Jellinbah Group

LAKE VERMONT MEADOWBROOK PROJECT ENVIRONMENTAL IMPACT STATEMENT

APPENDIX A3 DRAFT DECARBONISATION PLAN

arc ENVIRONMENTAL SOLUTIONS

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1 Executive summary

This document is Bowen Basin Coal's (BBC) Decarbonisation Plan for the Lake Vermont Complex (facility) inclusive of the Meadowbrook Mine Extension Project (Project). BBC is part of the Jellinbah Group. The Decarbonisation Plan uses the recently released Terms of Reference (TOR) that would apply for a new approval in 2023.

The decarbonisation objective is to lower or else offset the emissions intensity of coal production. This will be achieved through the following:

1) providing captured pipeline specification gas to Arrow Energy;
2) offering goaf gas to power station developers for up to 15 megawatt (MW) of onsite gas fired power generation;
3) the flaring of gas not taken by Arrow or by power station developers;
4) underground mine goaf sealing and pressure balancing to further reduce methane volumes entering the vent air methane (VAM);
5) staff and contractor engagement in energy efficiency and emissions reduction; and
6) new technologies and process evaluation for further cost-effective emissions reduction.

Lake Vermont's strategy for greenhouse gas (GHG) emission management is timeline and operations focussed.

Open cut

- near term: diesel reduction and replacement strategies; and
- longer term: fugitive emission capture with gas use or flaring.

Underground

- near term: gas capture and management via gas pre-drainage to Arrow and goaf gas to third party users for power generation and/or flaring; and
- longer term: Vent Air Methane (VAM) commercial abatement.

Arrow Energy's overlapping gas tenure at the Project means available GHG strategies are linked to Arrow Energy's first right to gas produced by the Project. Arrow has a statutory 18 months from the offer of gas after the Project Mining Lease grant to confirm if it will take the produced gas. The best outcome for the Project is for Arrow to take all pipeline specification gas. This decision will drive the Project's strategy for how it manages fugitive gas emissions. The balance of post drainage goaf gas is unlikely to be taken by Arrow because it is not pipeline quality. Forecast goaf gas volumes can support up to 15 MW of power generation that can scale up to 50 MW if Arrow or third-party users do not take the pipeline specification gas.

The Project will contribute to Queensland Government targets for renewable energy use and emissions reduction by ensuring commercial emissions reduction opportunities and local renewable power projects are evaluated and where feasible and commercial they are implemented.

Potential actions for decarbonisation when commercially feasible include:

- meeting electricity needs through increased use of renewable electricity generation;

- mobile truck emissions per ROM ton per annum progressively reduced by up to 14%;
- electric drive conveyor instead of trucking underground coal to the wash plant;
- support for development of new local renewable energy power supply via a power purchase agreement (PPA);
- support via a PPA for use of waste mine gas into power generation;
- vent Air Methane (VAM) abatement for the low concentrations of methane in ventilation air exiting the underground mine;
- monitoring and optimising the wash plant for further energy efficiency;
- progressively migrating open cut mobile fleet to biodiesel or dual fuel compressed natural gas or to electric drive;
- pre-drain and flaring of higher gas domains in open cut mine; and
- carbon offset projects on land owned by Jellinbah around the Project.

The Project will be subject to the Safeguards Mechanism and will be expected to progressively reduce or offset its production-weighted emissions intensity by 4.9% per annum until 2030 and reduced to zero by 2050. The Project forecasts a requirement to purchase Australian Carbon Credits Units (ACCUs) and/or Safeguard Mechanism Credits (SMCs). Safeguard Mechanism Credits (SMC's) generated through implemented abatement measures will be able to be used in years where the Safeguard Baseline may not be met. In the absence of SMC's being available to use, Australian Carbon Credit Units (ACCU's) will be purchased. Carbon offset projects on land owned by Jellinbah are also being investigated to create ACCU's.

2 Introduction

Queensland Government updated terms of reference (TOR) for environmental approvals and environmental impact statements included a new requirement for development of a Decarbonisation Plan that identifies how a project will contribute towards Queensland's emissions reduction and renewable energy targets. These targets are:

1) 30% reduction in GHG emissions on 2005 levels by 2030;

2) 50% of energy provided by renewable energy sources by 2030 (70% by 2032); and

3) a zero net emissions economy by 2050.

This document is the Meadowbrook's Extension Project Decarbonisation Plan for the Lake Vermont Mine Complex in support of its application for environmental approval. Whilst not specifically identified as part of the Terms of Reference for this Project, this plan has been developed to meet the requirements of what are now standard Terms of Reference criteria. Appendix A1 sets out where this Decarbonisation Plan meets the new requirements.

2.1 The Project

A voluntary Environmental Impact Statement (EIS) was submitted by the Jellinbah Group Pty Ltd (Jellinbah) under the *Environmental Protection Act 1994* (EP Act) for the Lake Vermont Meadowbrook Project (the Project), near Dysart in central Queensland.

The Lake Vermont Mine owners, BBC, are seeking approval to evolve current operations from open cut coal mining to a combination of open cut and underground mining supplying the existing coal wash plant and train load out facilities.

The Lake Vermont mine produces and sells predominantly metallurgical coal for steel manufacture into domestic and international markets. The products and customers are not expected to change with this mining extension project. Global steel manufacturing is expected to continue to rely on access to high quality Queensland metallurgical coal for the life of this mine.

The Project involves the construction and operation of an underground multi-seam, longwall coal mine as well as an additional small open-cut pit. Extraction rates are forecast to be up to 7 million tonnes per annum (Mtpa) of ROM coal, equivalent to approximately 5.5 Mtpa of metallurgical product coal. Product coal tonnes (t) from the complex will remain at current production levels of approximately 9 Mtpa, as shown below in Figure 2.1. An infrastructure corridor will link the Project mining area to the Lake Vermont Mine coal processing area to use the existing plant and train loadout facility. The Ergon Energy substation will be upgraded to supply the increased electricity demand of the Project.

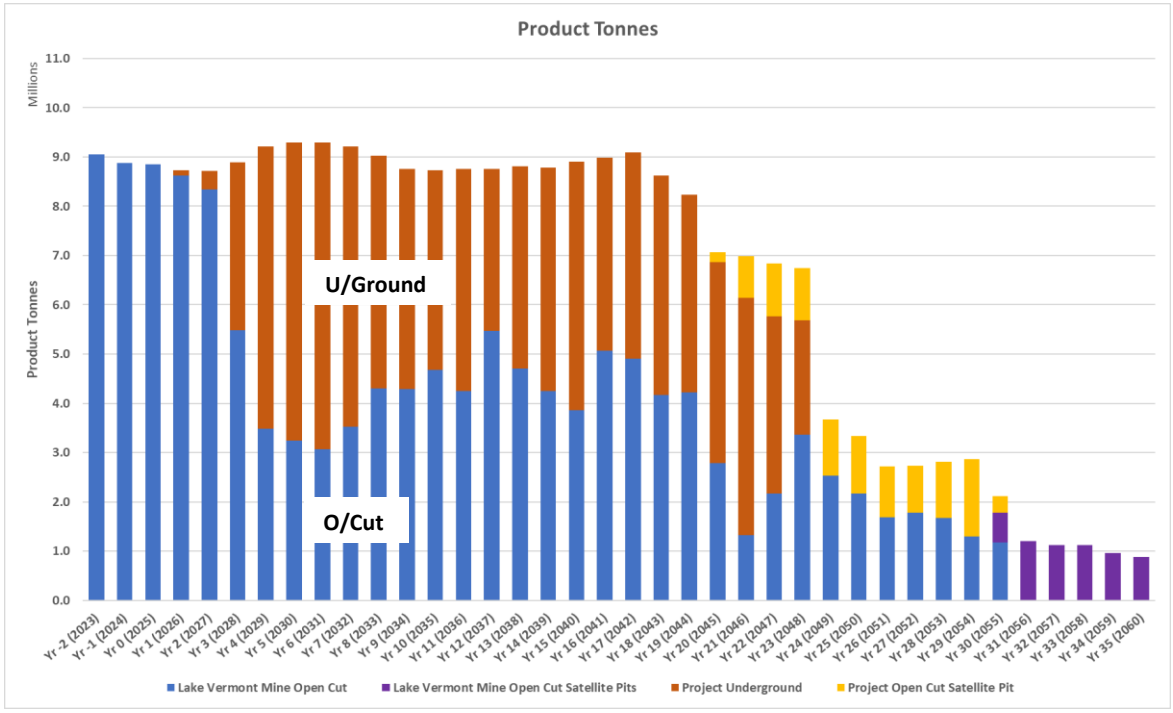

Figure 2.1: Lake Vermont planned production from the facility showing Open Cut (OC) and Underground (UG)

Methane management costs factored into assessment of the feasibility of the Project include costs for pre and post gas drainage wells with gas capture and abatement. Assumed market electricity costs for the Project provide a basis for increase renewable power over time from the National Electricity Market or for providing a power purchase agreement to initiate a renewable power project or a power project that uses Project incidental coal seam gas. The project has also assumed a carbon cost and tested a range of sensitivities. Any future increases for this carbon cost will assist other decarbonisation options become feasible.

The complex life will extend to at least 2050. The planned underground operations are identified as Meadowbrook. This is neither a greenfield project nor an expansion project. The location of the Project is shown in Figure 2.2.

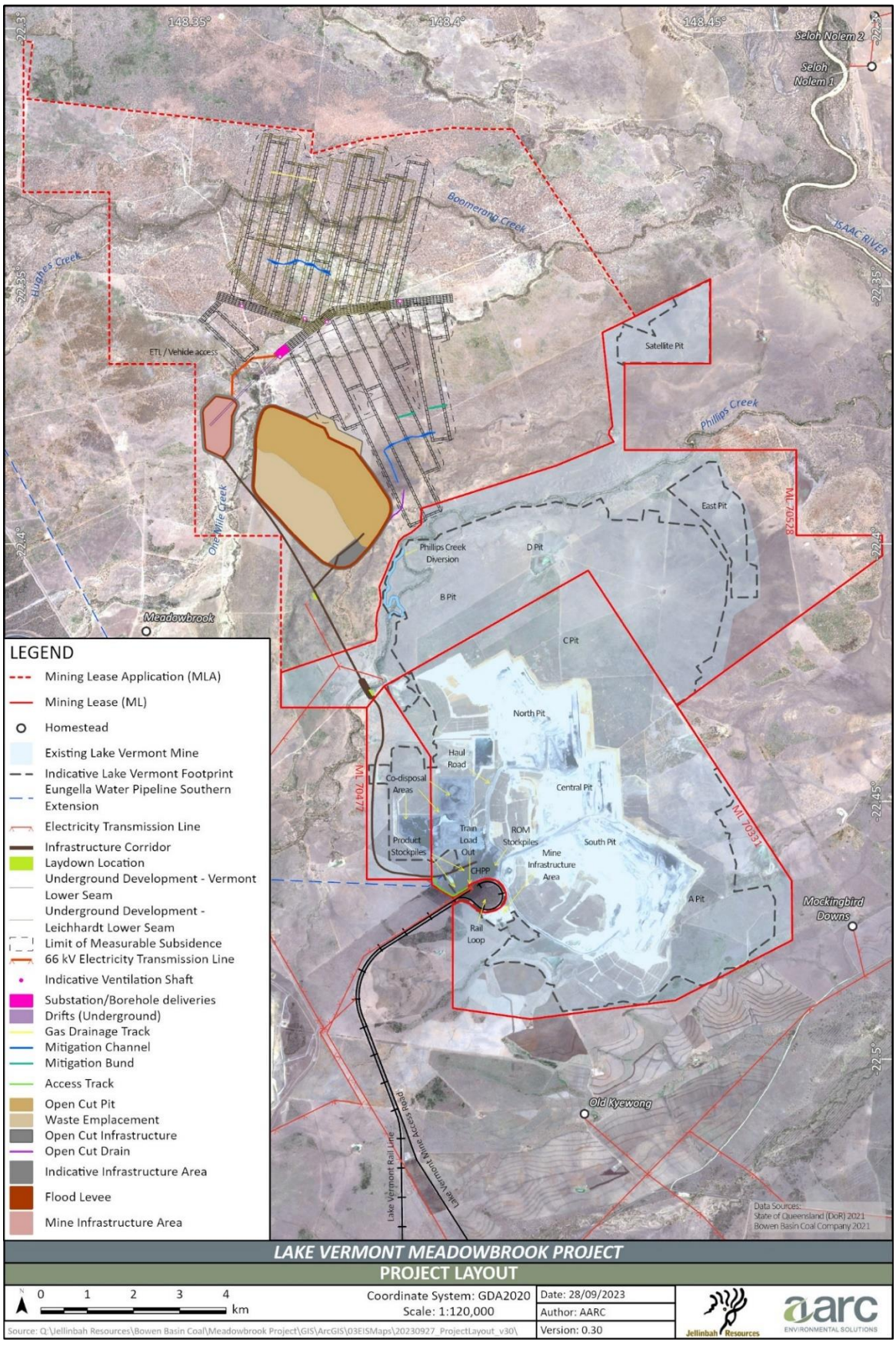

Figure 2.2: Location of Project

The key objectives of the Project are to:

- extend the life of the existing Lake Vermont Mine, at existing (approved) production levels of up to 12 Mtpa of ROM coal, by supplementing the future decline in production from the existing open-cut operation with output from an adjoining underground operation and open-cut pit;
- operate profitable mining operations which provide high-quality hard coking coal and pulverized coal for injection (PCI) coal to the export and domestic marke;
- design, construct, and operate a project that minimises adverse impacts on the social and natural environments;
- maximise recovery of economically minable coal resources within the BBC tenements;
- maximise the use of BBC owned land and infrastructure at the Lake Vermont Mine to minimise the environmental impacts from additional infrastructure, and to provide project efficiencies; and
- comply with all relevant statutory obligations and continue to improve processes which enhance sound environmental management.

2.2 Safeguard

The safeguard baseline for the facility (existing mine with extension) has been calculated using the current facility baseline based on NGERS reporting using Method 2 and then making the required production weighted adjustment to this number with the NGER industry average emissions intensity of 0.653 tCO2-e/t. The profile reduces by 4.9% to 2030 and from 2030 to 2050 it assumes a straight line of annual reductions to zero emissions by 2050.

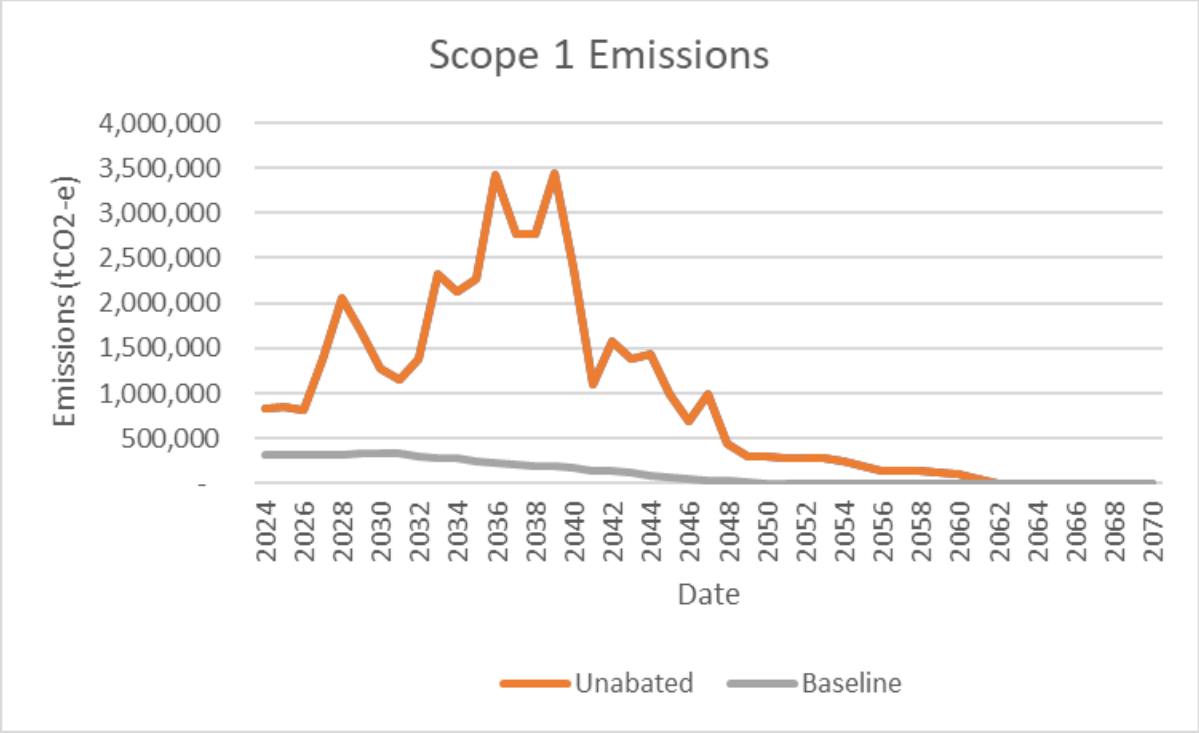

Figure 2.3: Facility Safeguard baseline (including estimate post 2030) and estimated facility emissions

3 Meadowbrook Extension Project

3.1 Mining activities

The mining component of the Project will be a typical underground longwall operation. Operations include:

- pre-drainage of gas via surface to inseam (SIS) and underground to inseam (UIS) wells;
- development mining and longwall mining;
- transport of coal to existing coal processing facilities;
- collection and capture of post drainage gas from the goaf;
- flaring of captured gas; and
- ventilation of the mine for safe operations creating Vent Air Methane (VAM).

Proportions of fugitive emissions including pre drainage and post capture gas from SIS, UIS, and Goaf and for vent air methane VAM for the underground are shown in Figure 3.1. VAM emissions from the underground mine are estimated to be 5.94 Mt CO_2-e for the life of mine.

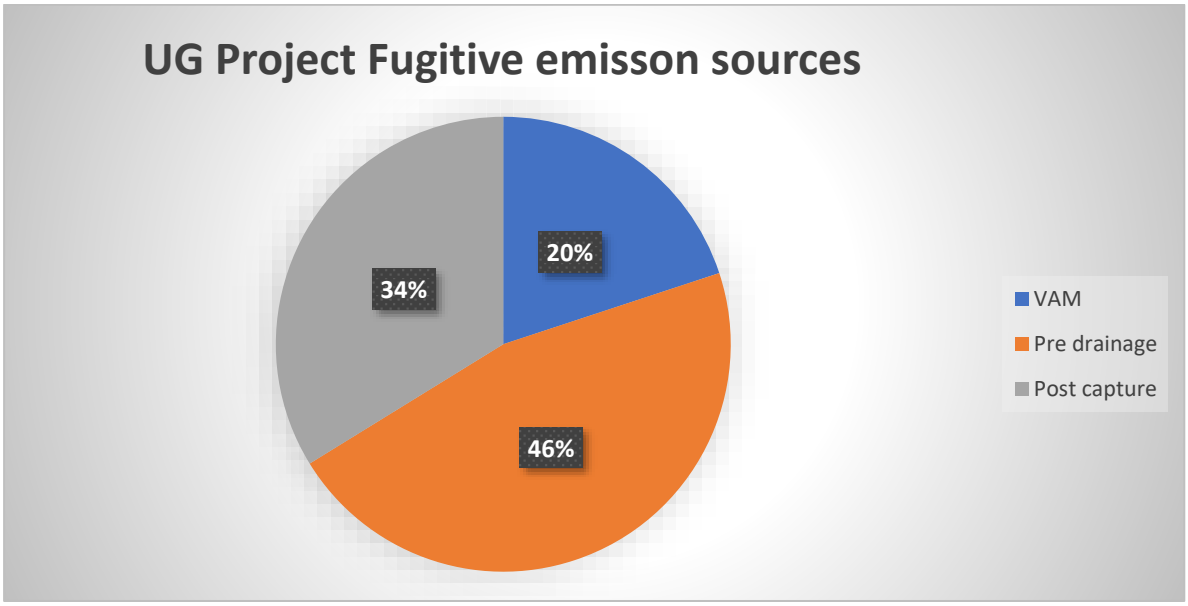

Figure 3.1: Fugitive Gas sources from underground mine

3.2 Overlapping tenure

Queensland's overlapping tenure laws mean rights to coal and to gas can be allocated to different parties at the same location. This is the circumstance for the Project where gas rights are owned by Arrow Energy (Arrow) via their overlapping Potential Commercial Area (PCA) tenure. This means that gas extracted to make the mine safe for mining must be offered to Arrow. This offer and acceptance process, although time bound to 18 months, creates uncertainty for planning and investment for the use and abatement of this gas that is demonstrated in the decision tree in Figure 3.2. Arrow acceptance of gas would mean Scope 1 emissions attributed to this gas move to Arrow shifting 20 Mt CO_2-e of Project fugitive emissions. Jellinbah has engaged with Arrow on the Project and will continue to engage with Arrow on their plans for this gas.

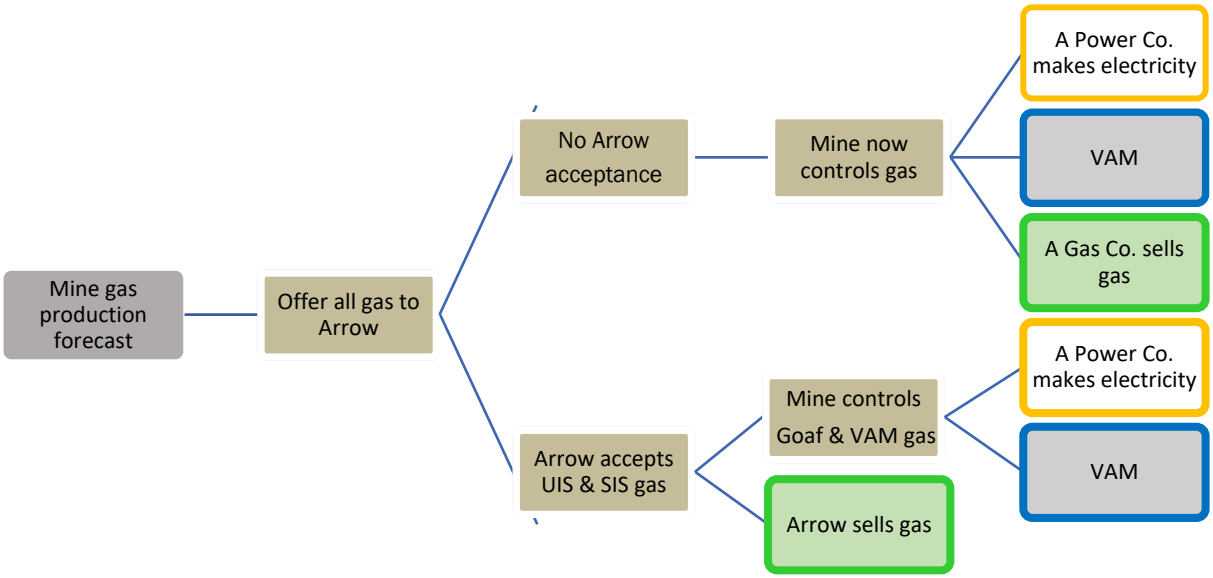

Figure 3.2: Decision tree resulting from overlapping tenure

There are commercial markets for this gas via gas processing facilities in Moranbah that sell gas to customers in Townsville. Access to these gas markets via Moranbah requires new gas transport via either a pipeline or by trucking of compressed natural gas (CNG). New gas pipeline routes from Moranbah to Gladstone were considered by Queensland Government in a KPMG study and these routes could be suitable for accessing Project gas. Queensland Pacific Metals (QPM) has expressed an interest in accessing more gas.

3.3 Coal processing

The Project will use the existing wash plant and train load out facilities. This plant applies electrical energy in these processes. An external review of energy efficiency opportunities has been undertaken and those assessed to be commercially viable will be considered for implementation.

3.4 Ancillary processes

Other ancillary processes that will require electrical energy include ventilation of the mine for safe operations.

3.5 Projected GHG emissions

Combustion of diesel and fugitive gas are the material sources of Scope 1 GHG from the facility (Table 3.1).

Table 3.1: Base case sources and quantities of GHG emissions (kt CO_2-e) by activity

Activity	Max Annual Emissions (Mt CO_2-e)	Max Life of Mine Emissions (Mt CO_2-e)
Diesel combustion	0.3	6.6
Fugitive emissions	3.2	37.2
Total	Not applicable	43.8

4 Contribution to emissions reduction and renewable energy targets

This section describes how the facility will contribute to Queensland's emissions reduction and renewable energy targets via the main sources of emissions. A summary is provided in Table 4.1.

Table 4.1: Contribution of Project to Queensland's emissions and renewable energy targets

Queensland Targets	Project Contribution
30% on 2005 levels by 2030	The focus to 2030 will be on reducing emissions in the open cut mine and building a new underground with high methane capture rates.
50% renewable energy by 2030	Electricity will be sourced from the NEM. Queensland Government's policy is 70% renewables in Qld by 2032
Zero net emissions economy by 2050	Mine life forecast is 2055, the offset to achieve net zero emissions post 2049 will be funded by BBC

Over the life of mine(facility), 44Mt CO_2-e Scope 1 emissions would be released in an unmitigated scenario. This reduces to 22Mt CO_2-e with a base case modelled mitigation scenario of flaring all gas excluding VAM as shown below in Figure 4.1.

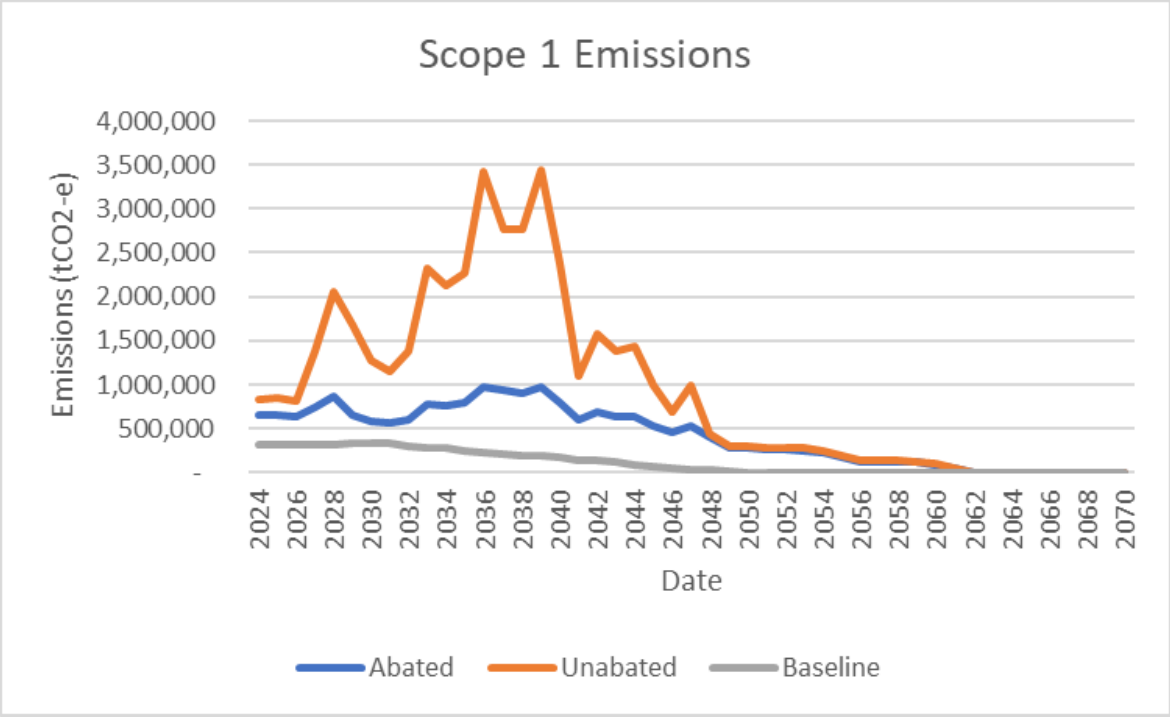

Figure 4.1: Project base case emission range

4.1 Coal fugitive emissions

The capture of methane to avoid venting of pre and post drained underground mine methane is a key objective of the Project.

Jellinbah will continue to monitor technology evolution for VAM abatement. Current views are the viable solution will be Regenerative Thermal Oxidisers (RTOs) or Regenerative Catalytic Oxidisers (RCOs)

This is because:

- More than 20,000 RTO's have been installed globally, most in factories and many in built up urban environments.
- No gas stream ignitions have been able to be identified in reporting globally.
- The technology is simple, achieves high availability, can be operated unmanned and has +95% destruction efficiency.
- They can operate down to a limit of 0.3% methane in VAM.
- Demonstrations on mine sites started in 1990's, the first commercial application was in 2007 and at least 6 commercial projects had operated by 2019.
- In 2022, a 72m^3/s RTO unit was installed at Coronado's Buchanan Mine in Virginia USA. A 2nd unit is being installed on another shaft at this mine that will be 85m^3/s. The mine plan to is process 100% of this shaft's ventilation flow of 170m^3/s with installation of 3rd unit at this mine.

A Queensland underground mine is working with Queensland Government on the safety case for RTO implementation. Key to successful technology deployment at an underground mine will be the design for the operation and control of the system.

Jellinbah view is RTO may become commercially viable during the Project mine life and it is a legitimate abatement technology for the high abatement scenario. VAM destruction technology is being monitored and will be implemented when commercially feasible.

It may also be feasible to pre-drain and abate some of the gas in the high gas domain areas of the open cut mine.

4.2 Diesel displacement

The open cut mine's other main source of Scope 1 emissions is diesel use in the open cut mining fleet. Mining operations at Lake Vermont are contracted to Theiss. Jellinbah are working collaboratively with Theiss to identify emission reduction opportunities.

4.3 Electricity use

Electricity used across mining operations is sourced from a National Electricity Market (NEM) retailer. The electricity consumption at the mine will increase with the Project progressively displacing current coal mined with diesel use in the open cut with underground production using electricity. Jellinbah will continue to procure the most competitive electricity supply from the NEM noting that the Queensland Government is on track to have 50% renewable power in Queensland by 2030 and plans to be 70% renewable power by 2032. By 2050 the mining operations expect all electricity could be sourced from renewable generation and energy storage from the NEM.

4.4 Solar and/or wind farm potential

Jellinbah is considering opportunities to facilitate new build solar projects using land owned by the company around its operations. Batteries and/or compressed gas storage may also be part of this system allowing for better matching of supply to the mine's power demand.

This may be further extended to include facilitation of new solar and/or wind power projects that are proximate to the Project. Jellinbah has assessed the potential for Lake Vermont mine land to support development of renewable energy to provide power to the Project. There are constraints to navigate such as the flood plain, mine assets, transmission capacity and land allocated to environmental offsets.

4.5 Carbon offsets

The Project forecasts a requirement to purchase of Australian Carbon Credits Units (ACCUs) and/or Safeguard Mechanism Credits (SMCs). Jellinbah is actively investigating the potential of land that is owned by the company to be used for carbon storage projects.

5 Decarbonisation plan

5.1 Goal

Jellinbah's goal is to support Queensland's decarbonisation transition by reducing fugitive emissions, reducing diesel use, and increasing use of renewable electricity for operations.

5.2 Objective, key results, and actions

Under the National Greenhouse and Energy Reporting (Safeguard Mechanism) Rule 2015, the Clean Energy Regulator (CER) is required to publish information relating to emissions baseline determinations (baselines) as part of the Safeguards Mechanism.

The Project is subject to Australian Government's Safeguards Mechanism as its total annual emissions are more than 100,000 t CO_2-e per annum. The Project will be expected to progressively reduce or offset its production-weighted emissions intensity by 4.9% per annum until 2030 and then by a factor yet to be decided.

Table 5.1 outlines BBC's nominated objective, key results and actions to achieve the Project's emission targets.

Table 5.1: Objective, key results and actions

Objective: Lower or else offset emissions intensity of BBC coal production	
Key Results	**Actions**
1: Pre drain gas taken by Arrow Energy or other commercial entity.	Early engagement to facilitate offer and acceptance processes with Arrow. Definition of commerciality gaps with collaborative approaches to create certainty for this best use of pipeline specification gas.
2: Goaf gas provided to power generation	Market engagement for reciprocating power station to use goaf gas and any pre-drainage gas not commercially taken.
3: Goaf sealing and pressure balancing to reduce VAM.	Design and implement goaf sealing. Design and implement pressure balance of goaf
4: Project staff are engaged in energy efficiency and emissions reduction	Energy efficiency and emissions reduction are included in mine KPIs. National Greenhouse and Energy Reporting (NGER) assessments are linked to KPIs and efficiency/emissions programs. Standard Operating Procedures (SOP) are established for energy efficiency and emissions reduction. Staff are trained in SOPs for energy efficiency and emissions reduction.
5: New technologies and processes are evaluated for further cost-effective emissions reduction.	Continuous improvement based on monitoring and research across mining operations to further reduce emissions where practicable.

Jellinbah commits to continuous improvement of decarbonisation outcomes by ensuring there are engaged staff, monitoring, and research and development.

5.3 Alternatives considered

5.3.1 Abatement options – open cut operations

Decarbonisation opportunities at the open cut operations have been identified. Scope 3 emission reduction have not been considered in this plan.

Scope 1 emissions for the open cut mining operations are primarily fugitive gas released from coal seams during mining and diesel use in the mining fleet. Baseline unabated Scope 1 emissions for the open cut is calculated to be 10.6 Mt CO_2-e. Not proceeding with the Project means mine coal production will continue from open cut operations at current tonnages with a reduced mine life compared to the Project. This reduced mine life constrains the ability of the mine to invest in the changes to decarbonise and on an annual basis will likely result in more scope 1 emission because the methane capture techniques are more effective in underground mining.

The open cut historically produced relatively low fugitive gas emissions due to most of the coal mined to date being from the identified gas domain with low gas content. As the pit progresses, most of the coal will be mined from an identified gas domain with higher gas content.

Definition of the pre-drainage potential of this gas reservoir is currently immature. It is considered technically possible to pre-drain coal seam gas ahead of open cut mining where coal seams are thick enough and where gas contents are of order of magnitude material, say 6m^3/t, so that they can be then reduced to 3m^3/t by surface to in seam drainage wells. Injection of compressed inert gas into these existing drainage wells will preferentially displace more methane from the coal seam and further accelerate gas drainage down to lower than 1m^3/t. This collected methane dominated gas could then be flared or used in a similar way to the pre-drainage gas from the underground operation. The reduction in open cut emissions could potentially be 40% of the gas in place in a future mining block that would provide a 7.5% reduction in fugitive emissions from 2035 and a reduction of 0.8Mt CO_2-e. The degassing benefit is realised when the coal is mined which may be more than 5 years after starting the degassing processes in the target mining block of coal. If this approach is feasible the decarbonisation benefits are forecast to start from 2035. It should be noted that significant work is required to prove the potential of this for the Lake Vermont open cut mine and that open cut coal mines in Australia and mines globally are currently not commercially pre-draining gas[2].

The open cut mine will continue to optimise mine layout for diesel use efficiency. It will monitor and trend diesel use. The mine is investigating and will implement new technologies for reducing diesel use if practicable and cost-effective.

As open cut product tonnes reduce with the ramp up of the underground product tonnes, there is an opportunity to reconfigure the current contracted mobile fleet to use the most fuel efficient of the existing mixed truck fleet. A technical review of existing truck fleet performance shows there is an 14% fuel efficiency opportunity by using the most efficient truck type for all truck movements. Applied to the whole mining fleet this would be a 9.4% reduction in Scope 1 emissions from diesel for the open cut and a 0.56Mt CO_2-e reduction.

The main truck hauls for the open cut mine can be split into overburden removal and coal haulage to the ROM (run of mine) stockpile. The coal haulage to the ROM stockpile results in these trucks reporting to a central point multiple times during a shift, making it suitable for refuelling these trucks with compressed natural gas (CNG) from a central facility. There are different handling and storage requirement of CNG compared to diesel. CNG into dual fuel mobile mining equipment is being tested by MES and Thiess where a dual fuel truck has operated for +300hrs. Jellinbah and Theiss have had preliminary discussions on this technology for Lake Vermont. Depending on commercial viability, Jellinbah use of gas for CNG for ROM trucking at the open cut operation could further reduce Scope 1 emissions at the open cut mine by 2% and 0.1Mt CO_2-e.

Diesel emission reductions could be achieved through use of biodiesel or renewable diesel. Currently both products are available globally, however there is limited supply within the Australian market, and they are not currently commercially viable. Should the market for these products improve, then assuming all diesel is replaced in 2035 with these alternatives result in a 60% reduction in the open cut scope 1 diesel emissions and a reduction of 3.2Mt CO_2-e.

If electric trucks become commercially viable and available early enough in the mine life, then the mobile fleet could be recapitalised as electric. Available solutions are not predicted until after 2030 and supply constraints for smaller mining companies are forecast resulting in this technology not being an available option until later in the mine life. The required fixed electrical infrastructure and supply including trolley assist charging to support electric trucks is also a substantial capital investment. These options will be monitored but the expected timing of commercial solution availability means this has a lower probability of being part of the implemented decarbonisation plan. These options will be monitored.

Electric excavators, dozers, graders, water trucks and light vehicles are Scope 1 fuel displacement opportunities. Excavators represent 26% of current fuel use for the mining operations and light vehicles are 3%. Excavators and light vehicles are two opportunities that are the most credible near turn opportunities for electrification and with the use of renewable power would remove 29% of open cut Scope 1 diesel emissions which is a 3.8Mt CO_2-e reduction.

Scope 2 emissions are from electricity used mainly in the coal wash plant. The 74GWh per annum of electricity is sourced from the National Electricity Market for the wash plant contributes 2.05Mt to the site's life of mine Scope 2 emissions. A recent Arche Energy efficiency audit has shown that this could be reduced by up to 15% by efficiency measures within the plant. These measures include use of LED lighting and more variable speed drives. Coal wash plant Scope 2 emissions can be eliminated by procurement and use of renewable power.

The mine will:

- monitor electricity use including time of use and optimise processes for energy efficiency;
- implement commercially feasible energy efficiency technology;
- identify and assess renewable energy generation proximate to mine; and
- implement renewable energy procurement via mine power purchase agreement.

Using 100% renewable power at the open cut mine will reduce Scope 2 emissions by 2.05Mt CO_2-e respectively.

5.3.2 Abatement options - underground operations

Decarbonisation opportunities at the planned underground operations have been identified with reference to best practice guidelines [2,3]. Scope 3 emission reduction have not been considered in this plan.

Mining will be made safe by pre-drainage of the coal seam gas via surface to in-seam (SIS) and underground to in-seam (UIS) wells that are expected to produce pipeline quality gas. BBC assumes that the owner of the overlapping gas tenure will exercise their right to take this pre-drainage gas and therefore remove this gas from Jellinbah's Scope 1 emissions. The reduction in aggregate emissions for the mine without abatement with Arrow taking this gas is 20Mt CO_2-e.

If the gas tenement owner declines to take all the pre drainage gas, the initial plan is to flare this gas and goaf gas to reduce the Scope 1 underground fugitive gas emissions from 32.2Mt CO2-e to 9.8Mt CO2-e for life of the underground mine. This is a 70% reduction in these emission from the underground mine where flare efficiency is assumed to be 95%.

Design of the Pre and Post drain gas system will be for maximum capture and flaring if gas is not taken by Arrow Energy or a similar commercial entity. Any required field compression and flares will be designed for high availability and high efficiency.

The other sources of gas from the underground operations are Goaf gas post longwall coal extraction and vent air methane (VAM).

Goaf gas will be collected via wells drilled into the post longwall mining voids. Mines in Queensland routinely use vertical goaf wells for gas capture that may also collect gas in seams and strata above the longwall coal seam post subsidence. The Project is designing a horizontal goaf well system for the northern longwall domain that will limit gas collection to the goaf. Rather than vent this goaf gas, the initial plan is to offer the gas to a power station developer to combust the gas in a power station for a 16% reduction in underground Scope 1 emissions which will removing 5.1Mt CO_2-e. Goaf gas is not pipeline quality and the gas tenement owner has no history in commercialising this gas into electricity in the Bowen and so they are therefore not expected to accept this gas.

There are technologies for concentrating and keeping fugitive gas in the goaf to reduce the amount of gas contributing to VAM emissions. Goaf sealing and pressure balancing are technologies that the mine is investigating and designing to further reduce VAM CO_2-e.

Assuming that pre and post drainage gas is abated, the 5.9Mt CO2-e of VAM emissions will then account for 60% of the remaining underground fugitive emissions. VAM has very low methane concentrations and therefore cannot be flared to reduce CO_2-e emissions. VAM abatement technology continues to mature but a commercial scale plant with approved safety case to abate all VAM at a mine has not yet been achieved in Queensland. We are aware of pilot VAM projects being planned in the Bowen Basin and will seek to take learnings through our industry network. Jellinbah will seek to access progress in global deployment of VAM technology in underground coal mines so if suitable VAM technology becomes commercially viable in Queensland by 2030, this would reduce the underground mines fugitive emissions to 4.3 Mt CO2-e.

Several companies are commercially using coal seam gas in Far North Queensland including Queensland Pacific Metals (QPM), Energy Development Limited (EDL), Glencore, Dyno, and the Ratch Townsville gas fired power station. The connection to access these markets could be via a new build 65km pressure gas pipeline from the Project to QPM's Central Gas Processing facility at Moranbah or via a new build pipeline to QPM's Node 4 compressor near the Carborough Downs Mine, or by trucking compressed gas to Moranbah. These approaches would require a large capital investment and therefore need other nearby mines to participate and some government support to make them commercially viable.

There may be commercially viable ways for gas to be used on lease closer to the Project mining operations. Power generation that is either stand alone or combined with solar and wind power generation is one such an option. Coal seam gas into power stations using reciprocation engines is now well proven in the Bowen Basin. Land around the mine is prospective for solar and wind power generation. If gas was compressed and stored in a high-pressure pipe, then this gas could be used into a local power station to help firm renewable power. This compressed gas or with further capital expenditure liquified gas could then also be used in the open cut mobile mining fleet as a diesel fuel replacement.

The underground mine intends to move coal from the box cut via an infrastructure corridor to the ROM stockpile at the existing wash plant using road trains. The Scope 1 emissions for this trucking for the life of mine is 1.5% of total underground emissions or 0.51Mt CO_2-e. Dual fuel CNG/diesel or LNG/diesel trucks and electric trucks have not yet had commercial deployment in coal mining in Australia. Using electric trucks charged with renewable power is a pathway to eliminate these emissions. An alternative to trucking the coal to the ROM stockpile is to use an electric drive conveyor system. The electric drive conveyor was significantly more capital intensive than using contracted road trains and so this was not preferred in the pre-feasibility study. The conveyor is proven technology that has the advantage of removing safety risk associated with truck movements over the life of the mine. If the conveyor uses renewable power this removes the Scope 1 emissions of diesel trucking of the coal to the ROM stockpile. Electric road trains or a conveyor power by renewable power would eliminate 0.51Mt CO_2-e.

Jellinbah and its consultants have developed a tool for scenario testing decarbonisation opportunities for the facility. The model provides functionality to choose combinations of options, the starting year of each option and the percentage effectiveness of options can also be varied.

A future case abatement scenario and results are shown in Figure 5.1. This is illustrative as a future case scenario where options become commercially viable in the nearer term.

The options included are:

Option		Starting year	%
VAM abated		2030	100
	Combustion of GOAF in power station	2024	100
Pre drain gas taken by Arrow		2024	100
Replace road trains with electric road trains		2030	100
Replace grid electricity with renewable power		2030	100
Pre drain and flare open cut gas		2035	40
Replace diesel with biodiesel		2030	50
Move ROM trucks to CNG		2030	100
Fuel efficiency across mobile fleet		2030	15
Power efficiency improvement in CHPP		2030	14

This scenario allows the facility to get below the safeguard mechanism in 2030.

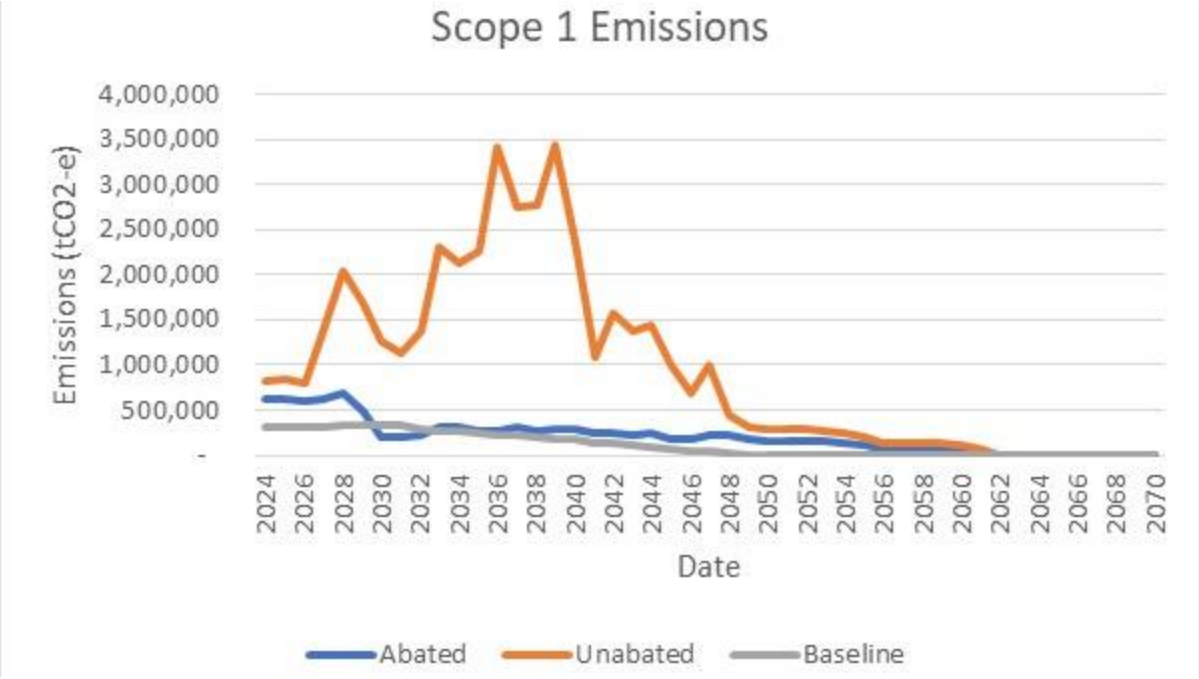

Figure 5.1: A future case facility abatement scenario

5.3.3 Creating offsets

ACCUs are the primary method of creating, trading, and offsetting carbon emissions within Australia. Jellinbah purchased ACCUs in 2023 and is defining ACCU creation opportunities and is building capability to participate in carbon markets.

LMS Energy is Australia's largest emission reducer under the Emissions Reduction Fund with over 15% of the Australian Carbon Offset projects coming from LMS projects. Jellinbah has engaged with LMS to better understand how they could support Jellinbah forecast ACCU requirements. There are electricity emission displacement opportunities that could create 1 million ACCU's over the life of the underground mine.

Most ACCU-generating projects in Australia are vegetation-based projects. These are primarily projects that manage or end suppression of existing or potential forest areas, and the establishment of new forest by way of plantings.

Independent modelling of suitable areas around the Project site was completed using State Land and Tree Survey (SLATS) data provided by Queensland government. This identified areas cleared of vegetation for 10 years or more to comply with Human Induced Regeneration (HIR) project methodology rules. The areas were then analysed for their ACCU production potential over a 25-year period, calculated using the FullCAM application and verified using the Landscape Options and Opportunities for Carbon Abatement Calculator tool created by the CSIRO. Areas available that comply with the environmental planting(EP) methodology where also quantified. Areas for potential soil carbon(SC) method projects were selected using the same criteria as the vegetation methodologies. This assumed that these areas would be restricted to areas mapped as non-remnant only. Soil carbon projects could likely be expanded to encompass all non-remnant areas on the properties.

Areas identified for consideration for potential carbon sequestration projects on land owned at Lake Vermont are described in Table 5.2.

Table 5.2: Areas identified for potential carbon sequestration projects

Property Area (ha)	**HIR** **ACCUs/yr**	**EP** **ACCUs/yr**	**SC** **ACCUs/yr**
1,325	1,722	3,313	2,518

A1 Appendix 1

Table A1.1: Locations within decarbonisation plan where TOR are addressed

Terms of Reference	Section
a. Quantify, describe, and illustrate the project's contribution toward Queensland's emissions reduction and renewable energy targets: **i.** 30% on 2005 levels by 2030 **ii.** 50% renewable energy by 2030 **iii.** zero net emissions economy by 2050.	Section 4 Table 4.1
b. Explain feasible alternatives that were considered to avoid or reduce the project's emissions as well as the alternative of not proceeding with the proposed project.	Section 5.3
c. Describe: i. Measures (preferred and alternatives) proposed to avoid and/or minimise Scope 1 and Scope 2 GHG emissions of the proposed project **ii.** Options for avoiding and/or mitigating Scope 3 emissions.	Section 5.3
d. Include: i. Opportunities to reduce greenhouse emissions through renewable energy use and innovation ii. Any voluntary initiatives, such as research into reducing the lifecycle and embodied energy carbon intensity of the proposed project's processes or products **iii.** Any additional carbon offsetting options for emissions that cannot be reduced (including, but not limited to, through carbon offsets, vegetation management).	Section 4 Section 5.3.3
e. Quantify emissions expected to be abated for each avoidance and mitigation measure.	Section 5.3.1 Section 5.3.2
f. Compare preferred measures for emission controls and energy consumption with best practice International environmental management in the relevant industry sector.	Section 5.3
g. Describe practicality, effectiveness and risks for each avoidance and mitigation measure.	Section 5.3
h. Demonstrate measures have been factored into the economic feasibility of the project.	Section 2.1

Terms of Reference	Section
i. Describe and commit to: i. Periodic energy audits that measure progress towards improving energy efficiency ii. A process for regularly reviewing new technologies to identify opportunities to further reduce GHG emissions and use energy efficiently, consistent with best practice environmental management iii. Monitoring, auditing and transparent public reporting on: GHG emissions from all relevant activities; the success of mitigation measures; and, the project's contribution to achieving Queensland's 2030 target and achieving net zero by 2050 **iv.** Ongoing training and capacity building around decarbonisation options, technology and reporting.	Section 5.2 Table 5.1

A2 Appendix 2

References

1 - Best Practice Guidance for Effective Management of Coal Mine Methane at National Level: Monitoring, Reporting, Verification and Mitigation; United Nations 2021

2- Best Practice Guidance for Effective Methane Drainage and Use in Coal Mines; United Nations 2016

3- Methane management in underground coal mines. Best practice and recommendations June 2019; Queensland Department of Natural Resources, Mines and Energy