SARAJI EAST MINING LEASE PROJECT

Environmental Impact Statement

Chapter 20
Hazards, Health and Safety

BHP

Contents

Saraji East Mining Lease Project

20 Hazards, health and safety

20.1 Introduction

This chapter describes the conditions and environmental values within the Saraji East Mining Lease Project (the Project) and how hazards associated with the Project and local environment interact. Potential impacts from hazards are described and mitigation measures are provided to minimise the risk through the various phases of the Project.

Hazard identification and a preliminary risk assessment was undertaken in accordance with the requirements of *AS/NZ ISO 31000:2009* (compliant with *ISO 31000:2018*). The following terms are used throughout the chapter and are defined as:

- hazard: a source of potential harm or an existing situation with the potential to cause loss, harm to people or damage to property
- risk: the chance of something happening that will have an impact on objectives. A risk is often specified in terms of an event or circumstance and the consequences that may flow from it. Risk is measured as a combination of the consequence of an event and their likelihood.

20.2 Legislation and policy

20.2.1 Relevant legislation

Hazards and risks to people and property were assessed against legislative and policy level objectives for the management of risk. The relevant legislation, policy and guidelines are presented in Table 20.1 and Table 20.2.

Table 20.1 State legislation

State legislation	Relevance to the Project
Coal Mining Safety and Health Act 1999 (CMSH Act) and Coal Mining Safety and Health Regulations 2017	Sets obligations for the operator, designer, constructor, contractors and others on a coal mine in relation to minimum mandatory health and safety standards and to ensure activities are carried out at an acceptable risk level.
Radiation Safety Act 1999 and Radiation Safety Regulation 2010	Sets the framework to ensure the health and safety of persons and protect the environment from radiation source.
Transport Infrastructure Act 1994 (TI Act)	Sets the statutory requirements for rail safety accreditation within Queensland. It is responsible for the construction, maintenance and operation of state controlled roads (SCR).
Transport Infrastructure (Dangerous Goods by Rail) Regulation 2008	Describes the obligations of persons involved in the transport of dangerous goods by rail and promotes consistent requirements between other modes of transport of dangerous goods.
Electrical Safety Act 2002	Establishes the legislative framework to prevent persons from being injured or killed by electricity.

State legislation	Relevance to the Project
Disaster Management Act 2003 and Disaster Management Regulation 2014	Provides disaster management for Queensland and assists communities in mitigating, preparing, responding to and recovering from a disaster or an emergency.
Fire and Rescue Services Act 1990 and Fire and Rescue Service Regulation 2011	Establishes the framework for the management of Queensland Fire Emergency Services (QFES) and State Emergency Service (SES), while providing the prevention, rescue and responses to fire and other emergency incidents.
Land Act 1994	Provides the framework to ensure sustainable resource use and development to ensure existing needs are met and the state's resources are conserved for the benefit for future generations.

Table 20.2 Applicable standards and guidelines

Standard/guideline	Relevance to the Project
Queensland State Planning Policy (SPP)	Provides guidelines to ensure that natural hazards, such as floods, bushfires and landslides are adequately considered on certain development.
Australian Code for the Transport of Dangerous Goods by Road & Rail (ADG code)	Details the technical specifications, requirements and recommendations applicable to the transport of dangerous goods in Australia by road and rail.
AS1692:2006 Steel Tanks for Flammable and Combustible Liquids	Set the standards to design and construct steel tanks that are used to store flammable and combustible liquids at normal temperatures and pressures.
AS1940:2017: The Storage and Handling of Flammable and Combustible Liquids	Sets the requirements for storage and handling of flammable and combustible goods Class 3.
AS3780:2008 The Storage and Handling of Corrosive Substance	Sets requirements to ensure the safety of persons and property where corrosive substances are stored and handled.
ISO 31000:2009 - Risk Management - Principles and Guidelines	Describes and provides principles and guidelines on the risk management process.
AS4801:2001 Occupational Health and Safety Management Systems	Sets the requirements for the formation of health and safety policy and objectives.
AS 4084:2001 Occupational Health and Safety Management Systems – General Guidelines on Principles, Systems and Supporting Techniques	Provides guidance on the development and implementation of occupational health and safety management systems and principles and their integration with other management systems.
AS2436:2010 Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites	Details the requirements in assessing noise and vibration control measures on and from construction, demolition and maintenance sites.
AS/NZS 3012:2010 Electrical Installations—Construction and Demolition sites	Sets the requirements to electrical installations associated with construction and demolition sites.

20.2.2 BHP Safety Our Requirements

The Project will operate under the *BHP Safety Our Requirements* (BHP, 2018b) under the framework of a Safety and Health Management System. The *BHP Safety Our Requirements* (BHP, 2018b) identifies risks that have the potential to cause fatalities, assesses their impact and records those risks.

20.3 Methodology

20.3.1 Risk assessment

A preliminary risk assessment was prepared to identify the potential risks to people and property associated with the Project. Findings and outcomes of environmental investigations completed during the development of this Environmental Impact Statement (EIS) were incorporated into the risk assessment. The assessment considered relevant sensitive receptors (including employees), environmental assets and activities conducted within and around the Project Site. This provided a basis for the assessment of potential impacts and preparation of safeguards to manage and mitigate impacts that might arise from the Project.

The basic methodology for risk assessment was based on *AS/NZ ISO 31000:2009* (compliant with *ISO 31000:2018*) *Risk Management: Principles and Guidelines* and *HB203:2012 Managing Environmental Risk.*

The risk management process as shown in Figure 20-1 is applied throughout the entire lifecycle of the Project, including design, construction, operation and decommissioning of the Project.

The application of *ISO 31000:2009* (compliant with *ISO 31000:2018*) provides a framework that enables ongoing identification and documentation of hazards and risks associated with the Project.

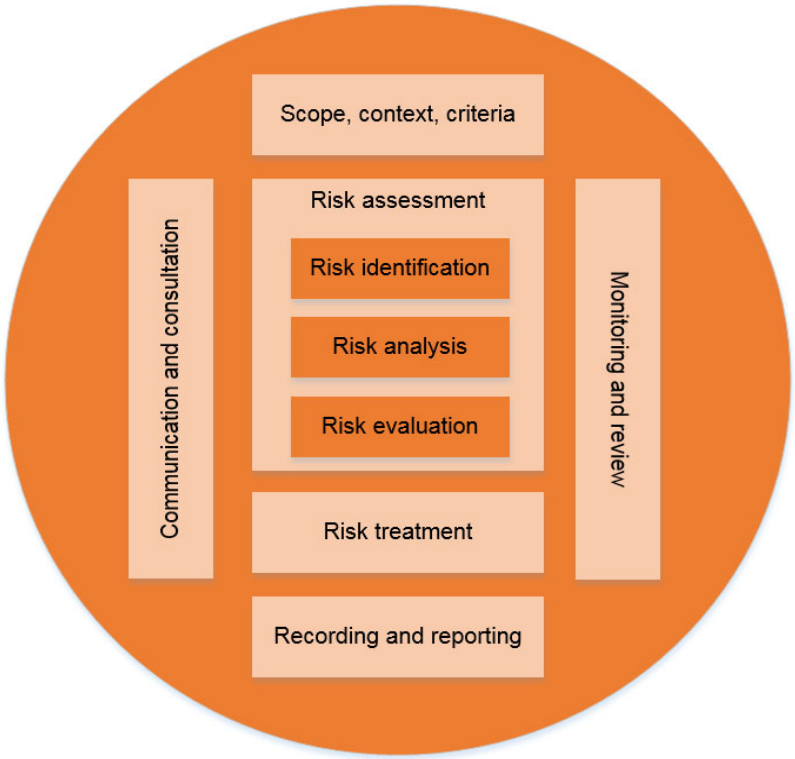

Figure 20-1 The ISO 31000:2018 Risk Management Process

In accordance with Figure 20-1, *ISO 31000:2009* (compliant with *ISO 31000:2018*), the risk management process involves risk identification, analysis and evaluation, followed by risk treatment. This process is detailed below:

- Scope, context, criteria – the health, safety, and infrastructure considerations relevant to the Project were established in relation to the Project Site. Risk criteria was adopted based on the risk ranking table presented in Table 20.3. The level of risk was determined as a function of potential likelihood and consequence Table 20.4 and Table 20.5.
- Risk identification – the risk identification phase identified hazards for the lifecycle of the Project.
- Risk analysis – identified hazards were analysed in terms of the available controls, the range of potential impacts in the context of those controls and the likelihood of those impacts arising.
- Risk evaluation – Consequence and likelihood were combined to produce an estimated level of risk in accordance with the criteria identified in Table 20.3 (both prior to and following implementation of proposed controls).
- Risk treatment – hazards ranked with medium, high and extreme residual risk were assessed as requiring further risk treatment throughout the Project lifecycle. Where appropriate residual risks will be managed through management plans or programs. Additional options for risk elimination, mitigation measures and safeguards are described in Section 20.6.
- Recording and reporting – all risks associated with the Project will be documented in the Project risk registers and tracked throughout the Project lifecycle.
- Communication and consultation – the Project team have undertaken community consultation with stakeholders in the vicinity of the Project. Community consultation and engagement forums were undertaken and included engagement with local communities to understand local hazards and risks. **Chapter 17 Social** and **Chapter 19 Stakeholders** discuss the Project consultation program and activities. Any residual risks from the design phase of the Project will be communicated to the appropriate stakeholders for construction and operations.

Table 20.3 Preliminary risk assessment matrix

	Consequence					
		1 - Insignificant	2 - Minor	3 - Moderate	4 - Major	5 - Catastrophic
Likelihood	A - Almost Certain	Medium	High	Extreme	Extreme	Extreme
	B - Likely	Medium	Medium	High	Extreme	Extreme
	C - Possible	Low	Medium	High	High	Extreme
	D - Unlikely	Low	Low	Medium	High	Extreme
	E - Rare	Low	Low	Medium	Medium	High

Table 20.4 Likelihood matrix

Likelihood rank	Category	Description	Frequency of occurrence
A	Almost Certain	The event will occur on an annual basis	Once a year or more frequently
B	Likely	The event is expected to occur several times or more over the life of the Project	Once every three years
C	Possible	The event is expected to occur at least once over the life of the Project.	Once every 10 years
D	Unlikely	The event could possibly occur over the life of the Project	Once every 30 years
E	Rare	The event may occur only in exceptional circumstances throughout the life of the Project	Once every 100 years or less frequently

Table 20.5 Consequence matrix

Consequence rank	Category	Health and Safety	Infrastructure
1	Insignificant	Slight injury or first aid	Any damage to infrastructure easily rectified.
2	Minor	Medical treatment	Superficial damage to infrastructure.
3	Moderate	Hospital treatment	Moderate damage to infrastructure.
4	Major	Permanent total disability	Major damage to infrastructure.
5	Catastrophic	Fatality	Infrastructure severely affected.

20.3.2 Dangerous goods

Where hazardous chemicals or dangerous goods (including explosives) are stored, handled or transported, specific hazards and risks need to be identified and mitigated throughout the Project life cycle.

The assessment of hazards and risks associated with dangerous goods applied the following process:

- review of the types and quantity of goods to be stored and handled during construction
- identification of the risk of physical or chemical reaction of dangerous goods and ensuring the stability of goods
- incorporating dangerous goods management into an emergency plan.

The risks associated with dangerous goods were qualitatively assessed based on the expected types and quantities of dangerous goods associated with the construction, operation and decommissioning phases of the Project.

20.4 Existing environment

There are risks and hazards in the existing environment (in the absence of the Project) such as natural events and infrastructure, which exist as external risk influences on the Project. Existing risks and hazards may potentially be exacerbated by the Project and an understanding of these hazards enables the Project's risk contribution to be analysed.

20.4.1 Natural hazards

Flooding

The Project Site sits within the Isaac River catchment, a sub-catchment of the broader Fitzroy Basin. The Fitzroy Basin covers an area of approximately 142,660 square kilometres (km^2) (DES 2018c), comprising numerous rivers, streams, waterholes and impoundments. There are a number of watercourses flow through the Project Site including Boomerang Creek, Plumtree Creek, Hughes Creek, One Mile Creek, Spring Creek and Phillips Creek.

Flood modelling was undertaken for the Project Site (**Chapter 8 Surface Water Resources**). Modelling was undertaken to determine the nature and extent of flood behaviour under existing conditions. The maximum predicted water depth across the Project Site was mapped for the two year average recurrence internal (ARI), 50 year ARI, 100 year ARI and 1,000 year ARI events. The lower limit of mapping was set at 0.2 m deep to avoid capturing puddles that result from direct rainfall.

Results indicated that for the two year ARI event, flows are contained within the channels except in the north east corner of the Project Site, where floodplain inundation occurs near the Hughes and Boomerang Creeks confluence. The extent and depth of inundation increases for each larger flow event modelled. Overland flow paths south of Hughes Creek also become more prominent under larger flows. In the 1,000 year ARI event, the construction village is free from flooding. Road access from the south is likely to be temporarily affected by inundation from One Mile Creek during large flow events.

Cyclones and storms

In Queensland, tropical cyclones mostly form from lows within the monsoon trough and affect the northern areas of the state (BoM, 2018). While relatively uncommon, these systems are generally formed during summer months and affect coastal areas. Since 2000, there have been several tropical cyclones of significance in Queensland, of which three impacted the vicinity of the Project Site. Climate modelling from the Commonwealth Scientific and Industrial Research Organisation (CSIRO) projects tropical cyclones to become less frequent, but with increases in the proportion of more intense storms.

Bushfire

The topography of the Project Site consists of predominately flat areas, with several creeks passing through the Project Site. The majority of the terrain within these catchments is undulating and land use is predominantly grazing and mining activities in the upper reaches of the catchment, the terrain becomes steeper and possesses tracts of remnant vegetation.

Fire hazards are common in the Isaac Region (IRC, 2018). The bushfire season extends from mid-late winter through to early summer. The threat of bushfires increases with periods of reduced rainfall and increased temperatures, which can increase the amount of dry grass available to burn.

The Department of State Development, Manufacturing, Infrastructure and Planning indicate the Project Site is located in a Bushfire Prone Area according to localised mapping through the State Planning Policy Integrated Mapping System (SPP IMS) Natural Hazards. Bushfires throughout the state are mapped on the following parameters:

- Potential fire-line intensity
- Potential fuel load
- Maximum landscape slope
- Fire weather severity
- Potential impact buffer.

When factoring in the above parameters, the Project Site was mapped as “Medium Potential Bushfire Intensity” with potential for medium levels of flame attack, radiant heat and ember attack.

Climate statistics from the Australian Bureau of Meteorology (BoM) shows the highest recorded temperature in the vicinity of the Project Site exceeds 40°C. Mean rainfall values also highlight the distinct wet and dry seasons experienced by the region, as well as the large variation in rainfall amounts received across the wider area. Climate modelling from CSIRO estimates a temperature rise of up to +1.3°C by 2030. The primary determinant of bushfire is fuel (vegetation) availability which varies mainly with rainfall (CSIRO, 2018).

The extreme heat and dry conditions experienced in the vicinity of the Project Site, both now and in the future, can be conducive for a bushfire event.

Climate change

Queensland’s total emissions have been on an upward trajectory since the mid-1990s but have fluctuated significantly due to the large contribution the land use, land use change and forestry (LULUCF) sector makes to Queensland’s emissions. The baseline emissions projection for Queensland shows a projected 35 per cent increase in Queensland emissions to 2030 – comprising a sharp increase in emissions between 2014 and 2020, followed by a more gradual rise to 2030. This is largely due to increasing emissions in the energy and LULUCF sectors. The projected increases in baseline LULUCF sector emissions are primarily due to an increase in land clearing. LULUCF emissions are projected to rise from 25.2 million tonnes carbon dioxide equivalent (Mt CO_2-e) in 2013 to 42 Mt CO_2-e in 2030. Other contributors to increasing emissions are increased transport activity, increasing fugitive emissions from coal mining and gas production expected in Northern Queensland (DEHP, n.d.).

The Queensland future climate Dashboard summarises information of climate models with regional scale simulations until the end of the current century. Representative Concentration Pathways (RCP) are used as per modelling based on the Intergovernmental Panel on Climate Change’s Fifth Assessment Report (AR5). The RCPs refer to differing radiative forcing values (relative to pre-industrial levels) which could be experienced in the future based on different atmospheric concentrations of greenhouse gases resulting from ongoing emissions. Four RCPs are modelled to cover a range of emission scenarios with and without climate mitigation policies (RCP 2.6 – 8.5). For example, RCP8.5 is based on minimal effort to reduce emissions; RCP2.6 requires strong mitigation efforts.

For the purposes of this assessment, RCP 8.5 was used to represent the worst-case and current trend emission scenario. Table 20.6 indicates the spatial information for the Project Site with Scenarios projected for Years 2030 and 2050.

Table 20.6 Climate Projections for the Project Site

Climate projection	2030 RCP 8.5	2050 RPC 8.5
Mean maximum daily temperature (°C)[1]	0.5 – 1.0	2.0 – 2.5
Mean minimum daily temperature (°C)[1]	0.0 – 0.5	2.0 – 2.5
Mean number of days above 40°C[1]	4 – 6	8 – 10
Drought duration (months)	1 – 2	2 – 3
Precipitation (%)	-4 – -2	-4 – -2
Mean maximum 1-day precipitation (mm)[2]	-3 – -2	-15 – -10
Frequency of Extreme Floods (months)	-0.05 – 0.05	0.1 – 0.2

Alteration of climatic conditions have the potential to change environmental parameters of the Project Site including flood, bushfire and heatwave characteristics.

20.4.2 Infrastructure

Traffic

The Project Site is located adjacent to Dysart-Moranbah Road. Dysart-Moranbah Road is a sealed local road of regional significance that provides connection between the Peak Downs Highway and other mines further south as well as to the town of Dysart. Its main designation is to provide access to the mining industry in the region and it therefore carries a high percentage of heavy vehicles.

School bus routes currently use the Peak Downs Highway and Moranbah Access Road to service schools in Moranbah and Dysart-Moranbah Road to service schools in Dysart. School bus routes typically operate outside of shift start and end times for the workforce.

A review of the latest available crash data in vicinity of the Project Site showed a total of 39 crashes were recorded in the past five years between June 2012 and June 2017.

Chapter 14 Transport provides an assessment of existing traffic conditions within the vicinity of the Project Site.

Existing Saraji Mine

The Project Site is located adjacent to the existing Saraji Mine. This open cut coal mine has been operational since 1974 and extends approximately 30 kilometres (km) from the north to the south, with a width averaging 4 km. The existing Saraji Mine is serviced by various elements of infrastructure, including the Goonyella railway line, Dysart Moranbah Road, a 132 kV Powerlink Powerline, a 66 kilovolts (kV) powerline, the Burdekin Pipeline and Eungella Water Pipeline Company (EWPC) Southern Extension Water Pipeline.

Chapter 4 Land Use and Tenure provides further detail on existing infrastructure in the Project Site.

20.5 Potential impacts

The health and safety hazards specific to the Project were identified through workshops, design reviews and impact assessments. Identified key hazards, considering also the proposed mitigations, are detailed in the risk register Table 20.7.

Ongoing workplace risk assessments will be carried out in accordance with the *BHP Safety Our Requirements* (BHP, 2018b).

The preliminary risk assessment documents the key hazards that present significant and high risk interaction between the Project and the local environment during construction, operation and decommissioning. Each hazard identified in the risk assessment has been assessed according to *BHP Risk Management Our Requirements* (BHP, 2018b) Section 20.3. Other hazards not documented in the risk assessment are considered to be low or insignificant risks.

Table 20.7 Preliminary risk assessment

Hazard	Impact	Pre-mitigated consequence level	Pre-mitigated Likelihood	Pre-mitigated risk level	Proposed controls	Residual risk after controls
High risk activities (e.g. confined space entry, hot work, hazardous materials, work on high voltage) that require a permit	• injury/fatality • misuse of equipment	3	A	Extreme	• identify, train and authorise permit issuers, permit authorisers and permit holders • authorise permits before commencing work and for suspension, handover, hand-back and changes to scope of work	Medium
Falling objects	• injury/fatality	3	C	High	• inspect and maintain the integrity of overhead structures in the vicinity of walkways and working areas • separate and protect personnel from objects that have the potential to be dropped or fall from height	Low
Confined space works	• injury/fatality	3	C	High	• set criteria for a safe environment within the confined space and provide a rescue plan specific to the confined space conditions, before entry • assess and use respiratory protective equipment where a safe atmosphere cannot be established • monitor, for the duration of the work activity, atmospheric contaminants and oxygen (including pre-entry) and personnel	Medium
Dust from road and earthworks	• poor visibility • traffic incidents • residential complaints • respiratory tract irritations	2	C	Medium	• water trucks • speed limits	Low
Lifting	• injury	3	B	High	• identify the activities that require a complex lift including lifting personnel, using multiple cranes and lifting over hazardous materials	Low

Hazard	Impact	Pre-mitigated consequence level	Pre-mitigated Likelihood	Pre-mitigated risk level	Proposed controls	Residual risk after controls
					• install and operate lifting equipment on stable ground and use cranes with devices that detect the potential for overload • separate and protect personnel from lifting equipment and loads	
Traffic incidents (collision with other vehicle, human or fauna)	• injury • haul road closure • project schedule delay	5	D	Extreme	• control access of light vehicles and personnel to active mining areas • implement an authorisation process for drivers and the number of vehicles that can enter mining operations • identify and control the impacts of environmental hazards including dust, fog and water • identify and implement segregation areas for mobile equipment and light vehicles	Extreme
Fall of ground	• injuries • project schedule delay • disruption of groundwater flow	4	D	High	• implement a ground control system based on geotechnical investigation, design and controls • monitor and analyse changes to ground conditions and the effectiveness of ground support • separate and protect personnel from ground that has the potential to slip, fall and collapse	Medium
Animal hazards (e.g. snake/spider bite)	• animal bites • injuries	3	D	Medium	• paramedic onsite and first aiders • personal protective equipment (PPE)	Medium
Underground fire	• air borne pollution/odour/dust • toxic gases emission • respiratory diseases	5	D	Extreme	• gas monitoring systems • design of gas ventilation systems • chemical data review for storage and handling • evacuation procedures	High

Hazard	Impact	Pre-mitigated consequence level	Pre-mitigated Likelihood	Pre-mitigated risk level	Proposed controls	Residual risk after controls
Loss of containment of hazardous materials	• pollution to stormwater and soil • potential fire	3	C	High	• refuelling in designated areas fitted with spill containment • storage and handling in accordance with AS 1940:2017 • identify and assess hazardous materials and perform hazard analysis (PHA) for processes where the volumes or quantities of hazardous materials meet the threshold of the Chemical Accident Prevention Provisions • contain and control hazardous materials taking into account the PHA • operate plant within design limits and maintain the integrity of process systems • use pressure relief, detection and shutdown systems • personnel trained in storage and handling • use of material Safety Material Data Sheets (MSDS)	Medium
Excessive noise (e.g. mine equipment)	• residential complaints • increase in stress level • hearing loss	2	C	Medium	• use of PPE • community and complaints management techniques as detailed in the Community Complaints and Grievances Procedure current at the time of project commencement	Low
Flooding	• impact on water quality • project schedule delay	2	C	Medium	• contingency plans • appropriate drainage and pumping systems • design of mine in consideration of flood modelling	Low
Fatigue	• Increased collision and misuse of operations	3	C	High	• adherence to the BHP fatigue management current at the time of Project commencement	Medium

Hazard	Impact	Pre-mitigated consequence level	Pre-mitigated Likelihood	Pre-mitigated risk level	Proposed controls	Residual risk after controls
Failure of mine water management system	• discharge of potentially contaminated water • downstream water quality impacts	4	D	High	• regular inspections of mine water storages, pipelines, drains, bunds • monitoring equipment to be installed to monitor storage volume during operations • pipes and pump systems to be designed with consideration to volume requirements predicted from water balance modelling • mine water storages should be designed in consideration to the predictions of the water balance model	Low
Pests (weeds) brought to site by earthmoving equipment	• possible health hazards to animals • changes to irrigation requirements	2	C	Medium	• all vehicles must be washed down and inspected prior to arrival onsite • invasive species to be removed as appropriate, if discovered onsite • implementation of a Weed and Pest Management Plan	Low
Natural disasters (e.g. cyclone and surface flooding)	• failure of infrastructure • operation of mining activities	5	D	Extreme	• implementation of Emergency Management Plan • evacuation procedures • appropriate drainage/ pumping systems	High
Mine gas explosion	• fatality • explosion escalating fire of flammable materials	5	D	Extreme	• safety inductions and competency based assessment for all project workforce (including contractors) operating machinery • gas monitoring systems • appropriate design of gas ventilation systems • assessment of pre and post gas drainage • confirm presence of trace gases (e.g. H2S) • gas study to determine amount and quality of gas	High

Hazard	Impact	Pre-mitigated consequence level	Pre-mitigated Likelihood	Pre-mitigated risk level	Proposed controls	Residual risk after controls
Mine collapse	• injuries/fatality • project schedule delay	5	D	Extreme	• requirements of CMSH Act are met • detailed safety hazard assessment • geotechnical investigation, design and controls • geotechnical management planning and surveillance • use of hydraulic roof supports at the working face • evacuation procedure	Extreme
Above ground fire	• loss of properties and equipment • injuries • release of soot and smoke particles • release of toxic gases	4	D	High	• approved fire alarm, detection, suppression and fighting system designed and installed in consultation with the relevant fire control authorities • liaise with landowners and local authorities with respect on fire breaks and ongoing maintenance programs to minimise the risk of bush fire • limit ignition sources around refuelling and fuel storage areas • spontaneous combustion controls	Medium
Inadequate waste management	• air borne/ odour pollution • impact on aesthetic • cross contamination of hazardous chemicals with general waste polluting soil	1	D	Low	• provision of a Waste Management Plan • recycling/recovery as appropriate	Low

Hazard	Impact	Pre-mitigated consequence level	Pre-mitigated Likelihood	Pre-mitigated risk level	Proposed controls	Residual risk after controls
Mine gas asphyxiation / poisoning	• lack of oxygen in blood leading to dizziness • fatality • fire or explosion from ignition of flammable contaminants	5	E	High	• gas monitoring systems • appropriate design of gas ventilation systems • maintenance of critical plant to avoid ignition sources and use of intrinsically safe/ explosion protected equipment in relevant areas • provision of rescue chambers and self-rescuer caches at sufficient intervals • assessment of pre and post gas drainage • implementation of an Incidental Mine Gas strategy	High

20.5.1 Natural hazards

Flooding

Risk of mine flooding arises due to heavy rainfall or changes in hydrology from subsidence as a result of mining. Changes in the flow condition within the Project Site can also lead to increased erosion or destabilisation of riverbanks. Additionally, floodwater may be contaminated leading to degradation of downstream surface water quality and impact on aquatic ecosystems.

Bushfire

Potential intensity of a bushfire under extreme weather conditions has been mapped as Medium Potential Bushfire Intensity using the Queensland state-wide mapping of bushfire prone area (CSIRO, 2014).

Climate modelling from CSIRO identified that bushfire frequency depends on the spatial variability of future rainfall. Operational activities have the potential to escalate the risk of bushfire by introducing ignition sources. The main sources of ignition in the Project Site include welding, spontaneous combustion from coal stockpiles, lightning, arson or arcing from powerlines. Leaks and spill from freight and other machinery can also increase the potential for bushfires. Further impacts that have the potential to promote ignition include fuel and exhaust fires, hazard reduction and biodiversity burns, fencing and land management activities and High/Extreme/Catastrophic Fire Danger Days.

Increased bushfire frequency has the potential to result in potential safety and asset loss impacts including:

- Reduction in air quality from increased bushfire smoke and dust
- Slower operating machinery due to reduced visibility
- Limited access to fire-fighting resources due to working some distance from a mine site
- Confined conditions, restricted evacuation options, and potential loss of air quality smoke and noxious fumes in an underground mine
- Life threatening conditions for workers when in a remote condition.

Climate change

An increase in climate change projections over time has the potential to increase flooding at the Project Site. Environmental hazards may increase, with increased flood frequency, duration or severity as a result of changing weather conditions and climate change.

Increasing temperatures over a multitude of days has the potential to create heatwaves which would create direct and indirect impacts. Direct impacts include human health impacts such as morbidity and morality, infrastructure failure and possible wellbeing or death to plants and animals. Indirect impacts as a result of direct impacts include increased health and social service demands, lost productivity, failure of essential services, transport interruptions, crop and live stock loss and bushfires.

The operational phase of the Project is estimated to result in approximately 18.3 Mt CO_2-e of GHG (Scope 1 and Scope 2) over the 20 year life of Project. This equates to 0.92 Mt CO_2-e on an annual basis. The annual GHG emissions for the Project represent 0.17 per cent of Australia's 2016 GHG emissions.

The Project generally has a limited vulnerability to climate change impacts, with the greatest potential impacts being an increased risk of flooding, and potential for increased soil erosion due to increase in rainfall intensity. **Chapter 11 Air Quality and Greenhouse Gas** provides a detailed assessment of the Project's potential vulnerability to impacts from climate change.

Terrestrial ecology

The construction phase has the potential to disturb fauna which may reside in the Project Site. These risks may involve vehicle collision with fauna, and hazards such as snake or spider bites.

The Project is not expected to lead to an increase in the number of pests during construction or as a result of site operations. However, clearing as a result of the construction stage has the potential to impact ecosystems through the removal of habitat features such as trees, shrubs, ground cover, rocks, and other features. The disturbance of soil may enhance the conditions for weed infestations and reduced buffers to core habitat may result in disturbances to fauna and a reduction in functional habitat.

20.5.2 Project hazards

Air quality and dust

The construction and operational phases are expected to increase air quality and dust, from activities such as earthworks, increased traffic, heavy mining equipment, and the CHPP. Increased dust and other emissions have the potential to impact on health and amenity.

Mine vehicle and traffic

During the construction phase, between 162 (in Financial Year (FY) 2021) and 222 (in FY 2022-2023) vehicles will be required for the transportation of workforce, construction materials and equipment. In the operational phase, between 123 and 222 vehicles will be required. The traffic assessment (**Chapter 14 Traffic**) identified that the regional road network highway links and intersections are anticipated to operate within capacity without significant delays and queuing. Regardless of the traffic volume, movement of heavy equipment to and from the Project Site may confer specific safety risks to the public. There are collision risks with these increased vehicles.

Noise and vibration

Noise and vibration sources from the Project will include mining (vehicle movements and underground mining equipment) and above ground processing activities (conveyors, crushers, screens, loading and gas drainage). The noise emission of machinery can vary with a number of factors including the age and condition of the equipment, the type of terrain the equipment is operating on, the type of operation the equipment is performing and the ability of the operator.

It is anticipated that noise emissions generated by underground mining activities during the operational phase are insignificant at nearby sensitive receptors, when compared to above-ground noise sources. Exposure to such unusually loud noise and vibration over an extensive period of time can lead to hearing damage or increase in stress level. **Chapter 12 Noise and Vibration** provides further assessment of the potential increases of noise as a result of the Project.

Mine water

The operational phase of the Project will generate mine affected water (MAW), from underground mining operations effluent, and runoff from surface infrastructure.

A mine water management system (WMS) is proposed for the Project. This involves components including a process water dam, portal sump, process areas runoff collection system, and a raw water dam. Preliminary capacity estimates for all mine WMS dams and the water transfer network have been determined through a water balance assessment using historical climate conditions and conceptual operational rules. For the purpose of the assessment, a conservative approach was adopted to sizing of each conceptual mine WMS storage such that:

- controlled releases of MAW to the receiving environment are not required
- capacities are sufficient to prevent the uncontrolled (spillway) discharge of MAW to the receiving environment.

It is noted however that this does not imply a zero release system. Any open system has the potential for uncontrolled discharge of MAW as a result of extreme rainfall events. As such, BMA will be seeking authority and licence conditions to conduct the controlled release of MAW from the Project Site. The indicative location for controlled release of MAW is located on Boomerang Creek adjacent to the proposed process water dam. Spillway discharges (uncontrolled) from the process water dam are also proposed to be directed to Boomerang Creek.

Waste

Sources of construction waste are generated by the haul road and infrastructure upgrade works, services upgrades (communications, water, power supply and sewerage) and by the construction of the proposed accommodation village. These include excavation waste, vegetation, concrete residue, scrap metal, regulated waste including fuel and hydrocarbon as well as general waste such as plastic, packaging materials and food scrap. Waste generated during operational and maintenance phases will be similar to those during construction phase, in addition, disposal of mine vehicle tyres, damage conveyor belts are also anticipated. These wastes produced have the potential to pollute soil, groundwater, surface water, risks to human health and environment if not managed appropriately. Wastage of raw materials are also the causes of indirect wastage of embedded energy and greenhouse gas emissions.

20.5.3 Specific work element hazards

Mine collapse and slumping of sloped ground

The main cause of mine collapse and slumping of sloped ground arise from ground instability, poorly designed underground mine roof and wall support or poor drainage of coal stockpiles. A collapse or failure of part or whole of an underground roof or stockpile slope could cause injury or death due to the immediate contact with the collapsing material or due to the effects of the physical entrapment within failure debris. Uncontrolled instability or movement of such structures can have many ramifications including serious injuries, production loss and economic loss.

Incidental mine gas and associated underground fire

Incidental mine gas is present in the Fort Cooper Coal Measures (FCCM) and Moranbah Coal Measures (MCM). Drilling and working along the faces of these coal measures can present exposure of personnel to methane gas. Generally, methane gas volume increases with depth. The principal danger arising from methane gas is underground fire and explosion. The explosive range for methane in air is five per cent to 15 per cent methane by volume (v/v). Although concentrations higher than 15 per cent v/v (the upper explosive limit) cannot be directly ignited, they can dilute into the explosive range or represent a risk of ignition as they will burn at the interface of the gas and air. Methane is ignited relatively easily by either naked flames or sparks from electrical equipment such as switches. Even small quantities of gas can produce significant damage and risk to people, especially if the gas volume is confined at the time of ignition. Methane is not toxic, but can act as an asphyxiant by displacing oxygen from the air.

Above ground fire

Any situation with the presence of both an ignition or fuel source, or the introduction of either source has the potential to result in a fire. Above ground fires have the potential to cause loss of properties and equipment and injury to personnel. The risk of releasing toxic gases, soot and smoke particles may occur during an above ground fire.

Electrical work

Underground coal mining activities involve the use of high voltage continuous mining machinery, which requires associated generator and transformer equipment. The Project Site is also traversed by 132 kV and 66 kV lines servicing BMA operations and these existing powerlines will be relocated to a new infrastructure and transport corridor on the eastern extent of the Project Site. There is an associated risk for personnel within or working on high voltage lines and equipment. Common high

voltage risks include electrical shock causing injury or death from direct or indirect contact. Electrical fire from an electrical fault as well as electrical arcing may release various gases and contaminants which may pose health and safety risks.

Equipment and plant

Personnel may be at risk of interacting with construction machinery, CHPP machinery, mining machinery, parts from vehicles and earth moving equipment, resulting in potential serious injury. The hazards from interaction with machinery may occur due to the movement of heavy equipment. Inappropriate operation of equipment including failure to observe exclusion zones can cause serious or fatal injuries.

Working at heights and confined space entry

There will be instances where personnel are required to work at heights. Fall risks include those from elevated work platforms (EWPs), ladders, rigging, scaffolding and roofs and may present safety risks to personnel.

Confined space entry will also be required in some occasions where personnel are required to enter vessels, tanks, pipes, tunnels and wells for maintenance and inspection. Confined spaces are generally associated with the hazards of low oxygen level and high concentration of methane gas. As less oxygen becomes available, nausea and vomiting, collapse, convulsions, coma and death can occur. Unconsciousness or death could result within minutes following exposure to a simple asphyxiant. Asphyxiants include argon, nitrogen, or carbon monoxide.

Fatigue

Personnel who are exposed to extreme heat or sun exposure can develop heat-related illness, such as fatigue and heat stroke. Continuous hot work processes can also contribute to fatigue. Heat stress can lead to construction injuries, and potentially fatalities in severe cases.

Construction personnel with underlying health symptoms, such as heat diseases, high blood pressure, obesity and other health complications will be prone to heat stress.

The onset of fatigue may also lead to poor decision making and result in an accident, for example, errors during equipment operation or misjudging the speed and distance of an approaching traffic. In this way fatigue can impact on surrounding communities by increasing the frequency of incidents during Project activities.

20.5.4 Dangerous goods and hazardous chemicals

Storage and handling

The storage and handling of hazardous chemicals introduces potential impacts associated with material properties such as flammability, corrosiveness and toxicity. Significant releases of hazardous chemicals can impact nearby sensitive receptors.

The hazardous chemicals expected to be used during construction activities will generally be limited to various combustible liquids associated with fuel and lubrication uses. These materials have the potential to contribute to fires, although their high flash points reduce the potential for small incidents to create significant consequences. During operation of the mine, incidents are generally expected to be limited to the local area of storage, although there is the potential for chemicals to spread into waterways should a spill occur. There is a potentially for flooding to inundate hazardous chemical depots and flush contaminants onto unsealed ground.

Transportation of dangerous goods

Operational transport of dangerous goods associated with coal processing has a risk of loss of containment during incidents such as tanker roll over. Loss of containment of dangerous goods could have severe consequences depending on the location and type of goods.

Where the transport route traverses areas of environmental sensitivity such as watercourses, there is the potential for significant loss of containment events to damage the environment through release of toxic, corrosive or flammable materials.

20.6 Mitigation measures

Hazard mitigation measures have been developed for the Project and shall be applied throughout the lifecycle of the development. Controls include mitigation measures incorporated into engineering and design development, in addition to management strategies and procedures for construction and operations.

The management of risks throughout the Project lifecycle will involve ongoing reporting, monitoring, reviewing and documenting the risks.

20.6.1 Natural hazards

The Project considered the impacts of potential natural hazards and will manage these hazards to minimise potential impacts to asset, health and safety to so far as is reasonably practicable (SFAIRP). The values that have the potential to be impacted throughout the Project lifecycle will be managed in accordance with an Emergency Management Plan, engineering procedures, and relevant Australian Standards to ensure compliance with the legislative requirements.

Flooding

The potential for flooding impacts on surface infrastructure (during flooding and high rainfall events) will be mitigated by the provision of adequate pumping systems, and water storages. The portal will be designed to 1 in 1,000 year Annual Exceedance Probability (AEP) flood immunity to mitigate inundation of the underground mine. In addition, the Project will have an Emergency Management Plan that will include preparatory measures for large flood events to minimise both environmental and health and safety risks.

Bushfire

The design of the Project Site will ensure adequate emergency service access. Consideration will be given to the provision and maintenance of access where local roads can facilitate emergency access, first response firefighting, accessible and sufficient water supply for firefighting purposes and safe evacuation.

The following mitigation measures are proposed for the Project Site:

- firebreaks will be maintained to assist with the management of bushfires
- suitably equipped water truck or trailer that can support fire response requirements will be present onsite at all times
- cattle grazing will continue throughout the life of the project
- toolbox talks and relevant health and safety plans will include discussions of bushfire and ignition prevention measures
- fuel reduction activities will be undertaken to limit the speed and spread of potential unscheduled fires. this would include thinning or removal of undergrowth.
- hazard reduction burning will not be undertaken during periods of declared total fire bans. (the use of regular hazard reduction burns to manage fuel loads across the surface of the project area and across the time frame of the project.)
- in the instance of a bushfire event, site firefighting capabilities will be addressed in the emergency Management Plan.

- the fire danger ratings during the fire season will be reviewed daily. any advice to extreme conditions will be relayed to environment and operations staff.
- bma will liaise with landowners and local authorities with respect to firebreaks and ongoing maintenance programs to minimise the risk of bush fire.

Climate change

The Project generally has a limited vulnerability to climate change impacts, with the greatest potential impacts an increased risk of flooding and heatwaves, and potential for increased soil erosion due to increase in rainfall intensity.

There are a number of best practice opportunities for the reduction of greenhouse gas generation during construction and operation of the Project, including:

- selection of construction materials with low embodied energy
- optimising the cut/fill balance for earthworks to minimise material transport requirements
- optimising underground ventilation to reduce energy requirements during operation
- vehicle speed management.

The Project will also allow for the potential increase in flood risk arising from any increase in extreme rainfall and sea level rise as a consequence of climate change by locating hazardous chemical depots away from watercourses and flood zones. The Project will also work towards minimising future risk in emergencies and engage with the local council and the Local Disaster Management Group.

Terrestrial ecology

To minimise disturbance to fauna, suitably qualified spotter catchers will be present during vegetation clearing activities to minimise risk of injury to native fauna. All spotter catchers will hold appropriate permits under the NC Act. The workforce will be provided with contact details of a suitably qualified spotter catcher in the event that fauna is present within the Project Footprint and needs to be removed, or fauna are accidentally injured. Site inductions will include information surrounding conservation significant species known to occur in the Project Site and measures to minimise harm to these species.

Existing weeds and pest fauna will be managed through a Weed and Pest Management Plan. All vehicles entering areas infested with invasive weeds will be washed, inspected and free of weeds prior to leaving the Project Site. Prior to arriving onsite all vehicles will be cleaned and free of weeds.

20.6.2 Project hazards

The key hazards to the mine workforce associated with the construction and operational phases of the Project are discussed below, along with appropriate mitigation measures.

Risks associated with the decommissioning stage will be re-visited in the last years of the operational phase. Likely potential risks include issues with the final landform stability (such as erosion and slumping), contaminated land and water quality. The Rehabilitation Management Plan **Appendix K-1** addresses the management of these risks.

Air quality and dust

The Project will implement emission controls of pollutants to the atmosphere and will be incorporated into the Project environmental management system. Coal dust from stockpile will be managed by dust suppression systems such as the use of water sprays. Mine traffic and maintenance vehicles on haul roads will be managed using speed controls and watering of haul roads. Additionally, the Project will also focus on the use of fuel efficient mining equipment and maintaining mining equipment in good working condition to ensure particulate emission is minimised.

When requested by the administering authority or as a result of an air quality complaint (which is neither frivolous nor vexatious nor based on mistaken belief in the opinion of the authorised officer), dust and particulate monitoring will be undertaken and the results notified to the administering authority.

Mine vehicles and traffic

Construction personnel operating vehicles onsite will be trained and authorised. Speed control signage, driving to conditions and prescribed driving procedures on the Project Site will be implemented to control the risk.

Adequate night lighting through the provision of lighting towers and vehicle headlights will be provided to ensure night operating and driving conditions are safe. Safety berms will be constructed and maintained to protect people and equipment from driving over embankments. These will be regularly inspected to ensure structural integrity.

Areas within the Project Site will have restricted access to ensure the separation of light and heavy vehicles. Separation may be achieved via the provision of bridges and separate roadways.

Vehicles used in underground operations will be restricted to the underground workings or dedicated access roads located between surface facilities and the mine portal entrance.

Public roads

The traffic assessment (**Chapter 14 Traffic**) concluded that the regional road network highway links and intersections are anticipated to operate within capacity without significant delays and queuing. Therefore, mitigation measures based on operation efficiency are not warranted.

However, based on road safety, the following mitigation measures are proposed to address the issues identified in this assessment:

- upgrade Lake Vermont Road for approximately 11km from Dysart-Moranbah Road, if required for the construction accommodation village and mine access
- provide intersection lighting at Intersection 1 (Lake Vermont Road / Dysart-Moranbah Road)
- construct proposed Intersection A on Dysart-Moranbah Road
- provide intersection lighting at Intersection 3 (Peak Downs Mine Access / Peak Downs Mine Road / Dysart-Moranbah Road).

The investments committed by DTMR and listed in QTRIP 2017-18 to 2020-21 (The State of Queensland (Department of Transport and Main Roads), 2017b) were taken into account in developing the mitigation measures proposed.

Additionally, a Traffic Management Plan (TMP) including police escorts and public notices will be implemented as necessary during the transportation of oversize vehicles on public roads.

BMA will work with road authorities during the detailed design phase to confirm the extent of predicted impact and finalise mitigation measures that are likely to be in the form of compensation contributions.

Noise and vibration

The level of noise at a sensitive receptor will vary depending on the type of machinery in use, traffic in the area and separation distance.

Noise and vibration sources from operational and maintenance work involving heavy machinery will incorporate appropriate noise mitigation equipment and devices including mufflers and acoustic barricades. Plant such as conveyors, pumps and motors will be maintained to adequate working conditions to minimise unusually loud noise.

BMA will implement control measures where practical which may include:

- maintaining machinery to minimise noise
- maintaining internal roads in good working order
- use of reverse alarms on all machinery that regularly reverse (e.g. bulldozers and front-end loaders)
- noise control to the ventilation shafts, which could comprise:
  - orientate discharge outlets away from nearby sensitive receptors
  - variable speed devices fitted to fan motors.
- treatments to conveyors, such as the used of low noise idlers, and partial enclosures
- BMA will provide awareness and understanding of noise issues through site inductions for all staff and contractors.

BMA will finalise the noise mitigation measures prior to the construction phase.

When requested by the administering authority or as a result of a noise complaint (which is neither frivolous nor vexatious nor based on mistaken belief in the opinion of the authorised officer), noise monitoring will be undertaken at the nearest privately-owned dwelling or affected receiver and the results notified to the administering authority.

Mine water management

The following mitigation strategies will be considered in the design, construction and operational phases to address water management system failure risk:

- mine water storages should be designed with consideration of the predictions of the water balance model which considers all inputs and outputs, and which has run through a long-term period of climatic data to test storage capacities particularly in high rainfall wet seasons
- in the design stage, proposed mine water storages should be assessed against the Manual for Assessing Hazard Categories and Hydraulic Performance of Dams (DES, 2016) or manual current at the time of design
- pipes and pump systems to be designed with consideration to volume requirements predicted from water balance modelling and designed and constructed under the supervision of qualified professional engineers
- monitoring equipment to be installed to monitor storage volume during operation and to mitigate overfilling
- regular inspections of mine water storages, pipeline, drain, bund and levees will be undertaken, particularly in relation to integrity of constructed embankments.

Waste

A Waste Management Plan will be prepared and implemented for the Project. General wastes from the Project will be recycled and reused on site where practicable.

Waste materials that are known to attract vermin will be stored and handled in a hygienic manner prior to removal by a licensed waste contractor. General wastes will be transported for disposal to a nearby landfill as described in **Chapter 15 Waste Management**.

The Project is expected to produce small quantities of hazardous (regulated) wastes such as hydrocarbons, hydrocarbon contaminated products (oily wastes and oil filters) and sewage effluent and sludge. Standard procedures will be developed in accordance with *AS1940:2017 Storage and*

Handling of Flammable and Combustible Liquids requirements for the storage, containment, disposal and spill response for potentially hazardous waste materials. These regulated wastes will be collected and disposed of by a licensed contractor.

20.6.3 Specific work elements hazards mitigations

Mine collapse and slumping of sloped ground

The potential dangers to personnel from falls of ground in underground mining at stockpiles, dam walls, waste rock dumps, trenches and similar locations will be monitored and managed.

In line with the *BHP Safety Our Requirements* (BHP, 2018b), ongoing geotechnical investigations and monitoring will be conducted to analyse early indicators to the changes of ground conditions and the effectiveness of ground support.

Slumping of stockpiles will be controlled by construction to appropriate slopes and provision of adequate drainage systems. Mine collapse will be controlled by the use of hydraulic roof supports at the underground working face along with secondary supports in other areas to ensure stability. Floor and roof mapping and regular checks will be undertaken to check wall and roof stability.

An approved Ground Control System will be developed, maintained and implemented in line with the *BHP Safety Our Requirements* (BHP, 2018b).

Incidental mine gas and associated underground fire

An Incidental Mine Gas Management Strategy will be developed prior to construction to reduce the associated risks of underground fire, explosion or asphyxiation.

Other controls to be implemented include gas monitoring systems, surveys and inspections, provision of fire testing alarm system, plant maintenance to avoid ignition sources and provision of rescue chambers.

Above ground fire

In conjunction with the mitigation measures highlighted for bushfires in **Section 20.6.1**, the following measures to mitigate the risks of above ground fire include:

- an approved fire alarm, detection, suppression and fighting system designed and installed in consultation with the relevant fire control authorities
- liaison with landowners and local authorities with respect on fire breaks and ongoing maintenance programs to minimise the risk of bush fire
- limit ignition sources around refuelling and fuel storage areas.

Spontaneous combustion

The Project will adopt strategies and the appropriate control measures to minimise the risk of above ground coal stockpile fires, including:

- minimising stockpile age
- appropriate stockpile design
- regular stockpile inspections
- provision of adequate firefighting equipment and water
- provision of training to relevant personnel.

Underground coal combustion will be mitigated by providing appropriate ventilation. Additional atmospheric and leakage monitoring will also be applied.

Electrical work

High voltage electrical work will be managed by adopting the approved codes of practice and procedures, including the *Electrical Safety Act 2002*, *AS/NZS 3012:2010 Electrical Installations—Construction and Demolition Sites*, CMSH Act and Regulation.

Equipment and plant

The Project will ensure the implementation of safe design with adherence to CMSH Act. This includes safeguarding of heavy equipment and machinery, exclusion zones and adequate access.

All vehicles and equipment will be inspected, maintained and serviced on a regular basis. Records of maintenance and servicing will be retained onsite for the duration of the construction, operation and decommission phases. Staff will be provided with PPE, training of job safety analysis (JSA) and maintenance lock-out/tag-out safety system prior to starting the work.

All plant will comply with the following:

- any exposed moving or rotating machine components must be guarded or fenced
- conduct continued testing of braking systems
- provide safe access and egress
- operators will be adequately trained.

Working at heights and confined space entry

High risk activities (including working at heights and confined spaces) will comply with the *BHP Safety Our Requirements* (BHP, 2018b). Mine personnel will be trained and competent for work involving working at heights and entering confined space. Fall of persons will be controlled through appropriate EWPs and the use of properly designed and maintained fall arrest equipment.

Objects that could potentially fall from a significant height will also be controlled through exclusion zones in accordance to the *BHP Safety Our Requirements* (BHP, 2018b).

Fatigue

The Project will adhere to the fatigue management procedures current to the time of Project commencement, to ensure conditions of work of personnel align with the CMSH Act. The maximum working time per 24 hours will not exceed 14 hours, inclusive of travel time. Shift work will be maximum of 12 hours duration.

Security

Throughout the construction, operational and decommissioning phases of the Project, public safety will be managed by limited access to the Project Site. Visitors will be escorted on site at all times. Additionally, BMA has a system in place to track access into and within its operating sites by all personnel and visitors. Exclusion zones will be developed to prevent public access, with fences and signs erected to delineate such areas.

Security measures implemented may include sign-in procedures for authorised personnel, identification, surveillance camera, security personnel after-hours, and if necessary, the involvement of police to manage more serious incidents.

20.6.4 Dangerous goods and hazardous chemicals management

The construction and operational phases of the Project will involve the use and storage of hazardous chemicals.

The expected list of chemicals used throughout the Project lifecycle, along with their purpose and dangerous goods details are presented in Table 20.8. Generally, low volumes of hazardous chemicals will be stored in the construction area near to points of use. The quantities stored will be equivalent to the demand for activities.

Table 20.8 Indicative list of dangerous goods and hazardous chemicals

Chemical name	Project phase	DG Class	Raw Conc (wt%)	Storage Conc. (wt%)	UN No.	PG	Purpose	Indicative rate of use	Indicative max inventory
Diesel fuel oil	Construction Operation	3 (Class C1)	N/A	N/A	1,202	III	Fuel for mobile equipment	6,800,000 L/year	155,000 L
Lubrication oils (hydraulic oil)	Construction Operation	3 (Class C2)	N/A	N/A	N/A	N/A	Lubricate plant and equipment	255,000 L/year	30,000 L
Lime (Calcium Oxide)	Operation	8	93	93	1,910	III	Potable water treatment	180 kg/year	60 kg
Caustic soda (sodium hydroxide)	Operation	8	50	50	1,823	II	Concrete degreasing agent	3,600 kg/year	3000 kg
Flotation agents MIBC - (methyl isobutyl carbInol)	Operation	3	99.5	99.5	2,053	III	CHPP frothing agent	450,000 L/year	155,000 L
Anionic flocculants	Operation	N/A	99.5	10	N/A	NA	CHPP thickener/flocculating agent	NA	NA
Solvents (e.g. acetone)	Operation	3	99.5	99.5	1,090	II	Workshop degreasing agent	1,800 L/year	900 L
Hypochlorite solution (liquid chlorine)	Construction Operation	8	N/A	N/A	1,791	II or III	Potable water treatment, sewage effluent treatment	15,000 L/year	1,500 L
Longwall lubrication emulsion	Operation	N/A	N/A	N/A	N/A	NA	Lubricating agent for longwall machinery	360,000 L/year	40,000 L

Chemical spillage and loss of containment

Chemicals stored and handled as part of construction or operations activities will be managed in accordance with the CMSH Act, the relevant Australian Standards and the requirements of the MSDS. MSDS information will be obtained from the supplier of these chemicals and stored in an easily accessible location.

Fuel storage onsite will be predominantly diesel, and storage design will comply with *AS1940:2017 The Storage and Handling of Flammable and Combustible Liquids*. Ignition sources will be controlled to avoid fire involving bulk fuel oil.

The hazard associated with the storage of diesel fuel oils and other hazardous chemicals arises from leaks/failures in the control system. To minimise these hazards associated with leaks during tanker unloading, the following measures will be in place:

- a spill kit will be available at the unloading pad for use in the event of spillage
- ignition sources will be strictly controlled and limited to avoid a fire
- permanent facilities, such as fuel storage areas, will have a dedicated fire alarm, suppression and firefighting equipment
- adequate bunding will be constructed to contain spills, in accordance with the applicable Australian Standards, such as *AS1940:2017 The Storage and Handling of Flammable and Combustible Liquids*
- maintenance of storage tanks will be undertaken, to ensure safe and effective operation of all components
- the tank will be designed in accordance with the applicable Australian Standards, such as *AS1692:2006 Steel Tanks for Flammable and Combustible Liquids* to minimise the potential for failure of the diesel storage vessel.

Transportation of dangerous goods

Dangerous goods will be required at construction sites and facilities. Licensed transporters operating in compliance with Australian Code for the Transport of Dangerous Goods by Road & Rail (ADG Code) will be utilised for dangerous goods deliveries. Transport vehicles will display HAZCHEM signage, including placards, and carry appropriate spill containment equipment to be used by emergency services personnel in the event of emergency spill.

20.6.5 Emergency response and management planning

Emergency management plan

The Project will develop an Emergency Management Plan which details the response procedures and available resources to manage emergencies. The Emergency Management Plan will be developed prior to construction considering the following components:

- an analysis of the key incidents likely to take place for each operational area
- an assessment of the degree of impact likely to occur
- an assessment of what constitutes an emergency for the particular operation
- an onsite plan to handle incidents
- an offsite plan with reference to emergency services needed
- communication, emergency responsibilities, control centre establishment

- post emergency procedures, including recovery, debriefing and review of plan
- testing of the plan under emergency-like conditions.

The Emergency Management Plan will detail response procedures including:

- first aid capability
- fire protection capability
- security systems capability
- remote travel emergency response capability.

Necessary resources will be available to ensure timely provision of first aid by trained competent staff, appropriate fit-for-use first aid facilities, emergency rescue facilities and access to medical and allied health support as per the Emergency Management Plan.

In the event of an emergency, effective and immediate action can contain the incident and mitigate it from escalating to an emergency.

The Project will have a Queensland Fire and Emergency Service (QFES) approved fire response/fighting system. All firefighting facilities and equipment will be installed, serviced, routinely maintained and inspected by a certified body. All buildings and equipment will be fitted with approved and certified fire detection equipment, such as smoke detectors, alarms and sprinkler systems) which will be regularly tested. First aid and firefighting equipment including hand held extinguishers and fire hoses will be installed at strategic points within each building. Firefighting equipment and exit locations will be suitably signed. All work areas will be within the required distance to reach emergency exits. Fire drills will be undertaken on a regular basis.

The Isaac Regional Council (IRC) Local Disaster Management Plans will be considered when preparing the Emergency Management Plan. The IRC Local Disaster Management Groups will also be contacted for consultation and will be notified on the schedule and activities of the Project. Consultation will also occur with the local emergency services (State Emergency Services (SES), Queensland Police Services (QPS), Queensland Ambulance Services (QAS) and Queensland Fire and Emergency Service (QFES)) to ensure that external support will be provided by these services in an event of an emergency.

Table 20.9 contains the elements and response procedures for the Project.

Table 20.9 Emergency plan elements for mine-site related emergencies

Event	Level of emergency	Emergency services required	Resources needed	Organisational aspects	Damage control actions
Surface fire and bushfire	Local/site	SES, QFES, QPS and QAS	Firefighting trucks, water tankers, plans and maps, on site firefighting team	Evacuation of affected mine personnel, communications to emergency services, site wide communication	Fire containment
	Potential external alert	SES, QFES, QPS and QAS	Firefighting trucks, water tankers, plans and maps, on site firefighting team	Roll call, evacuation notice, communications to emergency services	Shutdown of affected operations. Evacuation from around fire sensitive areas such as the fuel oil tanks
Vehicle collision	Local/site	QFES, QPS and QAS	Rescue, firefighting capability, fuel containment materials	People control evacuation of immediate area	Damage control actions, stabilise situation, contain fuel spillages, control ignition sources
Falls and impact incidents	Local	QFES and QAS	Site rescue equipment	Communication, evacuation of immediate area	Stabilise, isolate source of incident
Spontaneous combustion	Site	On site firefighting team and QFES	Dozer, fire truck and/or water truck	Communication, evacuation from area	Extinguish/ cool heat source
Mechanical and electrical failure	Local/site, external alert	Local maintenance	Replacement or standby equipment	Major failure requires external communication. Minor requires internal communication to maintenance groups.	Isolation and possible shutdown
Mine collapse / slumping	Local/site	QFES, QPS and QAS. Specialist rescue contractors.	Excavation equipment, plans and maps, site firefighting team	Evacuation of affected mine personnel. Communications to emergency services.	Evacuation from affected area. Shutdown of affected operations.
Mine gas	Local/site	QFES, QPS and QAS.Specialist rescue contractors.	Respirators, plans and maps, back-up ventilation systems	Evacuation of affected mine personnel. Communications to emergency services.	Evacuation from affected area. Shutdown of affected operations.

Event	Level of emergency	Emergency services required	Resources needed	Organisational aspects	Damage control actions
Underground explosion /fire	Local/site	QFES, QPS and QAS. Specialist rescue contractors.	Firefighting trucks, water tankers, plans and maps, on site firefighting team	Evacuation of affected mine personnel. Communications to emergency services.	Fire containment. Evacuation from affected area. Shutdown of affected operations.
Mine flooding	Local/site	SES, QFES, QPS and QAS. Specialist rescue contractors.	Back up pumping equipment, plans and maps	Evacuation of affected mine personnel. Communications to emergency services.	Evacuation from affected area. Shutdown of affected operations.
Oil / chemical spillage	Local/site	SES, QFES, QPS and QAS	Spill kits. drainage controls, plans and maps	Communications to emergency services and Environmental Regulators	Shutdown of affected operations
Contact with high voltage electricity	Local/site	QFES, QPS and QAS	Site rescue team, ambulance	People control evacuation of immediate area	Stabilise situation. Isolate source of incident.

Consultation

The Project's emergency response will be developed in consultation with relevant emergency management authorities to ensure that external support will be provided by these services in an event of an emergency. These include:

- QAS
- QFES
- Queensland Health
- QPS
- Rural Queensland Health
- IRC
- Dysart Medical Centre.

20.7 Residual impacts

Considering the nature, environment and activities of the Project, the residual risk as identified in Table 20.7 that remains medium to extreme includes:

- surface fire and bushfire
- traffic incidents
- working at heights
- confined space works
- fall of ground
- loss of containment of dangerous goods
- underground mine collapse
- underground mine fire
- high voltage electricity and natural hazards.

Other potential risks to people and property, such as noise, vibration and coal dust associated with construction and operation of the Project have been assessed with low residual risks, given the low frequency of occurrence or minor impact associated in the event of such incidents occurring.

The implementation of procedures described in Section 20.6 are anticipated to effectively manage the risks associated with the Project, and existing BMA operations have successfully demonstrated management of these risks. Further hazard analysis and ongoing communication and improvement strategies will also be carried out to enhance environmental values and workplace safety.

Risk assessment is an ongoing process and, as the Project design evolves, the impact on risk will be regularly reviewed to ensure risks are SFAIRP. BMA will prepare a detailed risk assessment upon approval of the Project.

20.8 Summary and conclusions

A preliminary risk assessment was carried out in accordance with relevant standards to identify the potential hazards to people and property associated with the construction, operation and decommissioning of the Project.

The Project will operate under the BHP *Safety Our Requirements* (BHP, 2018b) under the framework of Safety and Health Management System. The BHP *Safety Our Requirements* (BHP, 2018b) adopts an integrated approach to risk management, recognising and controlling hazards associated with the work, health and safety assurance aspects to the Project.

In addressing natural and man-made hazards associated with the Project, consideration was given to risks involving people and property. A preliminary hazard analysis found that high risk activities were likely to occur throughout all stages of the Project. However, following the implementation of mitigation and response measures, the residual impact rating was mostly reduced to acceptable levels.

The Project is not considered to present a significant hazard or risk, to people or property following the application of practical mitigation, control and management measures as outlined in proposed plans and procedures.