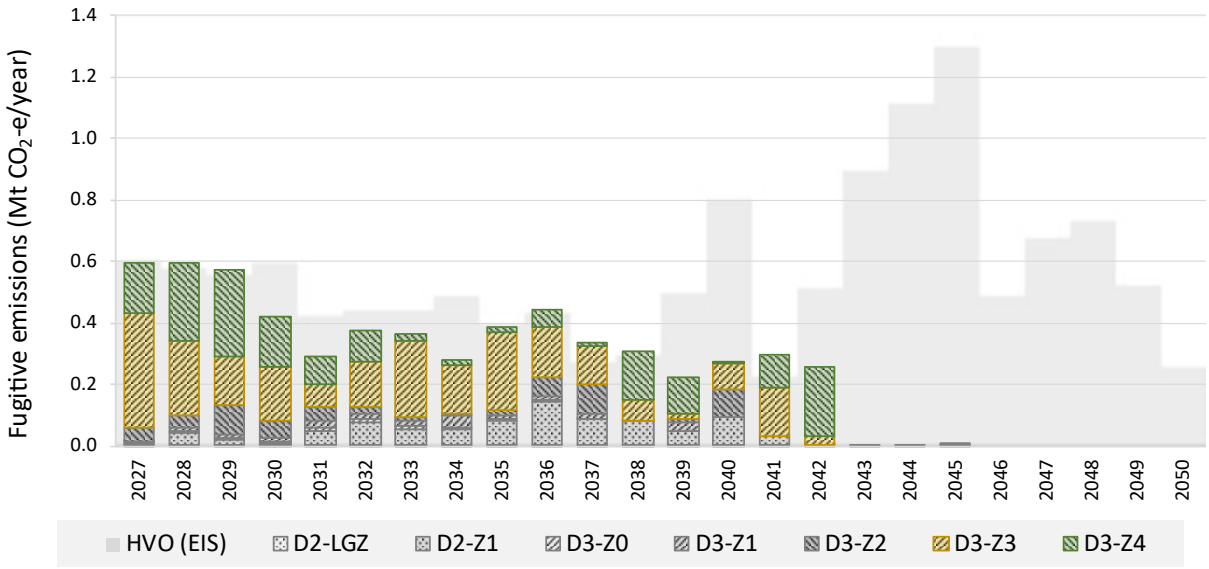

Figure 3.12 Fugitive emissions by zone

Proposed trial

HV Operations Pty Ltd proposes to undertake a trial in areas with higher potential for pre-drainage to investigate the feasibility and effectiveness of gas pre-drainage. It is envisaged that the scope of the trial would be developed in consultation with relevant stakeholders to the satisfaction of the Planning Secretary, and be provided within two years of commencement of consent should approval be granted for the Project. The scope of the gas pre-drainage trial would:

- include trial objectives
- identify the extent of the areas subject to further investigation
- utilise additional data that will be necessary to inform the design of the trial (e.g. gas saturation and permeability data to develop a gas reservoir model).
- outline the timing for the completion of the trial
- outline the results, review and conclusions processes.

Following agreement of the scope above, HV Operations Pty Ltd will implement the gas pre-drainage trial to the satisfaction of the Planning Secretary.

e Summary

At present, none of the assessed initiatives are considered practicable or feasible for implementation. HV Operations Pty Ltd will continue to undertake regular reviews of technologies and abatement measures to reduce GHG emissions from the Amended Project, including whether these measures are reasonable and feasible to implement at the HVO Complex. These reviews will be undertaken every three years, and will include consideration of the use of alternative fuels, including biofuels and hydrogen, and the transition to an electric-powered fleet, as these technologies advance and more information becomes available.

HV Operations Pty Ltd will investigate the feasibility and effectiveness of gas pre-drainage. This will involve a trial of gas drainage in areas identified with higher potential. The design of the trial will be developed in consultation with relevant stakeholders and to the satisfaction of the NSW Planning Secretary and will be submitted within two years of commencement of consent should approval be granted for the Amended Project.

Due to the inherent uncertainty in both technical and economic outcomes of such assessment, the potential effects of these measures on GHG emissions cannot yet be accurately quantified.

Table 3.11 Potential future initiatives for mitigation

Mitigation measure	Status	Comments	Effects on GHG emissions
Scope 1			
Fleet decarbonisation technologies	Review	Consideration of the use of alternatives to diesel fuel, including biofuels (e.g. renewable diesel) and hydrogen, and the transition to an electric-powered mine fleet as these technologies advance and more information becomes available. A review will be undertaken every three years.	Not quantifiable at this stage, due to the inherent uncertainty in both technical and economic outcomes.
Pre-drainage of coal seam to reduce fugitive emissions during coal extraction	Proposed trial	Trial of gas pre-drainage in areas with higher potential, to investigate feasibility and effectiveness. The design of the trial will be developed in consultation with relevant stakeholders to the satisfaction of the Planning Secretary and be provided within two years of commencement of the Project.	Not quantifiable at this stage due to the inherent uncertainty in both technical and economic outcomes.
Scope 2			
Use of renewable energy	Review	Whilst this is currently not a significant source of emissions, HVO will continue to consider the use of renewable energy.	Not quantifiable at this stage, due to the inherent uncertainty in both technical and economic outcomes.

3.4.2 Scope 3 emissions

Emissions from customer use of product coal comprise the major source of Scope 3 emissions for the Amended Project. Based on historical data, saleable coal from the HVO Complex is predominantly sold to customers in export markets in Asia, with Japan being the largest export destination over the past two years. The primary countries that HVO Complex coal has been exported to all have Nationally Determined Contributions (NDCs) under the Paris Agreement (or have followed international standards recognised by the UNFCCC and published their own NDCs document in support of the Paris Agreement). It is anticipated that future export destinations for HVO Complex coal will continue to follow similar patterns. However, as coal sales are market driven, export destinations may change in the future.

Table 3.12 shows the countries that received saleable coal from the HVO Complex in 2024, along with the corresponding percentage share of total export volume directed to each country.

Under the Paris Agreement, each country must submit a new NDC every five years. These are recorded in the UNFCC NDC Registry in accordance with Article 4.12 of the Paris Agreement. The next round is due by end of 2025. These regular updates and review cycles are designed to gradually make emission reduction commitments more stringent over time, thereby helping countries meet Paris goals.

Table 3.12 NDCs of countries that receive coal from HVO

Export destination	Percentage of total export volume - 2024	NDC
Japan	44.34%	• 46% reduction in GHG emissions compared to 2013 emissions by 2030 Net zero emissions by 2050
China	27.94%	• 65% reduction in CO_2 emissions in per unit of gross domestic product (GDP) from the 2005 level in 2030 • Net zero CO_2 emissions by 2060
Taiwan[1]	17.08%	• Committed to a 23-25% reduction in GHG emissions by 2030 from the 2005 base year • Net zero emissions by 2050
Malaysia	7.11%	• 45% reduction in GHG gas emissions per unit of GDP from the 2005 level in 2030 • Net zero emissions by 2050
Thailand	1.96%	• Unconditional target - reduce GHG emissions by 30% below business-as-usual (BAU) levels by 2030 (excluding land-use, land-use change, and forestry) • Conditional target - up to 40% reduction of GHG emissions below BAU by 2030, if sufficient international support is provided
Sout Korea	1.14%	• 40% reduction in GHG emissions compared to 2018 by 2030 • Net zero emissions by 2050
Indonesia	0.43%	• Unconditional target - 31.89% reduction in GHG emissions compared to the BAU projection by 2030 • Conditional target - 43.20% reduction in GHG emissions compared to the BAU projection by 2030 if sufficient international support is provided

Notes: 1. Taiwan is not recognised as a sovereign state by the UN, and as a result, cannot participate in the UNFCCC, which oversees the Paris Agreement. *However, Taiwan have followed the international standards recognised by the UNFCCC and published their own NDCs document in support of the Paris Agreement.*

It is beyond HVO's control to reduce or mitigate scope 3 emissions, given they are occurring outside Australia and by third parties. It should also be noted that the Amendment represents a significant avoidance of, and reduction in, emissions from the original HVO Continuation Project (see below).

3.5 Step 4: Emissions with mitigation measures

3.5.1 Mitigation measures relating to existing operational practices, as applied in the Amended Project

The benefits of mitigation measures relating to fuel efficiency and electricity consumption are not able to be defensibly quantified, as establishing the counterfactual scenario would be hypothetical and subjective.

3.5.2 Mitigation measures relating to the changes between the original and amended HVO Continuation Project

The benefits of mitigation measures relating to the changes between the original and amended project are able to be quantified, and consist of the avoidance of scope 1 and scope 2 emissions associated with the Amendment itself, as shown in Figure 3.13 and Table 3.13 (the table also shows scope 3 emissions).

Significant reductions in emissions are expected with the Amendment, particularly in the years from around 2039 onwards. Compared with the original HVO Continuation Project, total (life) scope 1 and 2 emissions would decrease by 11,487 kt CO_2-e over the life of the Amended Project, with the annual reduction varying from year to year. The largest reduction in any single year would be 1,515 kt CO_2-e. The major driver of these reductions would be the avoidance of fugitive emissions in Domain 1.

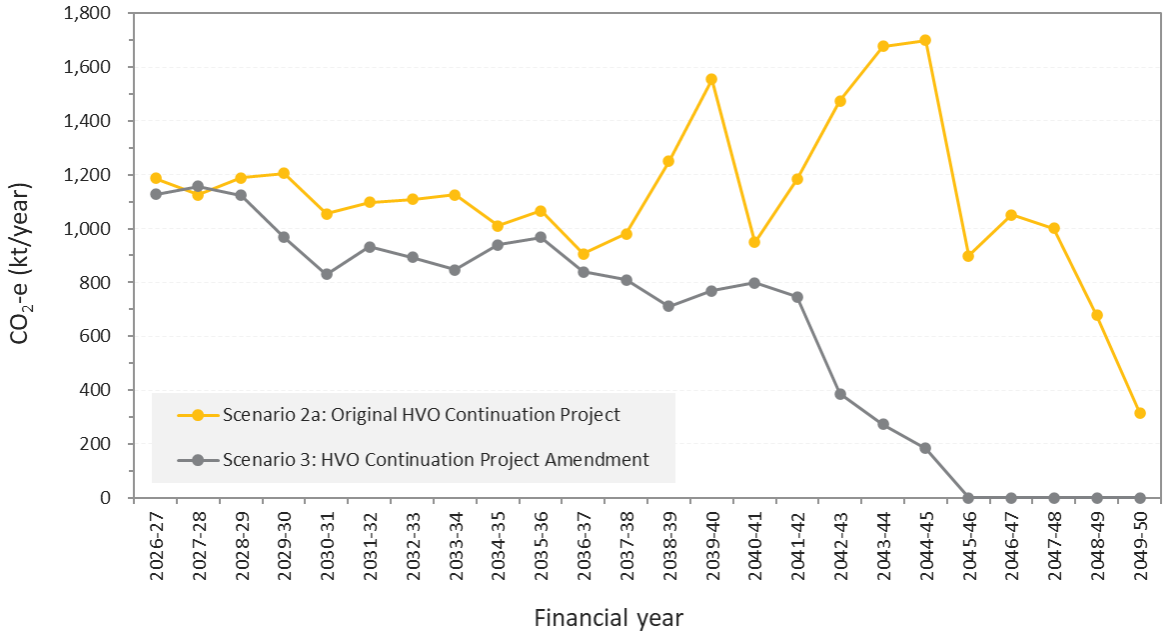

Figure 3.13 Reductions in scope 1 and scope 2 emissions from the HVO Complex with the Amendment

It is worth noting that Table 3.13 shows a change in scope 2 emissions with the Amendment. The emissions for the original HVO Continuation Project are shown 'as originally reported' (i.e. in the Submissions Report (EMM 2023a), and scope 2 emissions were calculated using the emission factors in *Australia's emissions projections 2022* (DCCEEW 2022). For the Amended Project, scope 2 emissions were calculated using the emission factors in *Australia's emissions projections 2024* (DCCEEW 2024b). The change in scope 2 emissions in Table 3.13 is primarily due to a change in the emission factors between the two publications.

Compared with the original HVO Continuation Project, total (life) scope 3 emissions would decrease by 241,039 kt CO_2-e over the life of the Amended Project.

Table 3.13 Reductions in emissions from the HVO Complex with the Amendment

Calendar year	Scope 1 emissions (kt CO_2-e/year)			Scope 2 emissions (kt CO_2-e/year)			Scope 3 emissions (kt CO_2-e/year)		
	Original HVO Continuation Project[a]	Amended HVO Continuation Project	*Change with Amendment*	Original HVO Continuation Project[a]	Amended HVO Continuation Project	*Change with Amendment*	Original HVO Continuation Project[a]	Amended HVO Continuation Project	*Change with Amendment*
2027	1,153.0	1,082.4	*-70.6*	34.0	42.2	*+8.2*	36,564	41,171	*4,607*
2028	1,102.0	1,129.7	*+27.7*	24.0	35.3	*+11.3*	46,831	40,611	*-6,220*
2029	1,168.0	1,103.8	*-64.2*	20.0	23.2	*+3.2*	48,328	42,059	*-6,269*
2030	1,194.0	953.9	*-240.1*	12.0	16.2	*+4.2*	48,914	40,198	*-8,716*
2031	1,043.0	814.6	*-228.4*	11.0	15.8	*+4.8*	45,318	42,677	*-2,641*

Calendar year	Scope 1 emissions (kt CO_2-e/year)			Scope 2 emissions (kt CO_2-e/year)			Scope 3 emissions (kt CO_2-e/year)		
	Original HVO Continuation Project[a]	Amended HVO Continuation Project	*Change with Amendment*	Original HVO Continuation Project[a]	Amended HVO Continuation Project	*Change with Amendment*	Original HVO Continuation Project[a]	Amended HVO Continuation Project	*Change with Amendment*
2032	1,086.0	919.8	*-166.2*	11.0	13.4	*+2.4*	47,138	42,729	*-4,409*
2033	1,096.0	883.6	*-212.4*	12.0	9.4	*-2.6*	49,922	45,294	*-4,628*
2034	1,124.0	837.7	*-286.3*	2.0	9.3	*+7.3*	51,130	44,048	*-7,082*
2035	1,009.0	932.2	*-76.8*	2.0	7.4	*+5.4*	50,462	46,052	*-4,410*
2036	1,064.0	960.8	*-103.2*	2.0	6.4	*+4.4*	52,660	46,142	*-6,518*
2037	905.0	833.2	*-71.8*	2.0	6.3	*+4.3*	53,236	45,878	*-7,358*
2038	979.0	803.6	*-175.4*	2.0	6.5	*+4.5*	49,463	46,727	*-2,736*
2039	1,248.0	705.0	*-543.0*	2.0	7.1	*+5.1*	54,320	49,153	*-5,167*
2040	1,552.0	766.1	*-785.9*	2.0	3.5	*+1.5*	61,964	47,761	*-14,203*
2041	948.0	796.2	*-151.8*	2.0	3.2	*+1.2*	46,899	42,085	*-4,814*
2042	1,181.0	743.5	*-437.5*	2.0	3.4	*+1.4*	48,487	47,143	*-1,344*
2043	1,474.0	383.5	*-1,090.5*	2.0	2.7	*+0.7*	46,171	36,869	*-9,302*
2044	1,676.0	271.6	*-1,404.4*	2.0	2.1	*+0.1*	44,875	28,784	*-16,091*
2045	1,698.0	183.0	*-1,515.0*	2.0	1.3	*-0.7*	43,774	18,379	*-25,395*
2046	897.0	-	*-897.0*	1.0	-	*-1.0*	31,442	-	*-31,442*
2047	1,051.0	-	*-1,051.0*	1.0	-	*-1.0*	29,517	-	*-29,517*
2048	1,000.0	-	*-1,000.0*	1.0	-	*-1.0*	26,253	-	*-26,253*
2049	678.0	-	*-678.0*	1.0	-	*-1.0*	14,989	-	*-14,989*
2050	315.0	-	*-315.0*	0.0	-	*0.0*	6,145	-	*-6,145*
Average[b] (kt CO_2-e/year)	**1,110.0**	**795.0**	***-480.7***	**6.3**	**11.3**	***+2.6***	**43,117**	**41,777**	***-10,043***
Total[b] (kt CO_2-e)	**26,641.0**	**15,104.2**	***-11,536.8***	**152.0**	**214.9**	***+69.9***	**1,034,802**	**793,763**	***-241,039***

Notes

(a) From Submissions Report (EMM 2023a)
(b) For the period 2027 to 2050.

3.5.3 Mitigation measures relating to the Safeguard Mechanism and NSW Net Zero Future Act

On the basis of the total scope 1 emissions presented in Table 3.4, the HVO Complex with the Amended Project would continue to emit above the Safeguard Mechanism threshold of 100,000 t of CO_2-e per year throughout its life. As a Safeguard facility, the Amended Project would be subject to the declining emissions trajectory required by the Safeguard Mechanism.

HV Operations Pty Ltd proposes that the emissions from the Amended Project would be managed in a way that is consistent with (and in fact exceeds) the company's obligations under the Safeguard Mechanism. The decline rate for emissions under the Safeguard Mechanism (i.e. the baseline) is calculated as:

- a reduction of 4.9% per year from 1 July 2023 to 1 July 2029

- a reduction of 3.285% per year thereafter.

The calculation of the baseline takes into account annual coal production.

HV Operations Pty Ltd also proposes to implement measures that go beyond its Safeguard Mechanism obligations. HVO Operations Pty Ltd will make additional, voluntary contribution towards the NSW emission-reduction targets to reflect consideration of the NSW Net Zero Future Act. With this in mind, HVO proposes that the emissions of the Amended Project are aligned, so far as practicable, with the Net Zero Future Act emission-reduction targets, including by using offsets to reduce the Amended Project's net GHG emissions where it is not feasible to avoid, reduce or substitute emissions. In effect, HV Operations Pty Ltd would implement a net emissions decline rate for the Amended Project that is more ambitious than the Safeguard Mechanism requirements, involving:

- a reduction of 5.9% per year from 1 July 2023 to 1 July 2029
- a reduction of 4.0% per year from 1 July 2030 to 1 July 2034
- a reduction of 2.58% per year thereafter.

In Figure 3.14, the resulting net baseline for the Safeguard Mechanism (dashed purple line), and the net baseline with the additional NSW voluntary contributions (dashed green line), are compared with the gross scope 1 emissions profile for the Amendment Project. The average and total scope 1 emissions for the life of the Amended Project with the baselines are given in

Table 3.14.

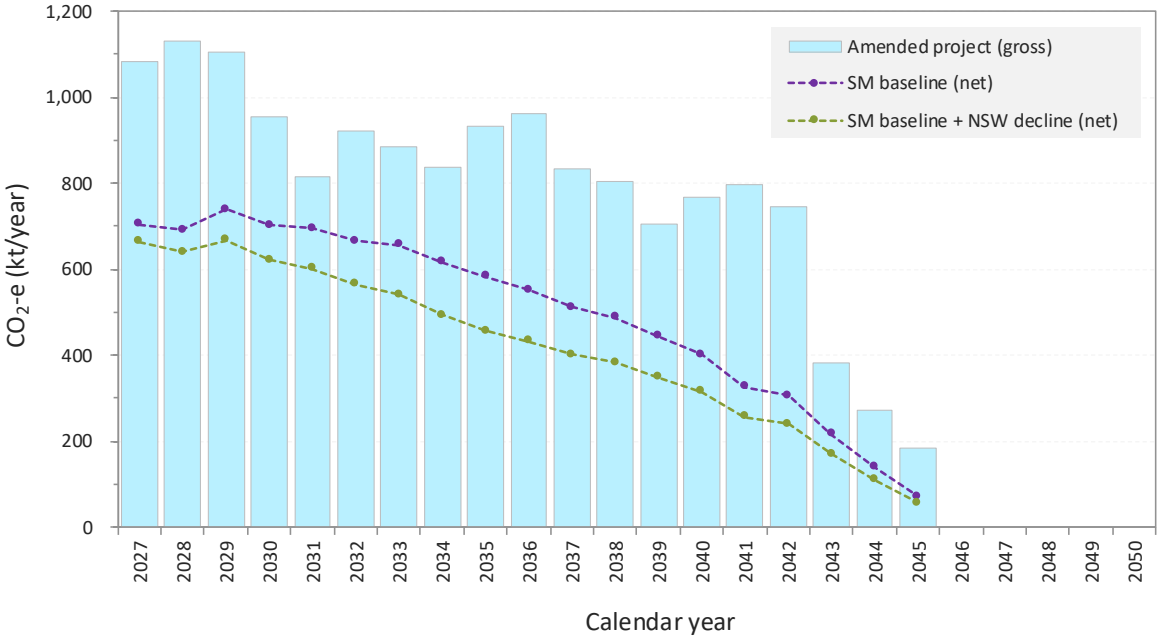

Figure 3.14 Scope 1 emissions for the Amended Project and baseline profiles

Table 3.14 Summary of scope 1 emissions for the life of the Amended Project with baselines

	Scope 1 emissions		
	Amended Project (gross)	**Safeguard Mechanism baseline (net)**	**Safeguard Mechanism baseline + NSW decline (net)**
Average emissions (kt CO_2-e/year)	795.0	500.5	419.2
Total emissions (kt CO_2-e)	15,104.2	9,509.7	7,965.2

Over the life of the Amended Project, compliance with the Safeguard Mechanism baseline would reduce scope 1 GHG emissions by 5,595 kt CO_2-e, and compliance with the combined Safeguard Mechanism baseline and NSW decline rate would reduce GHG emissions by 7,139 kt CO_2-e.

Note

The mitigated emissions for the Amended Project are the net emissions for the combined Safeguard Mechanism baseline and NSW decline rate.

3.6 Step 5: Emission benchmarking and goal setting

The *NSW Guide for Large Emitters* requires the GHG assessment to address the anticipated regulatory obligations for the project under the Safeguard Mechanism, to consider how project emissions compare to NSW emissions, and to set out long-term and interim GHG emission goals for a project. These requirements are addressed for the Amended Project below.

3.6.1 Safeguard Mechanism and NSW obligations

i Emission reductions

According to the *NSW Guide for Large Emitters*, given that the HVO Complex is Safeguard facility, the Safeguard Mechanism baseline and decline rate obligations are the starting point when considering emission goals and trajectories. The Safeguard Mechanism baseline was already discussed in section 3.5.3.

As also noted in section 3.5.3, HV Operations Pty Ltd also proposes to implement measures that go beyond its Safeguard Mechanism obligations, by making additional, voluntary contribution towards the NSW emission-reduction targets.

ii Emissions intensity

The Australian Government also defines ‘default’ and ‘best practice benchmark’ scope 1 emission intensities for various industries in the document *Safeguard Mechanism: Prescribed production variables and default and best practice emissions intensities* (DCCEEW 2024c). The default (industry average) emissions intensity represents an industry average, whereas the best practice benchmark reflects international best practice and applies to new facilities.

For coal mining the industry average emission intensity is 0.0653 t CO_2-e per tonne of ROM coal.

Figure 3.15 compares the estimated gross scope 1 emissions intensity of the Amended Project with the industry average emissions intensity for coal mining. The estimated emissions intensity of the Amended Project would be materially lower than the industry average emissions intensity, and is expected to decrease over life of the Amended Project. The figure also shows the net emission intensities under compliance with the Safeguard Mechanism baseline, and where the Amended Project is volunteering the additional NSW decline rate. For these, the emission intensity would be significantly lower: down to around 0.006 t CO_2-e per tonne of ROM coal by 2045, which is an order of magnitude below the industry average benchmark.

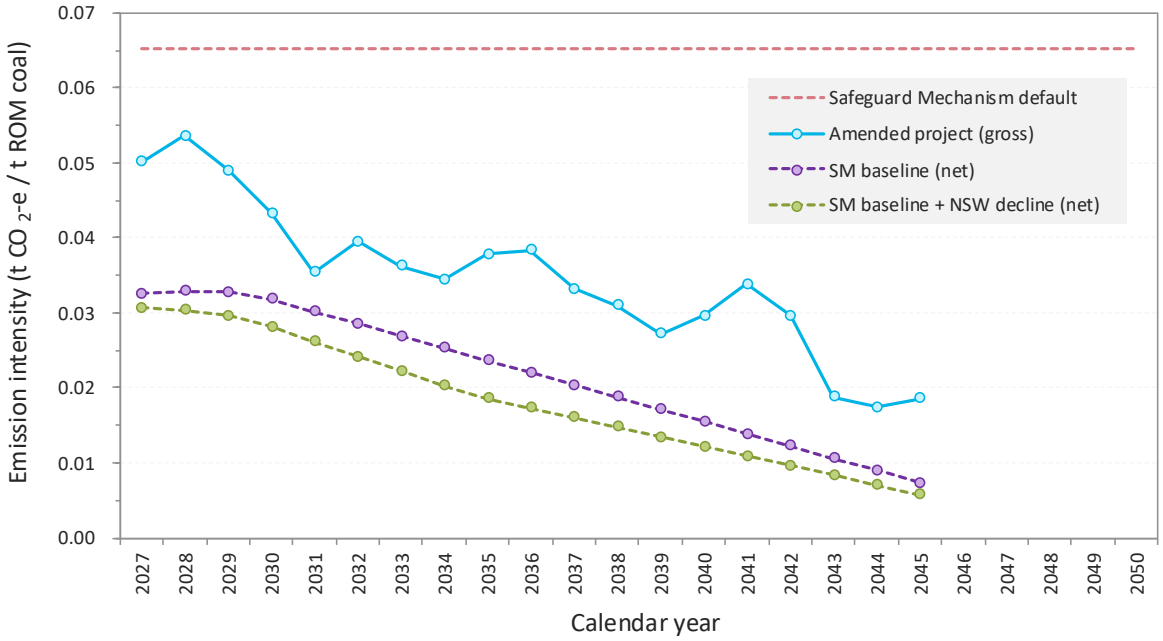

Figure 3.15 Emissions intensity for scope 1 emissions for the Amended Project and baseline profiles

Figure 3.16 was provided by HV Operations Pty Ltd. It compares the predicted average gross scope 1 emissions intensity for the life of the Amended Project (the blue dashed line – see Table 3.6) with those for all Australian coal operations in the year 2023-2024. The orange bar shows the actual emission intensity of the HVO Complex in 2023-24. The emissions data for other coal operations were taken from the publicly available dataset on the Clean Energy Regulator's Safeguard Mechanism website[6]. The ROM coal amounts were back-calculated using the published Safeguard Mechanism baselines, site-specific and industry average emission intensities, and the nominal decline rate. For facilities in Queensland, the ROM amounts were verified with the Queensland Government Open Data Portal – Production by individual mines - Coal industry review statistical tables[7]. For facilities in NSW, the ROM amounts were verified using company-specific, publicly available data. It can be seen that the average emissions intensity for the Amended Project would be low relative to other Australian coal operations.

6 https://cer.gov.au/markets/reports-and-data/safeguard-data#baselines-and-emissions-data

7 https://www.data.qld.gov.au/dataset/coal-industry-review-statistical-tables

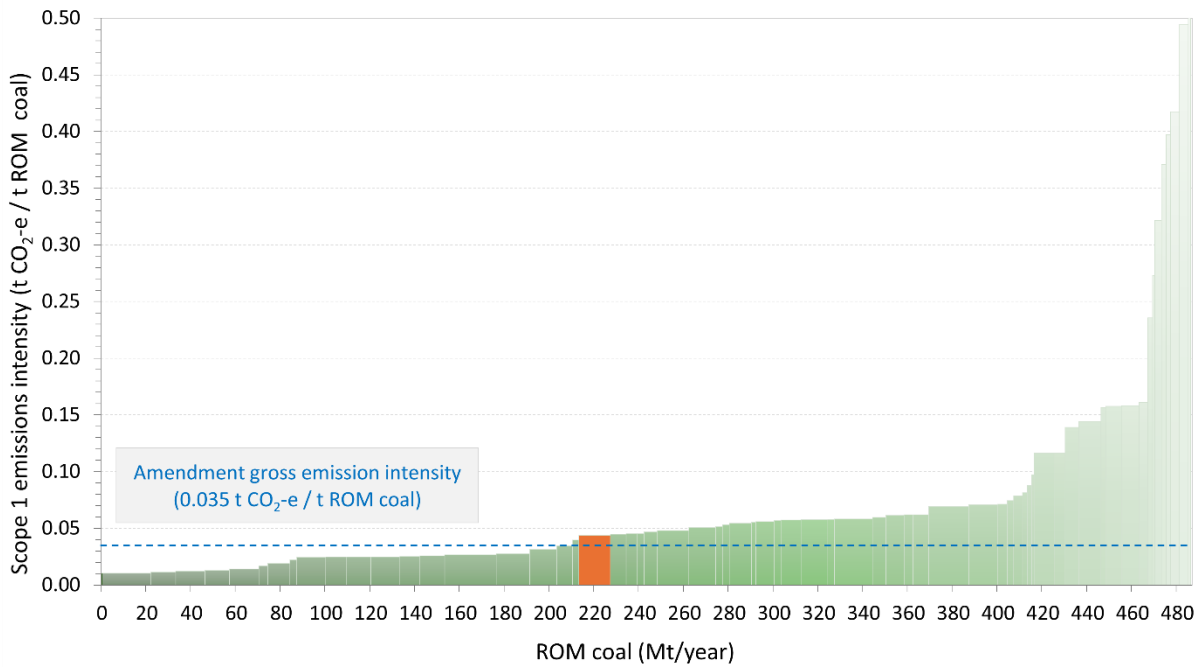

Figure 3.16 Scope 1 emissions intensity for the Amendment compared with all Australian coal operations in 2023-2024

The Australian best practice benchmark emission intensity in the Safeguard Mechanism is 0.00592 t CO_2-e per tonne of ROM coal (noting that this applies to new facilities), which is based on the top 10% of industry performance (lowest emission intensity) of all coal mines that report under NGERs (DCCEEW 2023). Whilst the metric is presented as 'best-practice', no data are disclosed by the Australian Government to allow the underlying emission minimisation practices to be examined. Given the highly geologically variable nature of mining, it is reasonable to infer that this best practice emission intensity is influenced more by geological conditions (e.g. lower strip ratio, low fugitive emissions), than any operational practices which could be replicated at other mines.

3.6.2 Comparison with NSW emissions

As noted in Table 2.2, the Net Zero Future Act sets the following legislated emissions reduction targets for NSW:

- 50% reduction in net GHG emissions from 2005 levels by 2030
- 70% reduction in net GHG emissions from 2005 levels by 2035
- Net zero GHG emissions by 2050.

These targets are more ambitious than the Commonwealth's, and are largely driven by the planned closure of coal-fired power stations and the increasing integration of firmed renewable energy into the grid. The NSW targets are supported by varying emissions reductions across different sectors, rather than requiring equal reductions from every sector.

The Net Zero Future Act establishes state-wide, whole-of-government targets and guiding principles, rather than imposing direct, binding obligations on individual projects or facilities. While the Net Zero Future Act requires the NSW Government to achieve net zero emissions by 2050, and sets interim targets, it leaves the specific implementation details and sectoral requirements to be developed through future regulations and policies.

For facilities like the HVO Complex (including the proposed Amended Project), the Commonwealth's Safeguard Mechanism sets regulated quantitative performance standards that must be met. Compliance with the Safeguard Mechanism by such facilities will contribute to NSW achieving its legislated emission-reduction targets under the Net Zero Future Act. HVO will comply with the Safeguard Mechanism framework and apply higher emission decline rates to reflect consideration of the Net Zero Future Act (as described in section 3.5.3).

The Net Zero Emissions Dashboard ('the Dashboard') presents past and projected future net GHG emissions for NSW (NSW Government 2025). The Dashboard shows emission trends and the progress being made towards the state's emission-reduction objectives. The Dashboard provides emissions for the following cases:

- Historical **actual** emissions up to 2022.
- A future **BAU** projection up to 2050. The BAU scenario accounts for major factors impacting NSW emissions including past state policies but excludes the impact of actions under the Net Zero Plan and related NSW Government policies and programs.
- A **current policy** emission projection up to 2050. The current policy emission estimates consider:
  - current policies and programs under Stage 1 of the Net Zero Plan
  - initiatives related to reducing emissions supported by the NSW Climate Change Fund (CCF) under future stages of the Plan.
  - related policies including NSW EPA Climate Change Policy and Action Plan and the Commonwealth's Safeguard Mechanism.

The future emissions from the Dashboard, and the projected annual scope 1 emissions for the Amended Project, are shown in Table 3.15.

Note

The emissions data in the dashboard are presented for financial years. The emissions data for the Amended Project are presented for calendar years, and therefore there is not a direct correspondence between the two series. For the purpose of the comparison, the calendar year data for the Amended Project are compared with the end year of the financial year (e.g. emissions for the Amended Project in the calendar year 2030 are compared with the data in the dashboard for the financial year 2029-2030).

The Amended Project would be a relatively small contributor to GHG emissions in NSW. For example, for the combined Safeguard Mechanism and NSW decline trajectory, it would represent between 0.25% and 0.81% (depending on the reference year) of state-wide emissions in the NSW current policy case.

In percentage terms, the Amended Project would follow a lower emissions trajectory than the NSW current policy scenario. In other words, emissions for the Amended Project are projected to reduce at a greater rate than those for the state. For example:

- For the NSW current policy trajectory, emissions between 2027 and 2045 would decrease by 79%, equating to an average annual decrease of 4.4%.
- For the Amended Project with the Safeguard Mechanism, net emissions between 2027 and 2045 would decrease by 90%, equating to an average annual decrease of 5.0%. Even on its own, this represents a larger reduction than the NSW current policy trajectory.
- For the Amended Project with compliance with the Safeguard Mechanism and the additional voluntary NSW decline rate, net emissions between 2027 and 2045 would decrease by 91%, equating to an average annual decrease of 5.1%.

The Amended Project therefore supports NSW efforts to decarbonise.

Table 3.15 Comparison with scope 1 emissions from NSW Net Zero Emissions Dashboard

Calendar year	NSW (Mt CO_2-e/year) [a]		Amended Project with SM baseline (Mt CO_2-e/year)	Amended Project with SM baseline + NSW decline (Mt CO_2-e/year)
	BAU	Current policy		
2027	109.21	107.06	0.704	0.663
2028	103.45	100.75	0.691	0.639
2029	101.11	97.54	0.738	0.668
2030	87.14	82.97	0.702	0.621
2031	90.17	84.13	0.694	0.602
2032	88.26	81.19	0.666	0.564
2033	87.19	76.75	0.656	0.541
2034	73.19	61.55	0.616	0.492
2035	70.69	57.44	0.583	0.458
2036	68.33	53.47	0.552	0.434
2037	66.45	50.68	0.511	0.402
2038	64.22	47.79	0.487	0.383
2039	63.12	46.00	0.444	0.348
2040	62.60	42.70	0.402	0.315
2041	53.71	33.00	0.327	0.257
2042	53.21	32.02	0.307	0.241
2043	51.50	30.96	0.217	0.171
2044	51.09	31.03	0.140	0.110
2045	44.79	22.28	0.072	0.057
2046	45.63	23.09	0	0
2047	44.66	22.20	0	0
2048	47.39	25.42	0	0
2049	41.67	19.87	0	0
2050	39.99	18.22	0	0
Average[b] (Mt CO_2-e/year)	**67.03**	**52.00**	**0.40**	**0.33**
Total[b] (Mt CO_2-e)	**1,608.77**	**1.248.11**	**9.51**	**7.97**

Notes

(a) The NSW data are for financial years.

(b) For the period 2027 to 2050, including years with zero emissions.

3.6.3 Emission goals

Under the *NSW Guide for Large Emitters*, proponents are required to set long-term scope 1 emission goals, as well as interim goals, for a project's residual emissions. The scope 1 goals are specified in absolute terms (e.g. tonnes CO_2-e for a given year). For the Amended Project, the emission-reduction goals are effectively stated in the combined Safeguard Mechanism baseline and additional voluntary emission reductions to help NSW to achieve its emission-reduction targets (i.e. the final column in Table 3.15, and the green dashed line in Figure 3.15). HV Operations Pty Ltd is committed to achieving the combined decline rate on a net basis and adjusted for ROM coal production.

3.7 Step 6: Offsets strategy

As previously outlined, HV Operations Pty Ltd will thoroughly consider and assess the feasibility of a range of mitigation measures to avoid or reduce emissions wherever reasonable and feasible. Based on the assessments conducted to date, HV Operations Pty Ltd anticipates that, in the short term, the primary approach to achieving the net emission-reduction targets set out in Figure 3.15 will involve the use of carbon offsets and Safeguard Mechanism Credits (SMCs). Any carbon offsets and SMCs surrendered will be fully compliant with the requirements of the Safeguard Mechanism. Eligible carbon offsets must meet the integrity standards set out in the Commonwealth *Carbon Credits (Carbon Farming Initiative) Act 2011*. This approach aligns with both the NSW EPA's expectations and the Safeguard Mechanism framework. As set out above, HV Operations Pty Ltd is committed to prioritising direct emission reductions where feasible, and has already implemented significant direct emission reductions via the Amendment, before relying on offsets.

Table 3.16 shows the potential maximum offsets required to achieve the net scope 1 emissions with the Safeguard Mechanism, and with the Safeguard Mechanism and the additional voluntary NSW decline rate.

Table 3.16 Annual scope 1 emissions and offsets

Calendar year	Scope 1 emissions for Amended Project (kt CO_2-e/year)				
	Gross [A]	Net with Safeguard Mechanism baseline [B]	Net with Safeguard Mechanism baseline + NSW decline [C]	Potential maximum offsets required[(a)] to achieve SM baseline [A - B]	Potential maximum offsets required[(a)] to achieve SM baseline + NSW decline [A - C]
2027	1,082.4	704.4	663.5	378.0	418.9
2028	1,129.7	691.4	639.1	438.3	490.6
2029	1,103.8	738.2	667.5	365.6	436.3
2030	953.9	701.9	621.3	252.1	332.7
2031	814.6	694.2	602.0	120.3	212.6
2032	919.8	665.9	564.1	253.9	355.7
2033	883.6	656.5	541.4	227.1	342.2
2034	837.7	616.0	492.4	221.8	345.4
2035	932.2	582.5	457.5	349.7	474.7
2036	960.8	552.1	433.6	408.7	527.2
2037	833.2	511.4	401.6	321.8	431.5
2038	803.6	487.0	382.5	316.6	421.1
2039	705.0	443.5	348.3	261.5	356.7
2040	766.1	401.6	315.4	364.5	450.7
2041	796.2	327.0	256.8	469.3	539.4

Calendar year	Scope 1 emissions for Amended Project (kt CO_2-e/year)				
	Gross [A]	Net with Safeguard Mechanism baseline [B]	Net with Safeguard Mechanism baseline + NSW decline [C]	Potential maximum offsets required[(a)] to achieve SM baseline [A - B]	Potential maximum offsets required[(a)] to achieve SM baseline + NSW decline [A - C]
2042	743.5	307.1	241.2	436.4	502.3
2043	383.5	217.1	170.5	166.3	212.9
2044	271.6	139.7	109.7	131.8	161.8
2045	183.0	72.3	56.8	110.8	126.3
Average (kt CO_2-e/year)	**795.0**	**500.5**	**419.2**	**294.4**	**375.7**
Total (kt CO_2-e)	**15,104.2**	**9,509.7**	**7,965.2**	**5,594.5**	**7,139.0**

Note

(a) These quantities reflect the maximum number of offsets that would be required, if reasonable and feasible measures to avoid, reduce, or substitute emissions are not identified during the project's life.

To meet its obligations, HVO Operations Pty Ltd will leverage its existing procurement strategies to secure offsets in a timely manner. These strategies typically account for market conditions, including supply, demand, pricing, volumes, timing, and the terms of purchase agreements.

Reflecting the NSW EPA's preference for offsets from NSW-based projects (domestic offsets), HVO Operations Pty Ltd will also consider purchasing NSW-based offsets where they are available and represent a cost-effective option.

3.8 Step 7: Independent expert review

As the Amended Project would have scope 1 and scope 2 emissions exceeding 100,000 t CO_2-e per year during its operational life, the GHG assessment has been verified by an independent expert reviewer (Zephyr Environmental).

The report from the independent expert reviewer is provided in Annexure E. The responses to the points raised by the reviewer are summarised in Table 3.17.

Table 3.17 Responses to comments from the independent expert reviewer

Comment no.	Comment	Response
1	Provide clarification as to where the raw data (input data) was sourced from.	Text added: *Input data were sourced from HVO's mine forecasting software, which provides estimates of diesel usage and electricity consumption, among other operational parameters.*
2	Provide clarification as to why the UK DEFRA EF were used for transport emissions instead of the Australia EFs for transport emissions.	Footnote added to Table A.10: *The DEFRA scope 1 emission factors were used for estimating transport emissions. The DEFRA database represents a comprehensive suite of emission factors that cover a wide range of activities, including energy, transport, water and waste disposal. These emission factors (most recently published in 2024) are more recent than those in the Australian NGER (Safeguard) Rule 2015, and are slightly more conservative.*
3	Provide clarification as to why the explosives were assumed to be the same as diesel emissions.	This refers to a note in the GHG calculation spreadsheet that is not applicable to the calculations. No action required.

Comment no.	Comment	Response
4	Provide clarification on: - the assumed transport of materials distance being 30km (Annexure A.3.3) - the assumed two uses of product coal by end users (Annexure A.4.1) - the assumed international transport being to Japan and China - the assumed immaterially of excluded emission source (Table 3.2 in Section 3.2.1)	Text of section A.3.3 revised: *Emissions were also calculated for the transport of the materials to the HVO Complex site, with an assumed distance of 30 km. This represented the estimated distance from the HVO Complex to the places of business in the Singleton LGA.* Text of section A.4.1 revised: *The split between the quantity of thermal coal and the quantity of metallurgical coal was provided by HV Operations Pty Ltd, through its mine planning processes.* Text of section A.4.2 revised: *The distance by rail from the HVO Complex to the Port of Newcastle was 150 km. For the purpose of simplicity in the calculations, the international transport distance was estimated to be 8,000 km, based on an analysis (in a geographical information system) of the route between Newcastle and Japan by sea.* Japan is identified as the main destination for product coal in section 3.4.2 of the report. Text of section 3.2.1 revised: *Where a particular source was excluded from the assessment, this was either because it was not relevant, activity data for it were not readily available, or its emissions were unlikely to be material (i.e. they would have been low (<1% of total emissions) over the life of the Amendment to materially change the outcomes of the assessment or influence decision-making).*
5	Provide clarification, besides future mitigation technologies, whether uncertainty has been considered for the GHG Assessment/calculations.	Text of section 3.3.3 revised: *The uncertainty in the emission estimates is underpinned by mine planning and geological parameters. The estimated emissions are likely to be conservative, as the calculations do not reflect potential measures for emissions reduction which may become practicable and feasible in the future, such as fleet electrification or alternative fuels.*
6	Provide clarification as to whether the offsets strategy has been considered in terms of timing of acquisition and surrender of credits.	As per item 13.
7	Provide clarification as to why SF6 has been excluded, noting that for NGERs reporting it is.	Footnote added to Table 3.2: *Emissions are expected to be less than 1% of the overall inventory based on data reported in the last two NGERS submissions.*
8	Provide a summary on the scenarios considered, and which scenarios include the mitigation measures.	To be provided in updated GHG assessment. *Refer to section 3.2.5.*
9	Provide clarification as to which substitution/reduction measures have been factored into calculations (see Section 3.4 of Report for mitigation measures).	To be provided in updated GHG assessment. *Refer to section 3.5*.

Comment no.	Comment	Response
10	Discuss the feasibility and effectiveness considerations that were taken into account when preparing the GHG Assessment.	Refer to section 3.4.1 and Table 3.9. With respect to scope 1 emissions, the mitigation measures for fossil fuels are commonly implemented as best practice in the mining sector, and have been reflected in the emissions estimates. A counterfactual case (i.e. without these measures) has not been quantified, partly because it would not occur in practice, and partly because it could not be reliably characterised. The mitigation measures for fugitive emissions have been quantified, as the counterfactual case relevant to the Amendment is informed by the fugitive emission profile of the original HVO Continuation Project. With respect to the evaluation of additional mitigation measures (existing or emerging), section 3.4.1 part iii states that "Mitigation measures are assessed using a range of criteria, including estimated costs, emission-reduction potential and the practicability of deployment."
11	Provide clarification as to how the Offset Strategy will meet the requirements of the Commonwealth Carbon Credits Act 2011.	As per Section 3.7: Any carbon offsets and SMCs surrendered will be fully compliant with the requirements of the Safeguard Mechanism.
12	Provide clarification as to which carbon offsets will be considered, i.e. will the offset projects be Australian/NSW-based?	The following wording has been added to Section 3.7: *To meet its obligations, HVO Operations Pty Ltd will leverage its existing procurement strategies to secure offsets in a timely manner. These strategies typically account for market conditions, including supply, demand, pricing, volumes, timing, and the terms of purchase agreements.* *Reflecting the NSW EPA's preference for offsets from NSW-based projects, HVO Operations Pty Ltd will also consider purchasing NSW-based offsets where they are available and represent a cost-effective option.*
13	Confirm the timing of offsets to be acquired and cancelled.	The differences between the gross scope 1 emissions and the SM or SM + NSW decline baselines reflect the maximum number of offsets that would be required, if reasonable and feasible measures to avoid, reduce, or substitute emissions are not identified during the project's life.
14	Confirm the expected number of offsets/SMCs that the project proposes to use.	As per item 13.

3.9 Climate change considerations

This section provides an assessment of the likely impacts of climate change arising from the Amended Project. It provides an overview of the effects of climate change globally, nationally, in the State of NSW and in the locality of the Amended Project – the Hunter region. Further, based on the estimated total GHG emissions of the Amended Project, it assesses how likely the Amended Project is to affect climate change within these geographies.

Climate change is a global phenomenon driven by the accumulation of GHGs in the Earth's atmosphere, primarily from the combustion of fossil fuels and land use change. The IPCC and the Australian and NSW governments have identified a range of anticipated impacts resulting from continued global warming, many of which are already observable.

The IPCC is the United Nations body for assessing the science related to climate change. The most recent comprehensive assessment from the IPCC is the AR6, published in three parts between 2021 and 2023.

Key findings on global climate impacts from AR6 (IPCC 2023) include:

- Warming observed: Global surface temperature has increased by approximately 1.1°C above pre-industrial levels (1850–1900) as of the 2011–2020 period.
- Extreme weather events: Increased frequency and intensity of heatwaves, heavy precipitation, droughts in some regions, and tropical cyclones (with regional variation).
- Water availability: Increasing water scarcity due to changes in rainfall and increased evapotranspiration.
- Sea level rise: Global mean sea level increased by about 0.2 m from 1901 to 2018, with accelerating trends. Further increases are virtually certain this century.
- Ecosystems and biodiversity: High risk of biodiversity loss, coral reef decline, and terrestrial and marine ecosystem disruption.
- Human health: Increased risk of heat-related morbidity and mortality, food- and water-borne diseases, and mental health impacts.
- Food and water security: Increasing threats to crop yields, food supply chains, and freshwater resources.

At the national level, the latest CSIRO and the Bureau of Meteorology (BoM) *State of the Climate 2024* report highlights the observed and projected effects of climate change in Australia. Its findings (CSIRO and BoM 2024) include:

- Warming observed: Australia's national average temperature has increased by ~1.51 ± 0.23 degrees Celsius (°C) since 1910, with sea surface temperature up by ~1.08°C since 1900.
- Extreme heat: An escalation in the frequency, duration, and intensity of heatwaves over both land and ocean surfaces.
- Marine heatwaves: Oceans are warming faster, triggering more frequent and longer-lasting marine heatwave events.
- Fire weather: Significant increases in extreme fire weather days and lengthening fire seasons across most regions.
- Heavy rainfall: While longer dry spells are emerging in cooler months across southern and eastern Australia, when heavy rainfall does occur it tends to be more intense "drier but flashier" pattern.
- Sea level rise: Ongoing sea level rise is documented, particularly pronounced in the north and south-east Australian coastal regions.
- Ocean acidification: Elevated atmospheric CO_2 concentrations are increasing ocean acidity, posing risks to marine ecosystems, such as the Great Barrier Reef.

AdaptNSW, a NSW Government agency established to help NSW take action and adapt to climate change, provides regional climate projections through the NSW and Australian Regional Climate Modelling (NARCliM) project. The latest model, NARCliM2.0, indicates that across the Hunter region (the locality in which the Amended Project is located), average temperatures in the Hunter Region are projected to continue to increase throughout this century. By 2050, average temperature is projected to rise by around 1.1°C under a low emissions scenario and around 1.9°C under a high emissions scenario (AdaptNSW 2025). It also shows that by 2050:

- sea level is projected to rise by around 19 centimetres (cm) under a low emissions scenario and around 23 cm under a high emissions scenario
- severe fire weather days are modelled to increase by around 0.9 days under a low emissions scenario and around 1.2 days under a high emissions scenario.

Annual average rainfall in the Hunter region is projected to remain variable throughout this century. On average, annual rainfall is projected to decrease by around 8.1% by 2050 under a low emissions scenario and around 15% under a high emissions scenario.

AdaptNSW defines the Hunter region broadly as the area covering the catchment of the Hunter River (which includes the locality of the Amended Project). It covers 21,000 square kilometres (km^2) and includes the city of Newcastle and major regional towns of Maitland, Lake Macquarie, Cessnock, Singleton, Muswellbrook and Scone (AdaptNSW 2025). The region exhibits a number of environmental, social and economic characteristics that are likely to increase its vulnerability to these predicted climate change impacts. These include:

- Agricultural sensitivity: The region supports a diverse agricultural sector, including viticulture, grazing, and cropping, all of which are climate-sensitive. These industries face heightened risk from reduced rainfall, increased temperatures, and higher evapotranspiration.
- Water resource pressures: The Hunter River and its catchments are subject to significant demands from agriculture, industry (including mining), and town water supplies. Climate change is expected to reduce inflows and increase water demand, compounding water security and quality challenges.
- Bushfire exposure: Extensive forested and grassland areas in the region are susceptible to increased fire frequency and severity due to hotter and drier conditions under future climate scenarios.
- Sea level rise: The region includes coastal and estuarine zones which face escalating threats from sea level rise, including inundation, erosion, saltwater intrusion, and infrastructure vulnerability. These risks will be amplified when combined with intense rainfall and river flooding events.
- Infrastructure vulnerability: Roads, energy distribution infrastructure, and water supply systems in the region, particularly in rural and peri-urban areas, may be less resilient to extreme weather events and prolonged heat.
- Community exposure: The region includes communities with economic reliance on natural resource-based industries. Climate change impacts on agriculture, water security, and air quality may affect economic stability and health outcomes.

The Amended Project is estimated to result in a total of about 809 Mt CO_2-e of GHG emissions (between 2027 and 2045) including scope 1, 2 and 3 emissions. It will produce a maximum of about 50 Mt CO_2-e of annual emissions in 2039 and an annual average of about 43 Mt CO_2-e.

In the context of global emissions:

- the maximum annual total emissions generated by the Amended Project in 2039 (about 50 Mt CO_2-e) would equate to 0.132% of the global energy-related[8] CO_2 emissions of 37,800 Mt in 2024 (IEA 2025)
- the total GHG emissions generated over the life of the Amended Project (about 809 Mt CO_2-e) would equate to 0.048% of the global emissions budget of 1,700,000 Mt CO_2-e for the period 2000 to 2050 (CCA 2014)

[8] CO_2 emissions from fuel combustion (including flaring) and industrial processes. Excludes fugitive emissions of other GHGs.

These figures demonstrate that the Amended Project's proportional contribution to global GHG emissions and atmospheric concentrations, and therefore to anthropogenic climate change, is likely to be very small.

It is acknowledged that climate change is driven by the cumulative effects of emissions globally and that any new or continuing source of emissions (such as the Amended Project), no matter how small, contributes to that total. However, from a scientific and policy perspective, the Amended Project's emissions are not of a magnitude that would materially alter the timing, scale, or severity of climate change impacts, whether globally, national, at the State level or within the locality of the Amended Project (Hunter region).

Furthermore, many of the climate impacts predicted to occur in the locality as outlined above (e.g. heatwaves, drought, bushfire conditions) are projected to occur under a wide range of global emissions pathways, including those in which the Amended Project does not proceed. The regional and local manifestation of these impacts will therefore be influenced far more by global and national emissions trajectories than by the emissions of any individual project.

It follows that while the emissions from the Amended Project are part of the broader emissions landscape, they are not a determinative factor in the severity or nature of climate impacts globally, nationally, at the State level or within the on the locality of the Amended Project.

4 Summary and conclusions

This report presents a GHG assessment for the Amended Project, which has been compiled in accordance with the *NSW Guide for Large Emitters* and the calculation methods identified therein. The assessment is based upon GHG emission calculations conducted by Airen (2025). The main outcomes of the assessment are summarised below.

4.1 Gross emissions from the Amended Project

In terms of gross emissions from the Amended Project:

- Scope 1 and scope 2 emissions
  - The Amended Project met the EPA's definition of a large emitter, and therefore the procedure in the *NSW Guide for Large Emitters* has been followed in the GHG assessment.
  - As current mining operations are approved / capable of continuing to the end of 2026, the scope 1 and 2 emissions from the Amended Project would represent incremental emissions relative to the existing project. The incremental scope 1 and scope 2 emissions would reduce with time, being around 1,125 kt CO_2-e/year in 2027, and 184 kt CO_2-e/year by 2045. The reduction would be due to decreases in production volume and fugitive emissions, and the impacts of decarbonisation of the electricity grid.
  - Over the life of the Amended Project, the aggregated scope 1 and scope 2 emissions of the Amended Project would be 15,104 kt CO_2-e and 215 kt CO_2-e, respectively.
  - For scope 1 emissions, the most significant sources would be diesel consumption (58%) fugitive emissions (39%). These sources have been targeted for avoidance and reduction, by applying the EPA mitigation hierarchy.
  - The average scope 1 emission intensity over the life of the Amended Project would be 0.0352 tonnes of CO_2-e per tonne of ROM coal. This value is low relative to other Australian coal operations in 2023-24 and lower than the default industry intensity under the Safeguard Mechanism.
- Scope 3 emissions
  - Scope 3 emissions would be much larger than scope 1 and scope 2 emissions. The aggregated scope 3 emission over the life of the Amended Project would be around 800 Mt CO_2-e.
  - Product coal combustion for power generation would be responsible for around 87% of scope 3 emissions, with coal combustion for steel production accounting for most of the remainder (12%).

4.2 Selection of mitigation measures

The selection of mitigation measures, and their application in the emission calculations, is summarised below.

- Scope 1 and scope 2 emissions
  - The approach to the selection of mitigation measures has followed the mitigation hierarchy in the *NSW Guide for Large Emitters*.
  - The Amendment

        - The Amendment itself would result in significantly lower emissions than the original HVO Continuation Project. This would mainly be achieved by avoiding coal extraction within Domain 1 at HVO North, reducing mining at HVO South, reducing the annual production rates across the complex, reducing the period over which mining would occur, and reducing diesel consumption through optimised haulage.

    - Planned mitigation measures

        - The scope 1 emission estimates for the Amended Project reflect the current operational practices at HVO in relation to maximising energy efficiency and minimising diesel consumption (e.g. optimisation of haul routes and ramp gradients, payload management, energy-efficient equipment).

        - The scope 1 emission estimates also reflect the avoidance of fugitive emissions, primarily at Domain 1, due to the changes in the mine design from the original HVO Continuation Project.

        - Measures for scope 2 emissions include optimisation of CPP operation and electrical mining equipment and decarbonisation of the NSW electricity grid.

    - Evaluation of additional mitigation measures

        - HV Operations Pty Ltd routinely evaluates existing measures and emerging emission-reduction technologies for potential future implementation at the HVO Complex, such as alternative fuels, electric-powered equipment and renewable energy. Mitigation measures are assessed using a range of criteria, including estimated costs, emission-reduction potential and the practicability of deployment.

        - At present, none of the assessed initiatives are considered practicable or feasible for implementation. Every three years, HV Operations Pty Ltd will review technologies and mitigation measures, including whether they are reasonable and feasible to implement.

        - HV Operations Pty Ltd will investigate the feasibility and effectiveness of gas pre-drainage. This will involve a trial of gas drainage in areas identified with high potential. The design of the trial will be developed in consultation with relevant stakeholders and to the satisfaction of the NSW Planning Secretary.

        - Due to the inherent uncertainty in both technical and economic outcomes of such assessment, the potential effects of these measures on GHG emissions cannot yet be accurately quantified.

- Scope 3 emissions

    - HV Operations Pty Ltd anticipates that future export destinations for HVO Complex coal will continue to follow similar patterns as historic sales. The primary countries that HVO Complex coal has been exported to all have NDCs under the Paris Agreement (or have followed international standards recognised by the UNFCCC and published their own NDCs document in support of the Paris Agreement).

4.3 Emissions with mitigation measures

- Mitigation measures relating to existing operational practices, as applied in the Amended Project
  - The benefits of mitigation measures relating to fuel efficiency and electricity consumption could not be reliably quantified, as establishing the counterfactual scenario would be hypothetical and subjective.
- Mitigation measures relating to the changes between the original and amended HVO Continuation Project
  - Significant reductions in emissions are expected with the Amendment, particularly in the years from around 2039 onwards. Compared with the original HVO Continuation Project, total scope 1 and 2 emissions would decrease by 11,487 kt CO_2-e over the life of the Amended Project. The major driver of these reductions would be the avoidance of fugitive emissions in Domain 1.
- Mitigation measures relating to the Safeguard Mechanism and NSW Net Zero Future Act
  - The Amended Project would continue to emit above the Safeguard Mechanism threshold of 100,000 t of CO_2-e per year throughout its life. As a Safeguard facility, the Amended Project would be subject to the declining emissions trajectory required by the Safeguard Mechanism.
  - HV Operations Pty Ltd proposes that the emissions from the Amended Project would be managed in a way that is consistent with the company's obligations under the Safeguard Mechanism (i.e. the decline rate for emissions under the Safeguard Mechanism baseline).
  - HV Operations Pty Ltd also proposes to implement measures that go beyond its Safeguard Mechanism obligations by making additional, voluntary contribution towards the NSW emission-reduction targets to reflect consideration of the NSW Net Zero Future Act.
  - Over the life of the Amended Project, the aggregated net scope 1 emissions with the Safeguard Mechanisms baseline would be 9,510 kt CO_2-e, and with the combined Safeguard Mechanism and NSW decline rate would be 7,965 kt CO_2-e
  - Over the life of the Amended Project, compliance with the Safeguard Mechanism baseline would reduce scope 1 GHG emissions by 5,595 kt CO_2-e, and compliance with the combined Safeguard Mechanism and NSW decline rate would reduce GHG emissions by 7,139 kt CO_2-e.
  - The mitigated emissions for the Amended Project would be the net emissions for the combined Safeguard Mechanism and NSW decline rate.

4.4 Emission benchmarking and goal setting

- Safeguard Mechanism obligations
  - Emission reductions
    - As noted above, emissions from the Amended Project would reduce according to the Safeguard Mechanism baseline and the additional, voluntary contribution towards the NSW emission-reduction targets.
  - Emissions intensity

- The gross scope 1 emissions intensity of the Amended Project (0.0351 t CO_2-e per tonne of ROM coal) is materially lower than the industry average emissions intensity in the Safeguard Mechanism (0.0653 t CO_2-e per tonne of ROM coal), and is expected to decrease over life of the Amended Project.

- Applying the Safeguard Mechanism with the additional NSW decline rate, the net emission intensity would be significantly lower: down to around 0.006 t CO_2-e per tonne of ROM coal by 2045, which is an order of magnitude below the industry average benchmark.

- Comparison with NSW emissions

  - The Amended Project would be a relatively small contributor to GHG emissions in NSW. For example, for the combined Safeguard Mechanism and NSW decline trajectory, it would represent between 0.25% and 0.81% (depending on the year) of state-wide emissions in the NSW current policy case.

  - In percentage terms, the Amended Project would follow a lower emissions trajectory than the NSW current policy scenario. In other words, net emissions for the Amendment (including the Safeguard Mechanism and additional NSW decline rate) are projected to reduce at a greater rate (5.1% per year on average) than those for the state (4.4% per year on average). The Amended Project therefore supports NSW efforts to decarbonise.

- Emission goals

  - For the Amended Project, the emission-reduction goals are effectively stated in the combined Safeguard Mechanism baseline and additional voluntary emission reductions to help NSW to achieve its emission-reduction target. HV Operations Pty Ltd is committed to achieving the combined decline rate on a net basis and adjusted for ROM coal production.

4.5 Offsets strategy

HV Operations Pty Ltd will thoroughly consider and assess the feasibility of a range of mitigation measures to avoid or reduce emissions wherever reasonable and feasible.

HV Operations Pty Ltd anticipates that, in the short term, the primary approach to achieving the net emission-reduction targets will involve the use of carbon offsets and Safeguard Mechanism Credits (SMCs). Any carbon offsets and SMCs surrendered will be fully compliant with the requirements of the Safeguard Mechanism. This approach aligns with both the NSW EPA's expectations and the Safeguard Mechanism framework, with HV Operations Pty Ltd having committed to prioritising direct emission reductions where feasible, before relying on offsets.

4.6 Climate change considerations

The locality of the Amended Project, the Hunter region, is susceptible to certain climate change impacts, particularly those associated with heat, water scarcity, and bushfire risk.

These risks are not unique to the Hunter region but are influenced by its environmental and economic profile.

The Amended Project will contribute to global GHG emissions. However, this contribution will be very small as a proportion of global GHG emissions and is not sufficient to materially affect the extent or timing of climate change impacts in the locality, which are driven by global cumulative emissions. It is also not possible to conclude that the Amended Project's GHG emissions will lead to a net increase in global emissions, and therefore contribute to an increase in global temperatures, as this outcome is dependent on multiple factors external to the Amended Project.

Abbreviations

ACCU	Australian Carbon Credit Unit
CER	Clean Energy Regulator
CH_4	methane
CO_2	carbon dioxide
CO_2-e	carbon dioxide equivalent
COP	Conference of the Parties (to the UNFCCC)
DPHI	(NSW) Department of Planning, Housing and Infrastructure
EIS	environmental impact statement
EPA	(NSW) Environment Protection Authority
EP&A Act	Environmental Planning and Assessment Act 1979
GHG	greenhouse gas
GWP	global warming potential
HVO	Hunter Valley Operations
HVO JV	HVO JV Hunter Valley Operations Joint Venture comprising Glencore and Yancoal which own HVO and associated assets
IPCC	Intergovernmental Panel on Climate Change
MIA	mine infrastructure area
Mt	million tonnes
Mtpa	million tonnes per annum
MWh	megawatt-hour
N_2O	nitrous oxide
NGA	National Greenhouse Accounts
NGER Act	National Greenhouse and Energy Reporting Act 2007
NSW	New South Wales
OEM	original equipment manufacturer
ROM	run-of-mine
SEARs	Secretary's Environmental Assessment Requirements
SF_6	sulfur hexafluoride
SMC	Safeguard Mechanism Credit
SSD	State significant development
UNFCCC	Nations Framework Convention on Climate Change

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Annexure A

GHG emission calculation methods

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A.1 Scope 1 emissions

A.1.1 Liquid fuel consumption (diesel)

For each greenhouse gas *i* (CO_2, CH_4 and N_2O), annual scope 1 emissions from the on-site consumption (through combustion) of liquid fuels were estimated using the following equation:

$$E_i = \frac{Q \times EC \times EF_i}{1{,}000}$$

Equation A.1

where:

E_i = GHG emission for gas *i* (t CO_2-e/year)

Q = quantity of fuel (kL/year)

EC = energy content of fuel (GJ/kL)[9]

EF_i = emission factor for gas *i* (kg CO_2-e/GJ)[10]

For the Amended Project, the only significant liquid fuel would be diesel in on-site mobile and stationary plant and equipment.

The energy content and GHG emission factors for diesel are presented in Table A.1. The quantity of diesel fuel (kL) used in the assessment is given in Annexure C.

Table A.1 Energy content and emission factors – diesel consumption

Fuel	Energy content (GJ/kL)	Scope 1 emission factor (kg CO_2-e/GJ)			Reference
		CO_2	CH_4	N_2O	
Diesel	38.6	69.9	0.1	0.2	DCCEEW (2024a) (Table 8, diesel oil)

A.1.2 Fugitive emissions

Fugitive emissions would be released during the extraction of coal and from post-mining activities (e.g. coal stockpiles). Fugitive emissions were estimated using Method 2 of the NGER Measurement Determination[11]. This approach was also used for the original HVO Continuation Project (EMM 2023a).

Method 2 involves estimating fugitive emissions using site-specific data that have been obtained using industry standard methodologies. Fugitive emissions were calculated using the HVO gas assignment model – a gas domains/zones model – which has been constructed using site-specific gas data as per NGERs requirements (see Annexure B). This model assigns site-specific gas content and composition data to in-situ gas-bearing strata, considering spatial and vertical location, to estimate gas-in-place for the areas mined.

A.1.3 Blasting using explosives

GHG emissions from use of explosives for blasting were estimated using the following equation:

[9] GJ = gigajoules

[10] kg CO_2-e/GJ = kilograms of carbon dioxide equivalents per gigajoule

[11] Chapter 3, Part 3.2. Division 3.2.3, Subdivision 3.2.3.2, Method 2.

$$E_{CO_2-e} = Q \times EF$$

Equation A.2

Where:

E_{CO2-e} = emissions of GHG from explosives (emulsion) use (t CO_2-e/year)

Q = quantity of explosives (t/year)

EF = emission factor (scope 1) for explosives (emulsion) use (t CO_2-e/t explosive)

The GHG emission factor was sourced from the NGAF (DCC 2008), as shown in Table A.2. There are no more recent emission factors available in the NGAF documents for explosives use.

Table A.2 Emission factor – explosives use

Project phase	Fuel type	Scope 1 emission factor (t CO_2-e/t)	Source
Construction	Emulsion	0.17	DCC (2008) (Table 4, emulsion)

A.1.4 Land use changes

The Amended Project is not likely to result in significant land use change. The clearing of vegetation for the Amended Project would occur in 2027 only. Activities would include clearing, grubbing and mulching to stockpiles all vegetation within earthworks areas.

GHG emissions from the loss of the carbon sink associated with the clearing of vegetation were estimated using the method from the TAGG Workbook and the Carbon Gauge tool (TAGG 2013a, 2013b). GHG emissions were estimated using the following equation:

$$E_{CO_2-e} = \sum_{i-1}^{i=n} A_i \times EF_i$$

Equation A.3

Where:

E_{CO2-e} = GHG emissions from vegetation clearing (t CO_2-e/year)

A_i = area of vegetation of type *i* (t/year)

EF_i = emission factor for vegetation of type *i* (t CO_2-e/ha)

In this case it was assumed, conservatively in terms of emissions, that all cleared vegetation would be of the same type (open woodlands – class D). The maps in Appendix E of TAAG (2013a) were used to determine the 'maximum potential biomass class', based on the location of the HVO Complex. This combination resulted in the emission factor given in Table A.3.

Table A.4 gives the amount of vegetation estimated to be cleared.

Table A.3 Emission factor – vegetation clearing

Vegetation type	Maximum potential biomass class	Emission factor (t CO_2-e/ha)	Source
Open woodlands (class D)	3	311.62	TAGG (2013a) and Carbon Gauge (Appendix E, Table 2 and Figure 1)

Table A.4 Vegetation cleared (2027 only)

Vegetation type	Amount cleared (ha)	Source
Open woodlands (class D)	76	Airen (2025)

A.2 Scope 2 emissions

Annual scope 2 GHG emissions associated with on-site electricity consumption were estimated using the following equation:

$$E_{CO_2-e} = \frac{Q \times EF}{1{,}000}$$

Equation A.4

where:

E_{CO2-e} = GHG emissions associated with on-site electricity consumption (t CO_2-e/year)

Q = quantity of electricity (MWh/year)[12]

EF = emission factor for electricity consumption (kg CO_2-e/MWh)

The scope 2 emission factors for electricity consumption were taken from *Australia's emissions projections 2024* (DCCEEW 2024b). These values are presented in Table A.5. The amount of electricity consumed in each year is given in Annexure C.

Table A.5 Scope 2 GHG emission factors for electricity consumption

Calendar year	Emission factor (t CO_2-e/MWh)	Reference
2027	0.40	DCCEEW (2024b) (values for NSW/ACT in Table 46)
2028	0.34	
2029	0.21	
2030	0.15	
2031	0.15	
2032	0.13	
2033	0.09	
2034	0.09	
2035	0.07	
2036	0.06	
2037	0.06	
2038	0.06	
2039	0.06	
2040 and later	0.03	

[12] MWh = megawatt hours

A.3 Scope 3 emissions (upstream)

A.3.1 Extraction, production and transport of liquid fuel (diesel)

Upstream scope 3 emissions for diesel consumption were calculated using Equation A.1. The energy content and scope 3 GHG emission factors for diesel are presented in Table A.6. The quantities of diesel fuel (kL) used in the assessment are given in Annexure C.

Table A.6 Energy content and scope 3 emission factors – liquid fuel consumption

Fuel	Energy content (GJ/kL)	Scope 3 emission factor (kg CO_2-e/GJ)	Reference
Diesel	38.6	17.3	DCCEEW (2024a) (Table 8, diesel oil)

A.3.2 Electricity consumption

Annual scope 3 GHG emissions associated with on-site electricity consumption were estimated using Equation A.4, in combination with the electricity consumption values in Annexure C and the scope 3 emission factors in Table A.7. The scope 3 emission factors for electricity consumption were taken from *Australia's emissions projections 2024* (DCCEEW 2024b).

Table A.7 Scope 3 GHG emission factors for electricity consumption

Calendar year	Scope 3 emission factor (t CO_2-e/MWh)	Reference
2027	0.03	DCCEEW (2024b) (derived from values for NSW/ACT in Tables 46 and 47)
2028	0.02	
2029	0.02	
2030	0.01	
2031	0.01	
2032	0.01	
2033	0	
2034	0	
2035	0.02	
2036	0.01	
2037	0	
2038	0	
2039	0	
2040 and later	0	

A.3.3 Embodied emissions and material transport

GHG emissions from embodied emissions (the emissions created over the life cycle of construction materials, from creation to disposal) were estimated using the following equation:

$$E_{CO_2-e} = Q_k \times EF_k$$ Equation A.5

Where:

E_{CO2-e} = emissions of GHG from material *k* (t CO_2-e)

Q_k = quantity of material *k* (t)

EF_k = emission factor for material *k* (t CO_2-e/y)

The GHG emission factors for different construction materials were taken from the Infrastructure Sustainability Materials Calculator (ISMC) Version 2.0, developed by the ISCA (ISCA 2019).

Emissions were also calculated for the transport of the materials to the HVO Complex site, with an assumed distance of 30 km. This represented the estimated distance from the HVO Complex to the places of business in the Singleton LGA. The emission factors were again taken from ISCA (2019).

The emission factors are presented in Table A.8, and the activity data are provided in Annexure C.

Table A.8 GHG emission factors – embodied emissions

Materia	Embodied emissions emission factor (t CO_2-e/t)	Transport emission factor (kg CO_2-e/tkm)	Source
3 x 1,500 mm diameter corrugated steel pipes	2.46	0.07	ISCA (2019)
32 MPa concrete	0.16	0.13	
40 MPa concrete	0.20	0.13	
40 MPa steel reinforced concrete	0.20	0.13	
Access track ballast	0.01	0.07	
Asphalt	0.05	0.07	
Asphalt correction layer	0.05	0.07	
Asphalt overlay (AC14 AR320)	0.05	0.07	
Basecourse material	0.01	0.07	
Buried conductor	2.73	0.07	
Copper	2.68	0.07	
DN630 PN16 PE100 pipeline	2.43	0.07	
DN900 PN12 PE100 pipeline	2.43	0.07	
Gravel	0.01	0.07	
Hot rolled asphalt	0.06	0.07	
Steel	1.55	0.07	
Steel reinforcement	1.23	0.07	
Steel reinforcement for concrete	1.23	0.07	

Materia	Embodied emissions emission factor (t CO_2-e/t)	Transport emission factor (kg CO_2-e/tkm)	Source
Sub-base/road base material	0.01	0.07	
Sub-base material	0.01	0.07	
Transmission cables	10.80	0.07	
Transmission steel	1.55	0.07	

A.4 Scope 3 emissions (downstream)

A.4.1 Product coal combustion

The product coal would be used by end users for two purposes:

- combustion of thermal coal for the generation of electricity in power stations
- combustion of semi-soft coking coal by end users for steel production.

The split between the quantity of thermal coal and the quantity of metallurgical coal was provided by HV Operations Pty Ltd, through its mine planning processes.

For each greenhouse gas *i* (CO_2, CH_4 and N_2O), annual scope 3 emissions for coal combustion were estimated using the following equation:

$$E_i = \frac{Q \times EC \times EF_i}{1{,}000}$$

Equation A.6

where:

E_i = GHG emission for gas *I* (t CO_2-e/year)

Q = quantity of coal (t/year)

EC = energy content of coal (GJ/t)[13]

EF_i = emission factor for gas *I* (kg CO_2-e/GJ)

The energy content and GHG emission factors for coal consumption are presented in Table A.9. Although the combustion of the coal would be a scope 3 process, the scope 1 emission factors were used to represent the actual emissions associated with the processes.

The quantities of coal used in the assessment are given in Annexure C.

Table A.9 Energy content and scope 1 emission factors – coal combustion

Fuel type	Energy content (GJ/t)	Scope 1 emission factor (kg CO_2-e/GJ)			Reference
		CO_2	CH_4	N_2O	
Coal (thermal)	27.0	90.0	0.04	0.2	DCCEEW (2024a) (Table 4, bituminous coal)
Coal (coking)	30.0	91.8	0.03	0.2	DCCEEW (2024a) (Table 4, coking coal)

[13] GJ = gigajoules

A.4.2 Product coal transport

Scope 3 emissions were calculated for the transport of product coal in two steps:

- transport by rail from the HVO Complex to the Port of Newcastle
- transport by sea from the Port of Newcastle to Japan (as the largest end user).

The distance by rail from the HVO Complex to the Port of Newcastle was 150 km. For the purpose of simplicity in the calculations, the international transport distance was estimated to be 8,000 km, based on an analysis (in a geographical information system) of the route between Newcastle and Japan by sea.

The GHG emission factors for coal transport are presented in Table A.10. Again, although the transport of the coal would be a scope 3 process, the scope 1 emission factors were used to represent the actual emissions associated with the processes.

The amount of product coal being transported is given in Annexure C.

Table A.10 Scope 1 emission factors – product coal transport

Transport mode	Scope 1 emission factor (kg CO_2-e/tonne-km)	Reference
Rail	0.02779	DEFRA (2024)[(a)] (Freighting goods / freight train)
Sea	0.00353	DEFRA (2024) [(a)] (Freighting goods / cargo ship, bulk carrier)

Note

(a) The DEFRA scope 1 emission factors were used for estimating transport emissions. The DEFRA database represents a comprehensive suite of emission factors that cover a wide range of activities, including energy, transport, water and waste disposal. These emission factors (most recently published in 2024) are more recent than those in the Australian NGER (Safeguard) Rule 2015, and are slightly more conservative.

Annexure B

Gas assignment model for the HVO Complex

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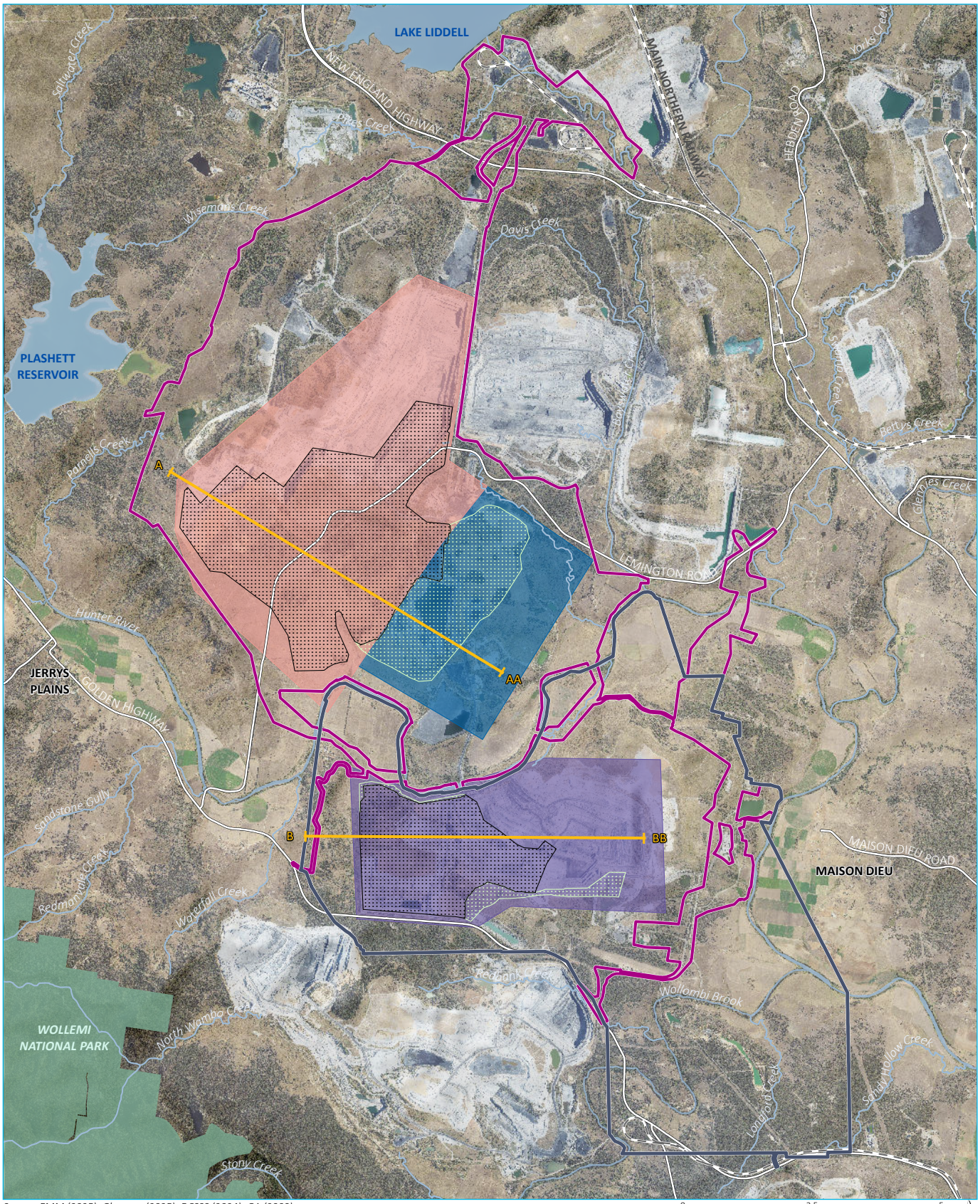
With respect to the estimation of scope 1 fugitive emissions, the mining areas across the HVO Complex have been divided into three gas domains in the gas assignment model, which are defined by gas concentration and gas composition. HVO North is within Domain 1 (proposed to be avoided by the Amended Project) and Domain 2 (bounded at the Hunter Valley dyke), while HVO South (south of the Hunter River), is entirely within Domain 3. Each domain is then further divided into a vertical sequence of zones which vary in depth, driven by changes in gas content and composition.

The near-surface Low Gas Zone (Zone 0 in HVO South) is present across all the domains (although much thicker in Domain 2), as is Zone 1, which has a typically low gas content.

Domains 1 and 3 also have Zones 2 to 4 modelled to better represent the variation in the vertical gas distribution, which generally has an increase in gas content with increased depth. The 20 m sub-floor interval is also modelled for each domain.

The zone boundaries have been interpreted using the gas drilling data on a borehole-by-borehole basis, and have initially been defined at the type holes within each domain and supported by validation hole data where available.

The mine plan for the Amended Project moves through these different domains (excluding Domain 1), which are illustrated in cross sections in Figure B.1. The locations of these two cross sections are shown in Figure B.2 and depict the revised extent of mining proposed by the Amended Project (excluding Domain 1) with reference to the extent of mining proposed in the original HVO Continuation Project (EMM 2023a and EMM 2023b).



Source: EMM (2025); Glencore (2025); DCSSS (2024); GA (2009)

0 2.5 5 km

GDA2020 MGA Zone 56

N

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KEY

- Amended proposed HVO North development consent boundary
- Proposed HVO South development consent boundary
- Cross section
- Previous mining area no longer proposed
- Proposed mining area

Domain (gas model)

- Domain 1
- Domain 2
- Domain 3

Existing environment

- Rail line
- Major road
- Named watercourse
- Named waterbody
- NPWS reserve

HVO greenhouse gas model domains

HVO Continuation Project - Amendment
Greenhouse gas assessment
Figure B.1

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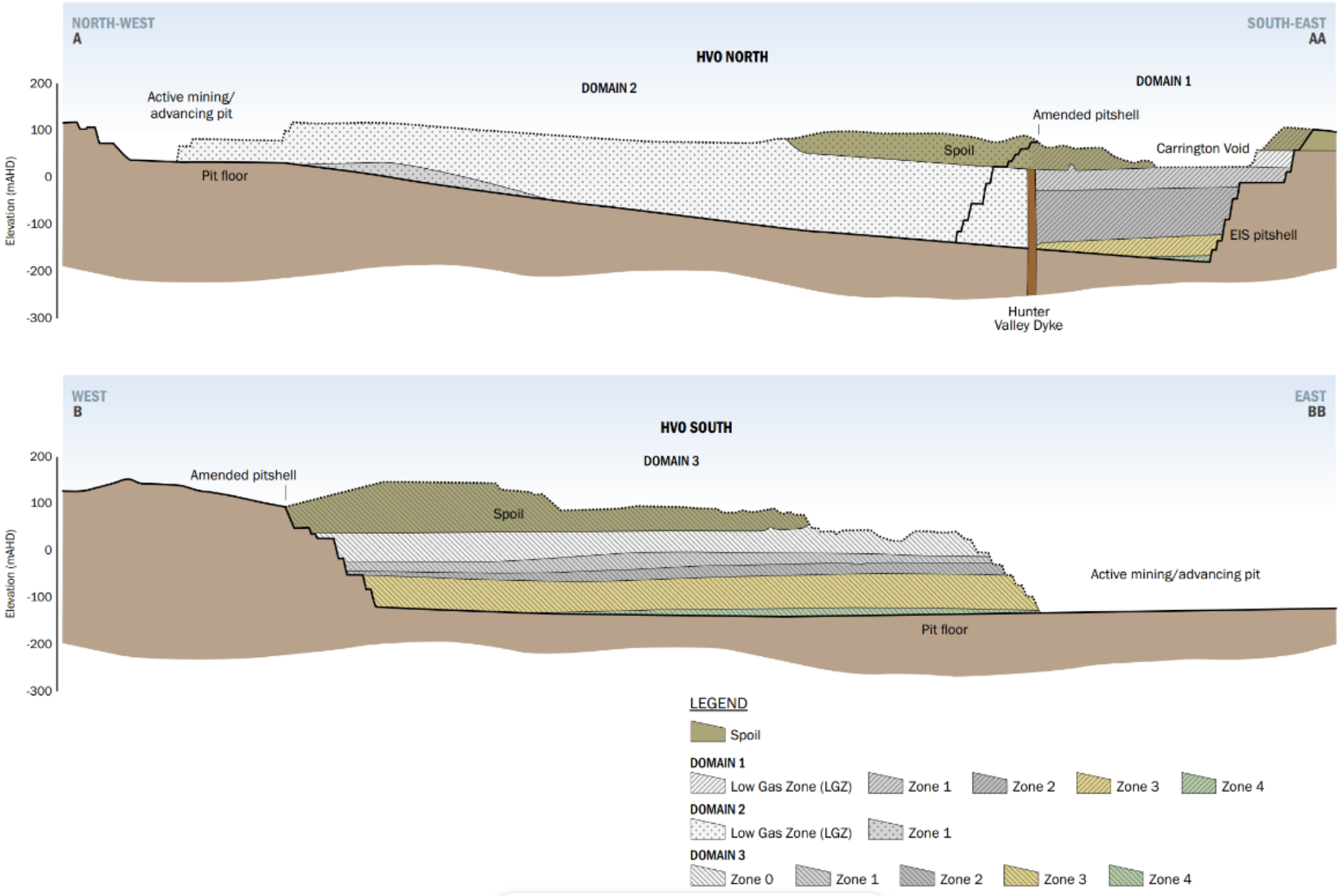

Note – Domain 1 will not be mined by the Amended Project

Figure B.2 Conceptual gas domains and zones across the HVO Complex

Annexure C
Activity data

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The activity data for use in the GHG emission calculations for the Amended Project (Scenario 3) were provided by HV Operations Pty Ltd. The annual data are provided in Table C.1, and the total life values are given in Table C.2.

Table C.1 Annual activity data for Scenario 3

Calendar year	ROM coal (kt/year)	Product coal (kt/year)	Thermal coal (kt/year)	Coking coal (kt/year)	Diesel (kL/year)	Explosives (t/year)	Vegetation removed (ha/year)	Electricity consumption (MWh/year)
2027	21,603	16,293	13,796	2,497	167,454	60,896	76	105,461
2028	21,056	16,064	13,537	2,527	193,112	75,059	-	103,885
2029	22,534	16,674	14,324	2,350	192,521	66,749	-	110,515
2030	22,053	15,994	14,202	1,792	191,832	64,933	-	107,958
2031	22,992	16,823	13,693	3,130	189,216	64,437	-	105,449
2032	23,313	17,022	15,259	1,763	196,138	66,176	-	102,786
2033	24,377	18,044	16,130	1,914	186,133	73,484	-	104,519
2034	24,348	17,462	14,989	2,473	201,047	78,083	-	103,855
2035	24,614	18,281	15,862	2,419	197,147	77,566	-	106,339
2036	25,055	18,495	17,404	1,091	187,656	68,143	-	107,088
2037	25,066	18,253	16,114	2,139	179,260	73,109	-	105,702
2038	25,948	18,699	17,339	1,360	179,648	65,458	-	108,767
2039	25,881	19,758	18,967	791	174,193	58,785	-	117,502
2040	25,897	19,096	17,568	1,528	179,121	56,768	-	117,278
2041	23,568	16,763	14,980	1,783	181,099	63,810	-	107,049
2042	25,089	18,907	17,840	1,067	175,589	57,037	-	113,924
2043	20,467	14,753	13,662	1,091	136,442	54,047	-	88,711
2044	15,566	11,494	10,439	1,055	96,677	36,588	-	70,358
2045	9,840	7,390	7,111	279	65,496	19,551	-	44,475

Table C.2 Life activity data for Scenario 3

Variable	Total for all calendar years
ROM coal (t)	429,268,019
Product coal (t)	316,265,000
Thermal coal (t)	283,216,000
Coking coal (t)	33,049,000
Diesel consumption (kL)	3,269,781
Explosives (t)	1,180,679
Vegetation removed (ha)	76
Electricity consumption (MWh)	1,931,618

Table C.3 Activity data for construction materials

Material	Amount	Density	Transport distance
3 x 1,500 mm diameter corrugated steel pipes	170 m	76 kg/m	30 km
32 MPa concrete	13,610 m^3	2,400 kg/m^3	30 km
40 MPa concrete	800 m^3	2,400 kg/m^3	30 km
40 MPa steel reinforced concrete	2,195 m^3	2,400 kg/m^3	30 km
Access track ballast	19,150 m^3	1,700 kg/m^3	30 km
Asphalt	1,000 m^3	2,120 kg/m^3	30 km
Asphalt correction layer	265 m^3	2,120 kg/m^3	30 km
Asphalt overlay (AC14 AR320)	975 m^3	2,120 kg/m^3	30 km
Basecourse material	31,040 m^3	1,700 kg/m^3	30 km
Buried conductor	11,000 m	0.377 kg/m	30 km
Copper	52 t	8.94 t/m^3	30 km
DN630 PN16 PE100 pipeline	16,200 m	0.14 kg/m	30 km
DN900 PN12 PE100 pipeline	500 m	0.14 kg/m	30 km
Gravel	12,060 m^3	1,700 kg/m^3	30 km
Hot rolled asphalt	6,867 m^2	2,120 kg/m^3	30 km
Steel	1,673 t	7,850 kg/m^3	30 km
Steel reinforcement	157 t	7,850 kg/m^3	30 km
Steel reinforcement for concrete	1,031 t	7,850 kg/m^3	30 km
Sub-base/road base material	82,512 m^3	1,600 kg/m^3	30 km
Sub-base material	32,020 m^3	1,600 kg/m^3	30 km
Transmission cables	169,000 m	2.65 kg/m	30 km
Transmission steel	204 t	7,850 kg/m^3	30 km

Annexure D
Emissions data

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For Scenario 3, the emission estimates (CO_2-e) for scope 1 and scope 2 emissions (by source and by year) are given in Table D.1, and scope 3 emissions are given in Table D.2.

Table D.1 Scope 1 and scope 2 emissions by source and year (Scenario 3)

Calendar year	GHG emissions by calendar year (kt CO_2-e/year)							
	Scope 1					Scope 2	Scope 1 total	Scope 1 + scope 2 total
	Diesel consumption (construction)	Diesel consumption (operation)[a]	Fugitive emissions	Blasting	Vegetation clearing	Electricity consumption		
2027	11.3	442.4	594.5	10.4	23.8	42.2	1,082.4	1,124.6
2028	8.5	514.8	593.6	12.8	-	35.3	1,129.7	1,165.0
2029	3.6	518.1	570.7	11.3	-	23.2	1,103.8	1,127.0
2030	3.3	516.6	423.1	11.0	-	16.2	953.9	970.1
2031	-	512.7	290.9	11.0	-	15.8	814.6	830.4
2032	1.1	530.4	377.1	11.2	-	13.4	919.8	933.2
2033	-	504.4	366.7	12.5	-	9.4	883.6	893.0
2034	-	544.8	279.7	13.3	-	9.3	837.7	847.1
2035	-	534.2	384.8	13.2	-	7.4	932.2	939.7
2036	-	508.5	440.7	11.6	-	6.4	960.8	967.2
2037	-	485.7	335.0	12.4	-	6.3	833.2	839.5
2038	-	486.8	305.7	11.1	-	6.5	803.6	810.1
2039	-	472.0	223.0	10.0	-	7.1	705.0	712.1
2040	-	485.4	271.0	9.7	-	3.5	766.1	769.6
2041	-	490.7	294.7	10.8	-	3.2	796.2	799.4
2042	-	475.8	258.0	9.7	-	3.4	743.5	747.0
2043	-	369.7	4.6	9.2	-	2.7	383.5	386.1
2044	-	262.0	3.4	6.2	-	2.1	271.6	273.7
2045	-	177.5	2.2	3.3	-	1.3	183.0	184.4
Average (kt CO_2-e/year)	**5.5**[b]	**464.9**	**316.8**	**10.6**	**23.8**[b]	**11.3**	**795.0**	**806.3**
Total (kt CO_2-e)	**27.7**	**8,832.5**	**6,019.5**	**200.7**	**23.8**	**214.9**	**15,104.2**	**15,319.1**

Notes

(a) Including progressive mine rehabilitation.
(b) Based on non-zero years only.

Table D.2 Scope 3 emissions by source and year (Scenario 3)

Calendar year	GHG emissions by calendar year (kt CO_2-e/year)								
	Scope 3 upstream				Scope 3 downstream				Scope 3 total
	Diesel consumption (construction)	Diesel consumption (operation)[a]	Electricity consump.	Embodied emissions	Product coal transport (rail)	Product coal transport (sea)	Coal combustion (power)	Coal combustion (steel)	
2027	2.8	109.0	3.2	20.7	67.9	460.1	33,614	6,894	41,171
2028	2.1	126.9	2.1	-	67.0	453.6	32,983	6,977	40,611
2029	0.9	127.7	2.2	-	69.5	470.9	34,900	6,488	42,059
2030	0.8	127.3	1.1	-	66.7	451.7	34,603	4,948	40,198
2031	-	126.4	1.1	-	70.1	475.1	33,363	8,642	42,677
2032	0.3	130.7	-	-	71.0	480.7	37,178	4,868	42,728
2033	-	124.3	-	-	75.2	509.6	39,300	5,284	45,294
2034	-	134.3	-	-	72.8	493.1	36,520	6,828	44,048
2035	-	131.7	2.1	-	76.2	516.3	38,647	6,679	46,052
2036	-	125.3	1.1	-	77.1	522.3	42,404	3,012	46,142
2037	-	119.7	-	-	76.1	515.5	39,261	5,906	45,878
2038	-	120.0	-	-	77.9	528.1	42,246	3,755	46,727
2039	-	116.3	-	-	82.4	558.0	46,213	2,184	49,153
2040	-	119.6	-	-	79.6	539.3	42,804	4,219	47,761
2041	-	120.9	-	-	69.9	473.4	36,498	4,923	42,085
2042	-	117.3	-	-	78.8	533.9	43,467	2,946	47,143
2043	-	91.1	-	-	61.5	416.6	33,287	3,012	36,869
2044	-	64.6	-	-	47.9	324.6	25,434	2,913	28,784
2045	-	43.7	-	-	30.8	208.7	17,326	770	18,379
Annual average (kt CO_2-e/year)	**1.4[a]**	**114.6**	**1.8[a]**	**20.7[a]**	**69.4**	**470.1**	**36,318**	**4,802**	**41,777**
Total (kt CO_2-e)	**6.8**	**2,176.7**	**12.8**	**20.7**	**1,318.4**	**8,931.3**	**690,050**	**91,245**	**793,762**

Notes

(a) Including progressive mine rehabilitation.
(b) Based on non-zero years only.

Annexure E

Independent expert review

EMM
creating opportunities

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5 August 2025

Independent Reviewer's Report for the HVO Continuation Project Amendment in accordance with the NSW EPA's Guide for Large Emitters

Zephyr Environmental Pty Ltd (Zephyr) has been engaged by Hunter Valley Operations Pty Ltd (HVO) to perform an independent review of the Greenhouse Gas (GHG) Assessment Report and Mitigation Plan prepared for the proposed HVO Continuation Project Amendment ('the Project').

Zephyr understands that the GHG Assessment Report was prepared by EMM Consulting Pty Ltd (EMM) and Airen Consulting Pty Ltd (Arien) for the Project, located at HVO North and HVO South sites in the Hunter Valley, NSW. The GHG Assessment Report is stated to have been prepared to support the application for the Project in accordance with the NSW Environment Protection Authority's (EPA) Guide for Large Emitters. It is our understanding that the report will be submitted as part of HVO's application to the Department of Planning, Housing and Infrastructure (DPHI).

This letter serves as the formal submission of the independent reviewer's report for HVO's conducted in accordance with Section 4.7 of the NSW Guide for Large Emitters.

1. INDEPENDENT EXPERT REVIEWER

In accordance with Section 4.7 of the NSW Guide for Large Emitters the GHG Assessment Report and Mitigation Plan are subject to an independent expert review from an independent and suitably qualified expert reviewer.

I confirm that I am a Category 2 (Lead) Auditor under the National Greenhouse and Energy Reporting (NGER) scheme, and I have attached my CV to Appendix A. This provides evidence of my qualifications and experience that are relevant to this review.

As a Category 2 registered greenhouse and energy auditor, my role is to evaluate compliance of the schemes administered by the Clean Energy Regulator (CER). This has provided me exposure to both the market demand for offsets (NGER and Safeguard Mechanism) and supply (ACCU scheme) and thus requires me to understand Australian carbon market dynamics.

No actual or perceived conflicts of interest have come to my attention, and I have not been employed by the proponent within the last five years.

2. SCOPE OF REVIEW

In accordance with Section 4.7 of the NSW Guide for Large Emitters, the independent expert review focused on the:

- assessment of the emissions boundary
- source of emissions associated with the full life cycle of the project
- mitigation assessment
- offset strategy

The review assessed the accuracy, completeness, and compliance of Project's emissions and mitigation reporting as detailed in the NSW Guide for Large Emitters.

3. FINDINGS AND RECOMMENDATIONS

Some of the findings from the independent expert review, in accordance with the scope of review detailed above, are summarised in Table 1 below. These findings, and HVO's responses, are also included in Table 3.17 of the GHG Assessment Report.

Further information regarding HVO's proposed mitigation measures and offset strategy are presented in more detail in Sections 3.1 and 3.2, respectively.

Table 1: Commentary on minor aspects of the independent reviewer's scope items

Review item	Finding	Recommendation
Assessment boundary	The initial Assessment Boundary did not include SF_6 or employee travel. This was updated and HVO has included statements on the reasons these emissions were considered not material. The final GHG Assessment boundary is considered satisfactory.	None
Scenarios	The independent reviewer asked for further clarification on the scenarios detailed in the initial Assessment Report. Specifically, which scenario(s) were being considered and which scenarios included mitigation strategies. The Assessment Report has been updated to reflect these specifications. The final scenarios for the GHG Assessment are considered satisfactory.	None
Emission Sources	In the initial Assessment Report, the reasons for excluding certain emission sources were not explained. This was update and HVO provided a response as to why these emission sources were deemed immaterial. The emission sources for the final GHG Assessment are considered satisfactory.	None
Monitoring	The monitoring and reporting detailed in the GHG Assessment Report was found to be in accordance with NGER and Safeguard Mechanism requirements.	None
Data Sources	The independent reviewer sought clarification on the source of the raw data used for emission calculations. HVO advised that this comes from their mine forecasting software. HVO also noted the reasoning behind the assumptions made in the report regarding:	None

Review item	Finding	Recommendation
	- Transport distance - End uses of coal products - International transport of products - The assumed immateriality of excluded emissions sources The final GHG calculation data and assumptions are considered satisfactory.	
Calculations	The independent reviewer sought clarification on whether mitigation strategies, uncertainty, and/or the offset strategy had been incorporated in the GHG calculations. This was resolved over the course of the independent review as HVO provided the reasons for including or excluding these factors in their calculations. The calculations associated with the final GHG Assessment are considered satisfactory.	None

3.1 Mitigation measures

The Amendment targets the avoidance and reduction of scope 1 diesel use and fugitive methane emissions, and plans to achieve this by:

- avoiding coal extraction within Domain 1 at HVO North
- reducing mining at HVO South (removal of some higher strip ratio coal from the mine plan)
- reducing the annual production rates across the complex
- reducing the period over which mining would occur by approximately five years
- reducing diesel consumption through reduced production and optimisation of haulage gradients and distances

The Independent Expert Advisory Panel for Mining (IEAPM) provided an independent review of HVO's original Continuation Project in July 2024. In their review, the IEAPM provided information on areas of high impact for the Continuation Project, as well as potential mitigation measures. The review noted that a significant avoidance measure would include not mining Zones 2-4 in Domain 1.

Within their mitigation strategy for the Continuation Project Amendment, HVO now commits to the avoidance of coal extraction in Domain 1 at HVO North, along with some areas of HVO South. This commitment avoids significant scope 1 emissions from both reduced diesel consumption and fugitive methane. Scope 2 emissions are also anticipated to reduce. HVO states that total scope 1 and 2 emissions for the Amended Project are set to decrease by 11,487 kt CO_2-e, with the primary driving force being avoidance measures. This outcome represents a material mitigation compared to the NSW status quo.

HVO has considered emerging technologies as a potential mitigation strategy. This includes a review of diesel and renewable electricity alternatives which were assessed against the Australian Renewable Energy Agency (ARENA)'s Technology Readiness Level (TRL) and Commercial Readiness Index (CRI). A number of these measures were investigated and found not yet ready for implementation. However, HVO's in-depth review of these technologies and their readiness, demonstrates a mature knowledge base as well as an ability and intention to track progress for potential future implementation. In that regard, HVO has committed to reviews of technologies and abatement measures every three years.

Meanwhile, HVO states that it will continue to employ best practice procedures to reduce fossil fuel emissions. The GHG Assessment refers to various best practice mitigation measures that are inherent to coal mine operations. Regarding diesel use, this includes optimising haul routes and ramp gradients, managing payload and loading equipment productivity, planning for fuel-efficient haul tracks, scheduling equipment use, and minimising idling.

As an additional mitigation measure, HVO states that it will investigate the potential for gas pre-drainage at HVO South. A feasibility study on gas pre-drainage has already been undertaken by CoalBed Energy Consultants Pty Ltd for the purpose of the Continuation Project (CoalBed 2023). HVO has drawn information from this study to inform its approach to gas pre-drainage mitigation and proposes to complete a trial study within two years of commencement of consent. It was found that Domain 3 Zones 3 and 4 have a material contribution to the fugitive emissions profile and could form a potential target area for a pre-drainage trial.

Identified challenges for pre-drainage have been addressed by HVO and will be considered alongside developing technologies.

Several adopted measures are noted as best practice in the *Best Practice Checklist for Greenhouse Gas Abatement by NSW Coal Mines* report (Katestone, 2023). Section 3.4.1 (ii) and (iii) of the GHG Assessment provide more detail on each measure, including information on planning for fleet maintenance / replacement and regular reviews of new technologies and abatement measures.

In addition, the GHG Assessment has provided evidence of investigation or commitment to adopt several measures noted in the EPA's draft *Greenhouse Gas Mitigation Guide for NSW Coalmines*. This document was not released prior to the time of writing of the GHG Assessment, and at this time it is still in draft form for comment. However, it noted that the two main scope 1 emission sources discussed in the draft Guide are fugitive methane and diesel consumption. As discussed above, mitigation measures to address these sources have already been comprehensively addressed in the GHG assessment.

In summary, HVO has committed to the measures laid out in Figure 3.8 of the GHG Assessment report, as shown below. These follow the NSW EPA Mitigation Hierarchy and have considered economic and operational feasibility, with offsets considered as a last resort. The number of offsets required for the Amendment Project has been reduced considerably with the adoption of these measures.

The Mitigation Assessment is therefore considered satisfactory.

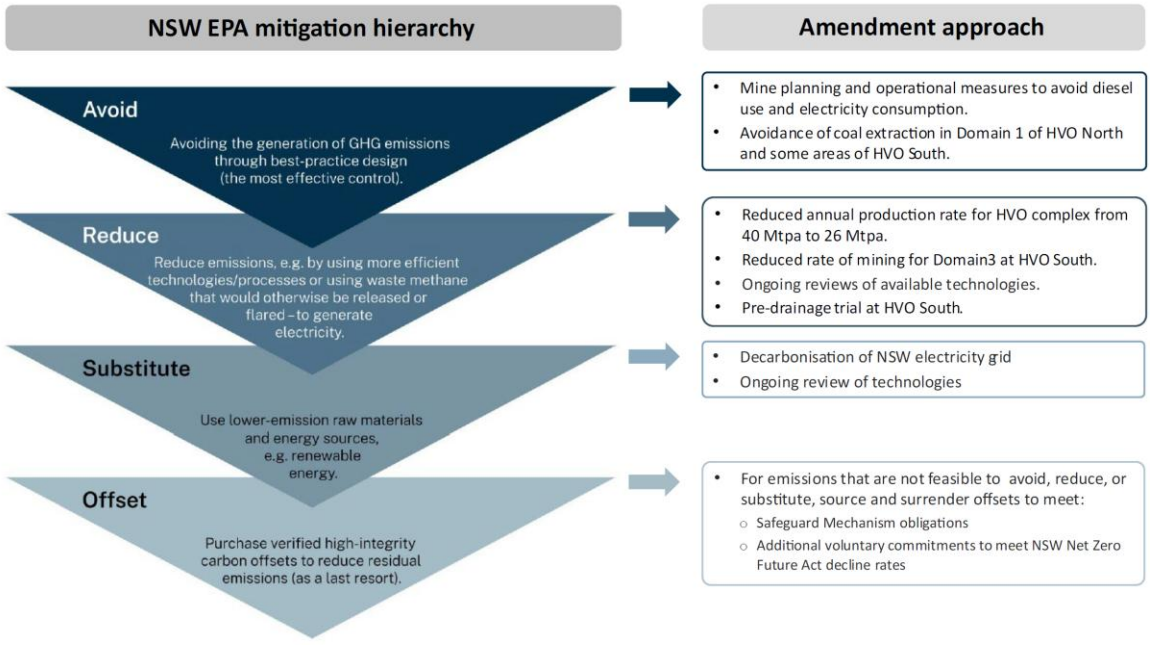

Figure 3.8 NSW EPA emission mitigation hierarchy and approach for the Amended Project

3.2 Offset Strategy

HVO's offset strategy has been assessed, with attention to feasibility and timing.

Table 3.16 of the GHG assessment presents the potential maximum offsets required, both to achieve the net scope 1 emissions with the Safeguard Mechanism, and accounting for the additional voluntary NSW decline rate.

This indicates that the average quantity of high-integrity offsets (e.g. ACCUs) required will be on average 375,700 per annum, with a maximum requirement of 539,400 per annum (in 2041). The maximum quantity of offsets required across the duration of the project is projected to be 7,139,000 offset units (with each offset representing 1 t CO_2-e abated or sequestered).

The Clean Energy Regulator (CER) provides detailed data on ACCU issuance, cancellations, and project registrations. Their Quarterly Carbon Market Reports provide a comprehensive analysis of market trends, including information on both offsets supply and demand.

Evaluation of these data indicates that ACCU issuance has grown steadily since the scheme's inception in 2011. In recent years, total annual ACCU issuances were recorded as being between 18-19 million.

An evaluation of the ACCU market supports that changes in government policy, particularly the reforms to the Safeguard Mechanism, have a significant impact on demand and, consequently, supply (via new project registration and ACCU generation).

Both the CER and market analysts (e.g. the Carbon Market Institute) project continued growth in ACCU generation. Forecasts suggest issuance could rise to 31 million in 2033, driven by a growing demand for offsets from the Safeguard Mechanism and voluntary markets. In view of the above, the maximum quantity of high-integrity offsets required by the Project in any one year are anticipated to comprise less than 3% of the total annual ACCU issuance.

It is also noted that ACCUs may be surrendered from multiple vintages (years of issuance).

It is considered that the Project's parent company, Glencore, has existing and mature procurement strategies to secure offsets. Further, the GHG assessment states that HVO Operations Pty Ltd will consider purchasing NSW-based offsets where they are available and represent a cost-effective option. In view of the above, it is considered that suitable high-integrity offsets are likely to be available at the time when it is proposed to acquire offsets.

As noted by the IEAPM, HVO originally proposed to rely on offsets to abate 11.7 Mt CO_2-e for the Continuation Project (2024). In HVO's Continuation Project Amendment, they now calculate the maximum abatement needed from offsets to be 7,139 kt CO_2-e (approximately 7.1 Mt CO_2-e) for the entirety of the project. This equates to nearly a 40% reduction in offset reliance, demonstrating the effectiveness of shifting mitigation to avoidance, reduction, and substitution methods.

The Offset Strategy in the final GHG Assessment is considered satisfactory.

4. CONCLUSIONS

This independent expert review has assessed the GHG Assessment Report provided by HVO for the proposed Project. The evaluation focused on the accuracy, completeness, and transparency of the emissions data, as well as the company's compliance with the requirements of the EPA's NSW Guide for Large Emitters.

The review determined that the GHG Assessment Report is compliant, with the EPA's NSW Guide for Large Emitters.

Yours sincerely,

Damon Roddis

Category 1 and Category 2 Auditor (RGEA 0155/2012)
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REFERENCES

CoalBed (2023) *Feasibility of Pre-drainage Capture for Hunter Valley Operations*, November 2023

Katestone (2023) *Best Practice Checklist for Greenhouse Gas Abatement by NSW Coal Mines*. Prepared by Katestone Environmental for the Department of Planning and Environment in May 2023.

NSW EPA (2025) *NSW Guide for Large Emitters: Guidance on how to prepare a greenhouse gas assessment as part of the environmental planning process*.

Australian Government, Clean Energy Regulator (2024) *Estimating emissions and energy from coal mining guideline.*

Australian Government, Clean Energy Regulator (2025) *Quarterly Carbon Market Report (March Quarterly 2025)*

Appendix A – Damon Roddis Curriculum Vitae

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