PROJECT CHINA STONE

Hazard and Risk 22

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22 HAZARD AND RISK

22.1 INTRODUCTION

The introduction of a new mine to an area carries potential hazards and risks. This section describes the potential hazards arising from the development of the Project China Stone (the project) on surrounding land, people and property in relation to health, public safety and quality of life. It also evaluates the risks associated with the identified hazards and discusses hazard management planning and, in particular, the proposed Safety and Health Management System (SHMS) that will be developed for the project.

22.2 REGULATORY FRAMEWORK

The *Coal Mining Safety and Health Act 1999* (CMSH Act) and associated regulations require mines to implement a management system, which incorporates risk management elements and practices, to ensure the safety and health of persons who may be affected by the coal mining operations. Section 62 of the CMSH Act states that the SHMS must be an:

> *"auditable documented system which forms part of an overall management system that includes an organisational structure; planning activities; responsibilities; practices; procedures; processes and resources for developing, implementing, achieving, reviewing and maintaining a safety and health policy."*

The proponent will prepare a SHMS to provide a framework for managing safety relating to all phases of the project. The SHMS will be developed to ensure compliance with applicable legislation, guidelines and standards. An overview of the SHMS is provided in Section 22.3.

The New South Wales Department of Planning *Hazardous Industry Planning Advisory Papers* (HIPAPs) and associated guidelines on multi-level risk assessment provide guidance on the assessment of hazards and safety planning. HIPAP 6 *Hazard Analysis* is considered best practice for conducting preliminary assessments of hazards that are undertaken in support of a development application, such as an Environmental Impact Statement (EIS). This guide has been followed in undertaking the Preliminary Hazard Analysis (PHA) for the project which is discussed in Section 22.4.

A suite of legislation also exists in relation to occupational health and safety (OHS) at mine sites. This legislation is supplemented by codes of practice issued under various regulations and Australian Standards (AS) that represent best practice for managing OHS risks. Minor OHS hazards, such as slips, trips and falls are not addressed within the EIS. Such hazards will be addressed in full as part of the SHMS that will be designed and implemented throughout the life of the project.

Table 22-1 presents a selection of key legislation, guidelines and standards relating to safety and risk management.

Table 22-1 Key Legislation, Guidelines and Standards for Safety and Risk Management

ASPECT	REGULATORY MEASURE
Land Use Safety Planning	New South Wales Department of Planning: Hazardous Industry Planning Advisory Paper 6 – *Hazard Analysis* (2008)
	New South Wales Department of Planning: Hazardous Industry Planning Advisory Paper 4 – *Risk Criteria for Land Use Safety Planning* (2008)

ASPECT	REGULATORY MEASURE
	Queensland Guidelines: *Planning for Aerodromes and other Aeronautical Facilities* (1993)
	Civil Aviation Act 1988 and associated regulations
Hazardous Substances, Dangerous Goods and Major Hazard Facilities	Queensland *Work Health and Safety Act 2011* and associated regulation
	Dangerous Goods Safety Management Act 2001
	Radiation Safety Act 1999 and associated regulation
	National Transport Commission (in conjunction with the Advisory Committee on the Transport of Dangerous Goods): *Australian Dangerous Goods Code (7th Edition)* (2007) (ADGC)
	Queensland Department of Justice and Attorney-General: *Hazardous Substances Code of Practice* (2003)
	Australian Standard AS1692:2006 *Steel tanks for flammable and combustible liquids*
	Australian Standard AS1940:2004 *The storage and handling of flammable and combustible liquids*
	Australian Standard AS2187:2006 *Explosives – Storage, transport and use*
	Australian Standard HB76:2010 *Dangerous Goods – Initial Emergency Response Guide*
	National Occupational Health and Safety Commission (NOHSC) *Approved Criteria for Classifying Hazardous Substances* [NOHSC(1008:2004)] *3rd Edition*
	Radiation Safety Standard PR100:2010 *Standard for Premises – Ionising Radiation Sources*
Safety and Risk Management and Management Systems	CMSH Act and *Coal Mining Safety and Health Regulation 2001*
	Explosives Act 1999 and associated regulations
	Fire and Rescue Service Act 1990
	Electrical Safety Act 2002 and associated regulations and Code of Practice
	International Standards Organisation ISO 14001:2004 *Environmental management systems - Requirements with guidance for u*se (2004)
	Australian/New Zealand Standard AS/NZS ISO 31000:2009 *Risk Management – Principles and Guidelines*
	Standards Australia HB203:2012 *Managing Environment-related Risk*
	Australian/New Zealand Standard AS/NZS 4801:2001 *Occupational Health and Safety Management Systems – Specification with guidance for use*
	National Emergency Management Committee (2010) *National Emergency Risk Assessment Guidelines* , Tasmanian State Emergency Service.

22.3 OVERVIEW OF PROPOSED SAFETY AND HEALTH MANAGEMENT SYSTEM

22.3.1 Introduction

The proponent recognises that the safety and health of employees, contractors and the wider community are of paramount importance. The proponent also understands that the success and performance of the project in these areas will be judged by employees, contractors, regulators and the community and will influence the ability of the proponent to enhance and develop future resources.

The proponent will develop and implement a SHMS to address the construction, operations and decommissioning phases of the project. The SHMS will meet the requirements of the CMSH Act and regulation, as well as AS/NZS ISO 31000:2009, AS/NZS 4801:2001 and ISO 14001:2004. The SHMS system will also align and comply with relevant corporate standards and will be comparable to best practice systems used at mining operations within Australia. The following section provides an overview of the proposed SHMS.

22.3.2 Safety and Health Management System

The SHMS will provide a framework for achieving the proponent's objectives in relation to health and safety and ensuring compliance with all applicable legislation. All project personnel will be expected to comply with the requirements of the SHMS. The SHMS will address the following components:

- Operational hazard analysis;
- Regular hazard audits;
- Fire safety;
- Emergency response planning;
- Qualitative risk assessment; and
- Construction safety.

The SHMS will comprise the elements and structure shown in Table 22-2. The elements of the SHMS are discussed in the following sections along with an overview of the key documents to be developed as part of the SHMS. This framework will form the basis of an iterative cycle of continual improvement in the SHMS.

Table 22-2 Safety and Health Management System Structure

SHMS ELEMENT	SHMS STRUCTURE
Policy	1 Policy, Leadership and Commitment
Planning	2 Risk and Change Management
	3 Legal and Other Requirements
	4 Objectives, Targets and Performance Management
Implementation and Operation	5 Training, Awareness, Competence and Fitness for Work
	6 Communication, Consultation and Involvement
	7 Documentation and Control of Documents
	8 Operational Control
	9 Emergency Preparedness and Response

SHMS ELEMENT	SHMS STRUCTURE
	10 Contractor Business Partner Management
Checking and Corrective Action	11 Safety Reporting and Investigation
Management Review	12 Monitoring, Audits and Review

Policy

The proponent will develop a corporate Safety and Health Policy that demonstrates a commitment to safe operations and continual improvement in safety performance. This policy will demonstrate leadership in safety and health and will align with other corporate policies. This policy will be prominently displayed at the mine site.

Planning

The SHMS will identify legislative, regulatory and voluntary requirements in order to ensure legal compliance and adherence to corporate standards. These requirements will be communicated to employees and other relevant parties through a range of methods including site inductions. Roles and responsibilities will be clearly defined to ensure transparency and accountability.

A detailed risk register will be created for the project that will identify hazards and management controls to reduce risks. The risk register will be based on the PHA conducted for this EIS (discussed in Section 22.8) and will be updated to reflect changes to the development of the project and/or on incident reporting and auditing of the SHMS.

Implementation and Operation

A high level Integrated Risk Management Plan (IRMP) will be developed for the whole life of the project including construction, operations and decommissioning phases. The IRMP will be a working document subject to ongoing review as part of a process to continually monitor and, where necessary, improve the management of safety at the site. The IRMP will be developed in accordance with relevant standards, including AS/NZS ISO 31000:2009 and will utilise a detailed risk assessment procedure.

Under the IRMP framework, the proponent will develop a series of Principal Hazard Management Plans in order to manage specific hazards at the site such as bushfires and the power station. As an example, the Bushfire Management Plan would address bushfire hazards and risks, and management including:

- Use of firebreaks that provide adequate setbacks between buildings and vegetation, allowing access for firefighting and other emergency vehicles and permitting safe evacuation;
- Fuel reduction (e.g. slashing and woody vegetation control) within fire breaks;
- Providing adequate road access for firefighting, other emergency vehicles and safe evacuation; and
- Providing an adequate and accessible water supply for firefighting purposes.

The proponent will also develop an Emergency Response Management Plan (ERMP) to specifically address major emergencies and incidents that could impact upon surrounding land uses. This will include protocols, notification systems and disaster management techniques including how site emergency response will integrate with response from emergency services providers. Under the ERMP, the following measures will be included to address emergency preparedness and response at the site:

- First response and mine rescue plan;
- First aid facilities, including the provision of a dedicated on-site team for first aid, firefighting and emergency response;
- Detailed risk assessments;

- Detailed evacuation and site access plans;
- Emergency drills and training;
- Monitoring of warnings relating to natural events like flooding and bushfires; and
- Fire management.

The proponent will consult with key stakeholders including emergency service providers, the Isaac Regional Council (IRC), the Charters Towers Regional Council (CTRC), State Government and other relevant community stakeholders during the development of the SHMS and key management plans such as the ERMP. Key issues to be discussed include:

- Roles and responsibilities of stakeholders and mine workers;
- Agreed muster points as part of the evacuation and access map planning; and
- Agreed procedure for surface rescue.

Consultation with the emergency services is discussed in more detail in Section 22.8.

All site personnel (including contractors) will undergo a comprehensive site induction and familiarisation, which will cover all aspects of the SHMS. Refresher training on the SHMS will be provided regularly to employees and contractors. Employees and contractors will also be trained in basic first aid and fire training as part of their induction and refresher training.

Checking and Corrective Action

The proponent will develop a Hazard, Defect and Incident Procedure to report any incidents, identify new hazards and to monitor conformance with the SHMS. Inspections, reviews and independent reporting will all be used to identify corrective actions as part of the continual improvement of the SHMS.

Management Review

Auditing will form a key part of the SHMS. Internal auditing of the SHMS will be undertaken against corporate standards, thereby ensuring that SHMS standards are both consistent with, and learn from, other comparable operations. These audits will be supplemented by legal compliance audits, which will be used as an internal measure of compliance with the applicable legislative requirements. The proponent will conduct detailed management reviews of the SHMS on a monthly basis.

22.3.3 On-site Accommodation Village

The project includes an on-site accommodation village. In accordance with the Department of Environment and Heritage Protection (EHP) Model Mining Conditions, the on-site accommodation village is not considered to be a sensitive receptor and has, therefore, not been included in the assessment of residential amenity impacts described in the EIS.

The health and wellbeing of workers staying at the accommodation village has been considered. The accommodation village will house workers for the duration of their block shift and will primarily be used for workers to rest and sleep between shifts. At the end of their block shift, workers will return home to their normal place of residence. The accommodation village will therefore be mostly used for sleeping, eating and relaxation activities predominantly within air conditioned rooms with closed windows. The air conditioned nature of the accommodation village facilities will prevent any impacts on the village occupants due to dust from the mining operations. Similarly, installation of air-conditioning is a well-established and effective means of mitigating noise impacts due to external industrial noise levels on the occupants of the village. In addition, it is noted that the predicted external noise and dust levels at the accommodation village are well below accepted OH&S levels for hazardous exposure, which are more than an order of magnitude above the residential amenity criteria.

22.4 OVERVIEW OF PRELIMINARY HAZARD ASSESSMENT

A PHA was undertaken for the project in accordance with the New South Wales Department of Planning *Hazardous Industry Planning Advisory Paper 6 – Hazard Analysis (July 2008)*. This document is considered best practice for conducting preliminary assessments of hazards that are undertaken in support of a development application, such as an EIS. The PHA was also developed in line with best practice risk management principles and processes, including standards AS/NZS ISO 31000:2009 and HB 203:2012.

The emphasis of the PHA is on preventing or minimising major hazardous incidents on-site that could potentially result in significant off-site effects. The focus of the PHA is, therefore, on unplanned or non-routine events. Potential impacts from daily activities associated with the operation of the mine were not considered in this assessment as they have been assessed in other parts of the EIS and will be managed by compliance with environmental approvals and licences. For example, the potential for the project to impact on human health or create nuisance issues for sensitive receptors from dust due to the removal of overburden, haul roads and other mining activities is discussed in detail in Section 15 – Air Quality. These impacts are not re-considered in this hazard assessment.

The PHA is described in the following sections and included:

- Identification of the surrounding land uses, sensitive receptors and community values in relation to health and safety (Section 22.5);
- Identification of project activities and hazards with the potential to affect people or property in the surrounding area. This included consideration of unplanned or non-routine project activities, the nature and quantities of hazardous materials transported, stored, and used at the site, natural events, malicious acts and events at neighbouring sites (Section 22.6); and
- Assessment of the consequences and likelihood of a potentially hazardous incident occurring that could impact on sensitive receptors or surrounding land uses. The level of risk was calculated for each identified hazard using a risk assessment matrix. The assessment also included consideration of risk reduction measures including technical, operational and organisational safeguards (Section 22.7).

The PHA was undertaken to identify potential hazards and risks associated with the project, in consideration of the current level of project planning. A rigorous re-appraisal of hazards associated with the project will be undertaken as part of the SHMS prior to the commencement of the construction, operations and decommissioning phases of the project, based on detailed design and operating plans.

22.5 SURROUDING LAND USE AND SENSITIVE RECEPTORS

In order to identify the potential hazards and risks associated with the project, the surrounding land use and sensitive receptors around the project site were identified. These are discussed in the following sections.

22.5.1 Surrounding Land Use

The primary land use surrounding the project site is cattle grazing, with grazing properties located on all sides of the site (Figure 22-1). A stock route traverses the southern part of the project site through the proposed mining and mine infrastructure areas. Land surrounding the project site is traversed by unsealed farm access tracks and there is other minor built infrastructure such as stock fences, farm dams and isolated rural residences.

Coal resource exploration is also present in the surrounding region, and the site is surrounded by mining exploration tenements. This includes the Carmichael Coal Mine and Rail Project (CCM&RP) which adjoins the project site to the south (Figure 22-1). The CCM&RP is a proposed 60 Mtpa open cut and underground coal mine which is currently in the approvals phase.

The majority of the site is located in the headwaters of two tributary creeks (Tomahawk Creek and North Creek) which feed into the Belyando River, downstream of the project site. The Belyando River is an ephemeral, regionally significant watercourse that enters the Suttor River upstream of the Burdekin Falls Dam. Site drainage is highly ephemeral and there are no major waterways traversing the project site.

The surrounding land also contains areas of remnant vegetation, typically associated with topographical features such as Darkies Range or along ephemeral creeks.

The surrounding region includes two recreational areas of note:

- Lake Buchanan is located approximately 20 km to the north-west of the project site (Figure 22-1). Despite being located on private property, Lake Buchanan is used by the local community for recreational activities such as water-skiing, camping and picnics. The land around the lake is predominantly used for grazing.
- Wilandspey Conservation Park is located approximately 25 km to the east of the project site (Figure 22-1). The park covers 5,200 ha and is used for outdoor recreational activities, tourism and for the preservation of natural ecosystems.

22.5.2 Sensitive Receptors

The project site is very remote. Belyando Crossing is the nearest settlement to the project site, located approximately 70 km to the north-east (by direct line) with a population of approximately five people. The closest urban centres to the project site are Charters Towers, approximately 285 km by road to the north, and Clermont which is approximately 260 km by road to the south-east.

Considering the remoteness of the site, sensitive receptors have been identified (Figure 22-1) as:

- Numerous isolated rural residences with the closest (R1) being located approximately 7 km from the project site; and
- The proposed Carmichael Coal Mine Accommodation Village (R7) which is planned to accommodate mine workers for the mine. The village is yet to be constructed but is expected to be located approximately 28 km from the project site on Moray-Carmichael Road.

In accordance with the EHP Model Mining Conditions, the project's on-site accommodation village is not considered to be a sensitive receptor (as discussed in Section 22.3.3).

22.5.3 Community Values

Based on feedback from consultation with stakeholders during the EIS, community values and concerns relevant to the PHA were identified as:

- Safety in relation to the impacts of major accidents particularly relating to transport;
- Amenity value in rural areas;
- Continuity of services (including emergency services);
- Safety in relation to the impacts of aircraft;
- Safety in relation to the power station; and
- Clean air and water.

These values and concerns have been addressed within the PHA.

22.6 HAZARD IDENTIFICATION

The following key potential hazards were identified for the project:

- Storage of mine-affected water in various mine water dams which could potentially be hazardous in the event of an unplanned or unmanaged release.
- Storage of tailings and other mine wastes which could potentially be hazardous in the event of an unplanned or unmanaged release.
- Operation of a coal-fired power station to provide electricity for the operation of the mine. The power station could be potentially hazardous in the event of an explosion.
- Operation of a private airstrip for the transport of mine workers.
- Transport, storage and use of a range of hazardous materials, including explosives, that can create hazardous conditions if not appropriately managed.

Key hazards from project activities are discussed in the following sections and summarised in Table 22-5.

In addition to hazards from project activities, the PHA also considered potential hazards associated with:

- Natural events such as bushfires, floods and climate change;
- Malicious acts and terrorism;
- Incidents with the treatment of potable water or sewage; and
- Disease vectors including mosquitoes and communicable diseases.

As far as is practical, project infrastructure has been located to maximise separation between potentially hazardous facilities and activities in order to minimise potentially hazardous conditions for workers, sensitive receptors and to address community safety values. The remoteness of the site from populated areas also limits the potential risks from the project. This remoteness also addresses the potential cumulative risks of the project interacting with off-site hazards.

22.6.1 Mine-Affected Water Storage

The mine water management system is discussed in detail in Section 13 – Surface Water. This section describes the expected sources and quantities of mine-affected water to be generated by the project and proposed storage, re-use and/or treatment, as well as controlled discharges into downstream receiving waters. The locations of the key mine water storage dams are shown in Figure 22-3. The assessment also provides a preliminary consequence assessment of the dams proposed as part of the project in accordance with EHP guidelines. The assessment indicated that the mine water dams are likely to fall into the low consequence category and will not be classified as regulated dams. A further, detailed consequence category assessment will be conducted at the detailed design stage to confirm whether any of the mine water dams will be regulated structures under the EP Act.

Despite the assessed low consequence category, the design criteria for all proposed mine water storages (including the Design Storage Allowance (DSA), Extreme Storm Storage (ESS) and Mandatory Reporting Level (MRL)) have been determined in accordance with the EHP requirements for ‘significant’ hazard category dams. This will ensure that the mine water management system complies with the regulated dam requirements in the event that any of the storages are assessed as regulated structures at the detailed design stage. The dam sizings and performance against these design criteria have been determined by operational simulation modelling, as discussed in Section 13 – Surface Water.

All dams on the project site will be designed by a suitably qualified engineer and will have their consequence category reassessed on an annual basis following construction. All dams will be designed and constructed in accordance with relevant design standards and licence requirements, including standards defined in the *Water Act*

2000 and will comply with the conditions of the Environmental Authority (EA). Designs will adequately address the structural integrity of containment walls during climatic extremes, including drought and flood. This will reduce the risk of any unplanned or unmanaged releases from mine water storages.

22.6.2 Mine Waste Storage

The mine will generate the following mine wastes that will need to be stored on the mine site:

- Tailings will be generated by processing coal at the Coal Handling and Preparation Plants (CHPPs). The tailings will be transported as tailings slurry by surface pipeline for storage in the Tailings Storage Facility (TSF).
- Coarse reject material will also be generated by processing coal at the CHPPs. Coarse reject will be stored within the overburden emplacement areas.
- Fly ash, bottom ash and clinker will be generated by the power station. These wastes will be transported by haul truck for storage in the Power Station Waste Storage Facility (PSWSF) and in later years, to overburden emplacement areas.
- Overburden will be removed to enable access to the coal resource. Overburden will be stored in overburden emplacement areas.

The nature of these materials has been assessed in the EIS in order to evaluate their geochemical properties and assess the level of risk from acid generation, presence and leaching of soluble metals and salts, and/or other salinity/erosion issues. These issues have the potential for environmental harm, in the event of an unplanned or unmanaged release from the mine waste storage facilities. This information is presented in Section 7 – Tailings and Power Station Waste Storage Facilities, Section 8 – Rehabilitation and in detail in the *Geochemistry Report* (Appendix D). The geochemistry assessment indicated the nature of the tailings, coarse rejects, power station waste material and overburden are likely to be benign and will generate slightly alkaline runoff and seepage with low salinity following surface exposure. Accordingly no special management measures or rehabilitation techniques are required for their handling and permanent (or temporary) storage. These mine wastes are therefore unlikely to present any environmental issues for on-site or downstream water quality.

The conceptual design and operation of the TSF and PSWSF has also been undertaken as part of the EIS. This information is presented in Section 4 – Project Description, Section 7 – Tailings and Power Station Waste Storage Facilities and in detail in the *Mine Waste Storage Facility Conceptual Design Report* (Appendix C). The rehabilitation of these facilities is discussed in Section 8 – Rehabilitation. The following assessments were undertaken to inform the conceptual design of these facilities. This will limit the risk that environmental harm may occur from the facilities:

- A preliminary consequence assessment was undertaken for the TSF in accordance with EHP guidelines and is discussed in the *Mine Waste Storage Facility Conceptual Design Report* (Appendix C). The TSF has been assigned a 'significant' consequence category and is therefore likely to be considered a regulated structure under the EP Act and would be regulated by conditions in the EA. A further, detailed consequence category assessment including full dam break analysis will be conducted at the detailed design stage to confirm the consequence category.
- Determination of the design criteria for the TSF (including the DSA, ESS and MRL) in accordance with the EHP requirements for 'significant' hazard category dams. This is discussed further in the *Mine Waste Storage Facility Conceptual Design Report* (Appendix C).
- Characterisation of the foundation soils of the TSF and PSWSF in order to assess the geotechnical stability of the facilities over their operating life and in post closure. Further detail is provided in Section 7 – Tailings and Power Station Waste Storage Facilities and the *Mine Waste Storage Facility Conceptual Design Report* (Appendix C).

- An assessment of the appropriate factors of safety to ensure the landform slopes of the mine waste storage facilities will be stable under a variety of load conditions. Further detail is provided in Section 7 – Tailings and Power Station Waste Storage Facilities and the *Mine Waste Storage Facility Conceptual Design Report* (Appendix C).

The design, construction and operation of the mine waste storage facilities will be undertaken by appropriately qualified and experienced engineers. All facilities will comply with the conditions of the EA and other relevant design standards and licence requirements. Regular monitoring will also be undertaken which is discussed further in Section 7 – Tailings and Power Station Waste Storage Facilities. This will reduce the potential risk of an unplanned or unmanaged release from the facilities.

22.6.3 Power Station

The project will construct a coal-fired power station to generate electricity for the mine. The power station will be air-cooled and will use circulating fluidized bed technology. Feed for the power station will consist of fine rejects from the CHPPs, supplemented by raw coal as required. It will be constructed in three stages, one for each of the 350 MW units.

The power station has been located, as far as practical, to maximise separation from infrastructure expected to have a high density of workers, such as the accommodation village and Mine Industrial Areas (MIAs), and also other potentially hazardous areas within the project site such as explosives storage areas (Figure 22-2). In addition, due to the remoteness of the site, the nearest sensitive receptor to the power station (R2) is located more than 10 km away (Figure 22-1). This sensitive receptor is a homestead that is not permanently occupied and is only used intermittently. Mine infrastructure on the proposed Carmichael Coal Mine site, which adjoins the project site to the south, is also more than 10 km from the power station. These separation distances will reduce the risk of harm to workers and sensitive receptors in the event of an incident at the power station.

The layout of the power station, based on current planning, is shown in Figure 22-4. The power station will be designed, constructed and operated in accordance with all relevant legislation, standards and guidelines. It will be operated as a discrete piece of infrastructure within the mine site, with fencing and a guard house and reception to manage entry and egress. A specific Principal Hazard Management Plan will be developed for the facility as part of the SHMS that will include a detailed risk assessment based on detailed project design.

22.6.4 Airstrip

The mine will operate a private airstrip for the transport of mine workers, with approximately 20 return flights per week. The airstrip has been located to maximise separation from other mine infrastructure, as far as practical, within the limits of the project site (Figure 22-2). The location and orientation of the airstrip considered potential hazards that could affect the safety of aircraft, including visible obstructions, such as the power station stack, and invisible hazards such as the exhaust plume from the power station stack. The airstrip is located more than 3 km from the power station and has been oriented to ensure the stack is not within the aircraft approach or departure flight paths. The exhaust plume from the power station will have a relatively low velocity and temperature (20 m/s and 48°C) and is not likely to be very buoyant, which reduces the potential hazard. However, in accordance with the Australian Civil Aviation Safety Authority (CASA) requirements, an application for an operational assessment of a proposed plume rise will be lodged and assessed by CASA. The application process will assess the need for any further detailed analysis of the exhaust plume in relation to aircraft safety. The airstrip will be designed, constructed and operated in accordance with all applicable CASA legislation and regulations including the *Civil Aviation Act 1988*. An aerodrome certification will be required to be obtained once it has been constructed.

22.6.5 Hazardous Materials

A hazardous material is a material which, in sufficient quantities, has the potential to cause harm to people, property or the environment because of its chemical, physical or biological properties. An assessment of the nature and quantity of hazardous materials to be handled or stored as part of the project was undertaken. This

included assessment of hazardous substances and dangerous goods, which are discussed in the following sections.

Hazardous Substances

Hazardous substances are materials that can have adverse human health effects due to their physical, chemical or biological properties. Hazardous substances are listed under the National Occupational Health and Safety Commission (NOHSC) *List of Hazardous Substances (1999),* or under the NOHSC *Approved Criteria for Classifying Hazardous Substances (2004)*. Hazardous substances may be classified as very toxic, toxic, harmful, corrosive, irritant and/or sensitisers.

All chemicals and proprietary substances used for the project will carry a Material Safety Data Sheet (MSDS) which will clearly state whether the substance is hazardous or non-hazardous. Where an MSDS shows a substance to be hazardous, the appropriate risk and safety phrases will be provided to ensure best practice management measures are applied.

Table 22-3 provides an indicative list of hazardous substances to be used, stored, processed or transported as part of the project. Maximum inventories and rates of use or generation are also provided. Should other hazardous substances (or dangerous goods) be required during the life of the project, transport, use and disposal issues will be planned and managed prior to arrival on site. Appropriate measures implemented in accordance with the requirements of the proposed SHMS and relevant guidelines (including the *Australian Code for the Transport of Dangerous Goods by Road and Rail (7th Edition)* where Dangerous Goods are concerned).

Dangerous Goods

Materials are dangerous goods if they meet the criteria in the *Australian Dangerous Goods Code (7th edition)* (ADGC), and are classified on the basis of the potential for immediate physical or chemical effects (such as fire, explosion, corrosion and poisoning) affecting property, the environment or people. Table 22-3 identifies dangerous goods to be used as part of the project, which include radioactive materials and explosives. Infectious substances, as defined within the ADGC, will not be used, transported or produced as part of the project.

Radioactive Material

Industrial gauges within the coal processing plant will, in some instances, incorporate radioactive substances used for a variety of purposes, such as level and density gauging, control purposes and in-stream analysis. The use of radioactive gauges is common practice throughout coal processing plants. The principle of operation depends on the detection of a beam of radiation transmitted through or scattered by coal as it passes by the gauge.

The project will appoint a radiation safety officer to ensure these gauges are stored and maintained in accordance with the relevant radiation safety standard (*Radiation Safety Standard PR100:2010 Standard for Premises – Ionising Radiation Sources*). In addition the project will develop a Standard Operating Procedure in accordance with Section 96 c (iii) of the *Coal Mining Safety and Health Regulations 2001*.

Explosives

The project involves both open cut and underground longwall mining. Blasting events will predominantly occur during open cut mining for overburden removal and may also be undertaken at the underground coal face due to the occurrence of unexpected rock intrusions in the coal seams. No blasting is expected to be required for underground mine access drifts.

The maximum number of blasting events per year is 365 (i.e. one event per day). The Maximum Instantaneous Charge (MIC) to be used for blasting is in the order of 2,000 kg MIC.

The bulk explosive material would be brought to site by a licensed contractor and the blasting would be undertaken by experienced and appropriately trained explosives contractors. Storage of explosives is discussed in Table 22-3. Explosives will be stored more than 10 km from any sensitive receptors and the explosives storage area has been located, as far as practical, to maximise separation from other potentially hazardous activities or facilities within the project site (Figure 22-3).

Management of Hazardous Materials

The following controls will be implemented to reduce the health, safety and environmental risks associated with the transport, storage and use of hazardous materials:

- The transport, storage and handling of all dangerous goods, explosives and hazardous substances will be undertaken in accordance with relevant legislation and guidelines.
- A register of hazardous materials, including MSDS, will be stored on site at specified locations and updated at predetermined intervals. This register, once completed, will be made available to the Queensland Ambulance Service (QAS) and Queensland Fire and Emergency Services (QFES).
- Hydrocarbons will be handled in accordance with AS 1940:2004.
- Bulk fuel storage and refuelling facilities will be designed and built in accordance with AS 1940:2004. Bunding will also allow for stormwater to be collected for treatment or appropriate disposal.
- The risk of storage tank failure will be minimised by designing in accordance with AS 1692:2006 *Tanks for flammable and combustible liquids*.
- All chemicals will be managed in accordance with the relevant MSDS and the 'Chemalert' chemical management system.
- Storage areas for all chemicals will be suitably located and bunded to minimise the risk of chemical spills and potential harm to human health, property and the environment.
- Suitable bunds will be constructed and maintained around fuel and oil storage facilities in accordance with AS 1940:2004.
- Regular inspection programs will be undertaken to ensure the structural integrity of fuel tanks and bunds.
- Firefighting facilities and fire suppression systems will be installed and maintained at all relevant fuel storage, chemical storage and refuelling locations and all appropriate staff will be trained in the operation of these systems.
- There will be strict control of ignition sources.
- A Spill Management Plan will be developed as part of the ERMP, prior to construction and will provide the procedure to be followed for the containment, clean-up, investigation and reporting of any spills.
- Key staff will be trained in spills prevention and clean up.
- All equipment and vehicle operators will be trained in the safe operation of equipment (including operating procedures for the refilling and maintenance of fuel storage tanks and mine vehicles) and the relevant emergency response procedures in the event of an incident.

The proponent has also made some specific commitments in relation to the transport of materials and wastes to and from the site and the ability to improve emergency response in the event of a transport incident. These commitments include:

- Coordinating project infrastructure upgrades, including communication infrastructure upgrades, with local emergency services and Adani Mining to enable cost-effective expansion of emergency service communications along the Gregory Developmental Road.
- Engaging with Adani Mining in relation to the proponent's participation in the Emergency Services Consultative Committee for the CCM&RP and the coordination of emergency response and sharing of resources where appropriate.
- Provision of a one-off donation of a heavy vehicle rescue kit to QFES in Charters Towers to improve local emergency service response to incidents.

- Consultation with the IRC, CTRC, Department of Transport and Main Roads, Queensland Police Service (QPS), Adani Mining and the Road Accident Action Group to determine the need or otherwise for additional driver rest areas along the primary project supply routes.

Table 22-3 Indicative List of Hazardous Substances and Dangerous Goods

SUBSTANCE (CHEMICAL NAME)	DANGEROUS GOODS CLASS [1]	PACKING GROUP [2]	MAXIMUM INVENTORY (INDICATIVE)	ANNUAL RATE OF USE/ GENERATION (INDICATIVE)	UN NO. [3]	STORAGE VESSEL SIZE	PURPOSE/ USE
Carrick II detonators (containing Pentaerythritol tetranitrate [PETN])	1.1B	N/A	1000 No.	365 No.	0465	Standard Magazine	Blasting
Ammonium Nitrate P1 Group Explosive	1.1D	N/A	250 kg	43,500 t	0241	Standard Magazine	Blasting
Acetylene	2.1	N/A	54 kg	280 kg	1001	9 kg	Welding / Cutting
LPG (Liquefied Petroleum Gas)	2.1	N/A	288 kg	1,498 kg	1075	48 kg	Fuel (Forklifts & Mobile Plant)
Diesel Oil/Fuel	3	III	100 kL	155,423 kL	1202	100 kL	Fuel
Lubricating Oils (incl. Waste Oil)	9	N/A	60 kL	500 kL	3082	20 L 1,000 L	Lubricant
Oily Rags	4.2[2]	N/A	<50 kg	260 kg	1856	200L	Oil Containing Waste
Glyphosate	9	N/A	<100 L	52 L	3082	5 L	Herbicide
Acetone	3	II (over 1 L)	<25 kg	<65 kg	1090	5 kg	Organic Solvent
Chlorine	2 (5.1, 8)	N/A	135 L	12,170 L	1017	15 L	Water Treatment
Methyl Isobutyl Carbinol (MIBC)	3	III	120,000 L	2,565 t	2053	60,000 L	CHPP
Anionic and Cationic Flocculants	N/A	N/A	180,000 L solution (at 0.3%) with 50 t dry storage	2,760 t	N/A	140,000 L and 40,000 L tanks; Dry store	CHPP
Polyurethane Resin	N/A	N/A	50 kg	<1000 kg	N/A	Standard Units (<10 kg)	Injection Resin

SUBSTANCE (CHEMICAL NAME)	DANGEROUS GOODS CLASS [1]	PACKING GROUP [2]	MAXIMUM INVENTORY (INDICATIVE)	ANNUAL RATE OF USE/ GENERATION (INDICATIVE)	UN NO. [3]	STORAGE VESSEL SIZE	PURPOSE/ USE
Phenolic Resin	N/A	N/A	50 kg	<1000 kg	N/A	Standard Units (<10 kg)	Injection Resin
Sulphuric Acid	8	II	1 L	0.5 t	1830	10,000 t	Power Station
Caustic Soda	8	II	1 L	65 kg	1824	20 kg	Power Station
		III	5 L				
Ammonium Hydroxide	-	-	-	Varies	-	25,000 L	Power Station
Sodium Hypochlorite	8	II or III	1 L	2 kL	1791	20 L	Power Station
Morpholine	8	I	0	Varies	2054	20 kg	Power Station
Cyclohexylamine	8	II	1 L	Varies	2357	200 kg	Power Station
Hydrogen Gas	2.1	-	0	7,300 m^3	1049	10 kg	Power Station

1 Subsidiary risk shown in brackets.

2 As defined under the Australian Dangerous Goods Code.

3 'UN No' is a hazardous substance identification number assigned by the United Nations Committee of Experts on the Transport of Dangerous Goods

22.6.6 Natural Events

Natural events such as bushfires, floods and landslides can also create hazardous conditions. Consideration of these natural hazards and their management is based upon the State Planning Policy (SPP), and includes provisions such as avoiding hazards, and design of infrastructure to withstand hazards. The SPP requires that the proponent identify whether the development area within the project site (i.e. the mine surface facilities, the open cut mining or TSF) is within a natural hazard area for each of the three natural hazard types. This assessment is as follows:

- Bushfire – Based on the Queensland Government's SPP Interactive Mapping System, the majority of the site including the mine infrastructure areas is classed as 'medium potential intensity' risk for bushfires. There are also some small areas in the northern part of the project site that are classed as 'high potential intensity' and 'very high potential intensity'. The proponent will manage bushfire risk through a Bushfire Management Plan developed as part of the SHMS to address bushfire hazards and risks and management.
- Flooding – Based on the Queensland Government's SPP Interactive Mapping System, the site does not lie within a Level 1 flood hazard area. However, a flooding assessment has been undertaken for the EIS and is discussed within Section 13 – Surface Water. The flooding assessment concluded the predicted changes in flood levels and distribution will not impact on any structures or property beyond the project site, and in most cases will not be discernible when compared to existing conditions due to the wide shallow nature of the flow paths. Flooding is considered in the PHA but is not considered a key hazard.
- Landslide – The majority of the mine infrastructure is located on relatively flat or gently undulating land that would have a very low risk of landslide occurrence. The northern MIA is located near Darkies Range which is a well vegetated sandstone ridgeline that runs roughly north to south through the western portion of the site. There has been no history of landslides on the site. Landslide is therefore not considered in the PHA.

In accordance with the project Terms of Reference, the following other natural events have also been considered:

- Cyclones – Cyclones mainly affect Queensland's coastal areas and given the distance to the coast is approximately 250 km, the project site is unlikely to experience cyclones. However, extreme rainfall and flooding associated with cyclones, storms and low monsoonal troughs have affected the region and have been considered in the PHA.
- Climate change – Current climate change predictions indicate that Central Queensland may experience a reduction of annual average rainfall, increased temperatures and evaporation, and extreme rainfall events and flooding resulting from the increased intensity of extreme events including cyclones and storms. There has been robust design of site drainage infrastructure and the mine water management systems which would account for any variability of water supply due to climate change. Climate change has been considered in the PHA.
- Earthquakes – Given that the area is not seismically active, earthquakes are not considered in the PHA.

22.6.7 Malicious Acts

Acts of vandalism and sabotage, including terrorism, toward the project have been identified as having the potential to create hazardous conditions, and have been included within the PHA. However, due to the remoteness of the site, such acts are not considered a key hazard.

22.6.8 Events at Neighbouring Sites

Due to the remote location of the site, it is unlikely that any catastrophic events at a neighbouring site, including the CCM&RP, would have the potential to cause hazardous conditions for the project operations. These have not been considered in the PHA.

22.7 HAZARD ANALYSIS

An assessment of the identified hazards discussed in Section 22.6 was undertaken in order to evaluate the potential for hazardous incidents to impact on sensitive receptors and surrounding land uses. This assessment included the determination of possible consequences and the likelihood of occurrence for each hazard. The assessment used the risk assessment matrix presented in Table 22-4 which complies with AS/NZ ISO 31000:2009 and HB 203:2012. The risk assessment matrix will be adapted, as necessary, as part of the SHMS to be developed for the site.

The consequences of a hazardous incident were assigned a value ranging from '1 – Insignificant' to '5 – Major' using the risk assessment matrix. The values applied to the consequences and effects of each hazardous incident were assessed using prior experience with comparable sites and based on technical environmental assessments undertaken for this EIS. The probability of a hazardous incident occurring was assigned a value between '1 – Rare' and '5 – Almost Certain'. The values assigned to each hazard are presented in Table 22-5.

The assessment of risk included consideration of safeguards that would reduce the likelihood and/or severity of the consequences and risks to surrounding people and property. Risk reduction is inherent in many aspects of the layout and design features of the project. Risk reduction measures have been applied in the derivation of hazard consequence and likelihood as shown in Table 22-5. These measures will be regularly monitored, audited and reviewed as part of the proposed SHMS.

Table 22-4 Risk Assessment Matrix

		CONSEQUENCE				
		1 - Insignificant	2 - Minor	3 - Moderate	4 – High	5 – Major
		First aid case / Exposure to health hazard resulting in temporary discomfort	Medical treatment case / Exposure to health hazard resulting in temporary alterations/limitations (no lost time)	Lost time/ Exposure to health hazards/ agents (over the Occupational Exposure Limit (OEL) resulting in reversible impact on health (with los time)	Permanent disability or single fatality/ Exposure to health hazards/ agents (significantly over the OEL) resulting in irreversible impact on health with loss of quality of life or single fatality	Numerous permanent disabilities or multiple fatalities/ Exposure to health hazards/ agents (significantly over the OEL) resulting in irreversible impact on health with loss of quality of life of a numerous group/ population or multiple fatalities
PROBABILITY		**Risk Level**				
5 - Almost Certain	90% and higher probability of occurring	**11 (Medium)**	**16 (Significant)**	**20 (Significant)**	**23 (High)**	**25 (High)**
4 – Likely	Between 60% and 90% probability of occurring	**7 (Medium)**	**12 (Medium)**	**17 (Significant)**	**21 (High)**	**24 (High)**
3 – Possible	Between 30% and 60% probability of occurring	**4 (Low)**	**8 (Medium)**	**13 (Significant)**	**18 (Significant)**	**22 (High)**
2 – Unlikely	Between 1% and 30% probability of occurring	**2 (Low)**	**5 (Low)**	**9 (Medium)**	**14 (Significant)**	**19 (Significant)**
1 – Rare	Less than 1% probability of occurring	**1 (Low)**	**3 (Low)**	**6 (Medium)**	**10 (Medium)**	**15 (Significant)**

Guidelines for Risk Matrix

Risk Rating	Risk Level	Guidelines for Risk Matrix
21 to 25	**High**	A high risk exists that objectives may not be achieved. Appropriate mitigation strategy to be devised immediately.
13 to 20	**Significant**	A significant risk exists that objectives may not be achieved. Appropriate mitigation strategy to be devised as soon as possible.
6 to 12	**Medium**	A moderate risk exists that objectives may not be achieved. Appropriate mitigation strategy to be devised as part of the normal management process.
1 to 5	**Low**	A low risk exists that objectives may not be achieved. Monitor risk, no further mitigation required.

Table 22-5 Preliminary Hazard Analysis

FACILITY / HAZARD	SCENARIO / EVENT	CAUSE / COMMENT	POSSIBLE CONSEQUENCES	RISK CONTROL MEASURES	ANALYSIS OF CONSEQUENCES	LIKELIHOOD OF HAZARDOUS INCIDENT	RISK ANALYSIS
Key Hazards to Surrounding Land Uses From Project China Stone							
LPG Storage	Catastrophic vessel failure	■ Direct flame impingement on tank due to bushfire, pipes, tank fittings or pump failure and ignition.	■ Pressure inside tank rises, if fire not extinguished, vessel may weaken and fail resulting in a boiling liquid expanding vapour explosion fireball with widespread damage, possibly spreading to other tanks.	■ Vessel fitted with pressure relief valves that discharge vertically. ■ Isolation valves to be fitted to all main liquid lines. ■ Multiple pump shut offs. ■ Storage area located at least 500 m from site boundary. ■ Development of Bushfire Management Plan to include protocols relating to the storage of LPG.	Moderate (3)	Rare (1)	Medium (6)
	Large leak	■ Mechanical impact. ■ Corrosion. ■ Failure of tank, fittings, pump or pipework and ignition.	■ On dispersion, vapour may form a gas cloud. ■ If ignited, may result in flash fire or unconfined vapour cloud explosion (UVCE).	■ Isolation valves on all main liquid lines. ■ Multiple pump shut offs. ■ Gas detection on LPG store perimeter. ■ Crash barriers around vessel.	Minor (2)	Unlikely (2)	Low (5)
Warehouse (Dangerous Goods Store)	Warehouse fire	■ Faulty wiring. ■ Handling equipment not intrinsically safe.	■ Fire involving warehouse contents. ■ Exploding vessels depending upon material stored.	■ All products segregated. ■ Thermal sensors and/or smoke detectors to be installed and linked to alarm.	Moderate (3)	Rare (1)	Medium (6)

FACILITY / HAZARD	SCENARIO / EVENT	CAUSE / COMMENT	POSSIBLE CONSEQUENCES	RISK CONTROL MEASURES	ANALYSIS OF CONSEQUENCES	LIKELIHOOD OF HAZARDOUS INCIDENT	RISK ANALYSIS
		■ LPG fired shrink wrapping used. ■ Bushfire. ■ Arson. ■ Mechanical impact. ■ Lighting not intrinsically safe. ■ Unsafe storage practices.	■ Toxic combustion products formed.	■ Warehouse sprinkler system to be installed. ■ Area to be bunded. ■ Suitable level of security to be maintained. ■ All lighting to be intrinsically safe. ■ Development of Bushfire Management Plan to include protocols relating to storage of dangerous goods. ■ Flameproof wiring to be used in dangerous goods store. ■ Drum storage racked or drum height restricted. ■ Storage to be located at least 500 m from the site boundary.			
	Catastrophic loss of containment	■ Extreme rainfall or flooding event.	■ Contamination of receiving waters at potentially toxic levels with resultant health effects upon public health.	■ As for warehouse fire.	Minor (2)	Rare (1)	Low (3)

FACILITY / HAZARD	SCENARIO / EVENT	CAUSE / COMMENT	POSSIBLE CONSEQUENCES	RISK CONTROL MEASURES	ANALYSIS OF CONSEQUENCES	LIKELIHOOD OF HAZARDOUS INCIDENT	RISK ANALYSIS
Explosives	Unplanned explosion during set up or use	■ Faulty wiring. ■ Handling equipment not intrinsically safe. ■ Malicious act. ■ Mechanical impact.	■ Unplanned ignition of explosives.	■ Use appropriately qualified and trained specialist explosives personnel. ■ Handling of explosives and detonators in accordance with all relevant legislation such as the *Explosives Act 1999*. ■ Development of standard operating procedures and emergency response planning.	Moderate (3)	Rare (1)	Medium (6)
	Magazine fire	■ Faulty wiring. ■ Bushfire. ■ Handling equipment not intrinsically safe. ■ Arson, malicious act. ■ Mechanical impact. ■ Lighting not intrinsically safe. ■ Unsafe storage practices.	■ Fire involving magazine contents. ■ Explosion of magazine depending upon material stored.	■ Handling and storage of explosives and detonators in accordance with all relevant legislation such as the *Explosives Act 1999* including relating to segregation, bunding etc. ■ Development of emergency response planning. ■ Bushfire Management Plan to include protocols relating to explosives storage. ■ Thermal sensors and/or smoke detectors to be installed and linked to alarm. ■ Sprinkler system to be	Moderate (3)	Rare (1)	Medium (6)

FACILITY / HAZARD	SCENARIO / EVENT	CAUSE / COMMENT	POSSIBLE CONSEQUENCES	RISK CONTROL MEASURES	ANALYSIS OF CONSEQUENCES	LIKELIHOOD OF HAZARDOUS INCIDENT	RISK ANALYSIS
				installed. ■ Flameproof wiring to be used in dangerous goods store. ■ Suitable level of security to be maintained in accordance with legislation and best practice. ■ Drum storage racked or drum height restricted. ■ Storage to be located at least 500 m from the site boundary.			
Diesel storage	Diesel tank fire	■ Static electricity build up and spark due to fast filling. ■ Mechanical impact. ■ Failure of tank or fittings, pump or pipework and ignition.	■ Fire engulfing tank and spreading to surrounding fuel infrastructure.	■ Pressure vent valves checked prior to fill/discharge. ■ Foam injection system in appropriate tanks. ■ Water cooling system on each tank.	Minor (2)	Unlikely (2)	Low (5)

FACILITY / HAZARD	SCENARIO / EVENT	CAUSE / COMMENT	POSSIBLE CONSEQUENCES	RISK CONTROL MEASURES	ANALYSIS OF CONSEQUENCES	LIKELIHOOD OF HAZARDOUS INCIDENT	RISK ANALYSIS
	Diesel bund fire	■ Failure of tank or fittings, pump or pipework and ignition. ■ Corrosion. ■ Mechanical impact. ■ Tank overfilled.	■ Leakage of tank contents into bund. If ignited may result in pool or bund fire.	■ Tanks cleaned, inspected and integrity tested regularly. ■ Adequate foam stocks onsite. ■ High level alarms provided on all storage tanks. ■ Foam and/or monitors to be placed within bund area.	Minor (2)	Unlikely (2)	Low (5)
Power station	Catastrophic failure	■ Mechanical impact. ■ Corrosion. ■ Mechanical failure. ■ Unsafe practices. ■ Malicious act.	■ Fire. ■ Exploding vessels. ■ Toxic combustion products formed. ■ Airborne emission of contaminants at potentially toxic concentrations causing acute health effects.	■ Designed, constructed and operated in accordance with all applicable legislation and regulations including the *Electrical Safety Act 2002*. ■ Development of Principal Hazard Management Plan including protocols for the management of emergency situations. ■ Power station has been located, as far as practical to provide separation from other potentially hazardous areas and sensitive receptors.	Major (5)	Rare (1)	Significant (15)

FACILITY / HAZARD	SCENARIO / EVENT	CAUSE / COMMENT	POSSIBLE CONSEQUENCES	RISK CONTROL MEASURES	ANALYSIS OF CONSEQUENCES	LIKELIHOOD OF HAZARDOUS INCIDENT	RISK ANALYSIS
	Partial equipment failure	■ Mechanical failure. ■ Spillage of bulk chemicals. ■ Fire.	■ Disruption to mine power supply.	■ Handling and storage of all chemicals in accordance with all relevant legislation and standards. ■ Spill response kits to be located in chemical storage areas. ■ Emergency Response planning. ■ Boiler units can be isolated for routine maintenance or emergency situations.	Minor (2)	Rare (1)	Low (3)
Mine Water Storages	Catastrophic containment failure	■ Poor design or construction. ■ Failure or blockage of emergency overflow mechanisms. ■ Extreme rainfall or flooding event relating to climate change.	■ Discharge of contaminated water into receiving water bodies, including potable supplies.	■ Design and engineer storages to accepted design standard so as to maintain integrity. ■ Design storage capacities to minimise risk of water levels reaching overflow level. ■ Design and construct storages using suitably qualified engineers. ■ Undertake reassessment of the consequence category of all structures that are dams or levees annually following construction.	Minor (2)	Rare (1)	Low (3)

FACILITY / HAZARD	SCENARIO / EVENT	CAUSE / COMMENT	POSSIBLE CONSEQUENCES	RISK CONTROL MEASURES	ANALYSIS OF CONSEQUENCES	LIKELIHOOD OF HAZARDOUS INCIDENT	RISK ANALYSIS
				■ Use monitoring system to identify potential issues. ■ Compliance with EA conditions.			
	Large leak	■ Poor engineering or design. ■ Failure or blockage of emergency overflow mechanisms.	■ Discharge of contaminated water into receiving water bodies, including potable supplies.	■ As for catastrophic containment failure.	Insignificant (1)	Rare (1)	Low (1)
Water Management System	Infection by biological pathogens	■ Poor sterilisation practices. ■ Malicious contamination.	■ Contamination of mine site water management system and release to receiving water bodies used as stock and potable water sources.	■ Use of a closed loop water management system to contain worked water.	Minor (2)	Rare (1)	Low (3)
	Off-site health effects by chemical contaminants	■ Accidental addition of chemical additive. ■ Malicious contamination. ■ Technological error.	■ Contamination of mine site water management system and release to receiving water bodies used as stock and potable water sources.	■ Use of a closed loop water management system to contain worked water.	Insignificant (1)	Rare (1)	Low (1)

FACILITY / HAZARD	SCENARIO / EVENT	CAUSE / COMMENT	POSSIBLE CONSEQUENCES	RISK CONTROL MEASURES	ANALYSIS OF CONSEQUENCES	LIKELIHOOD OF HAZARDOUS INCIDENT	RISK ANALYSIS
	Variability of mine water supply	■ Drought. ■ Climate change.	■ Insufficient water supply to operate mine.	■ Conservative design of mine water management system. ■ Liaise with government and other industry to address adaptation to climate change, where practicable.	Moderate (3)	Unlikely (2)	Medium (9)
Sewage Treatment at MIAs and Accommodation Village	Release of untreated or partially treated sewage	■ Mechanical failure of sewage treatment plant or associated pumps and pipelines. ■ Malicious contamination.	■ Contamination of sewage treatment system and release to receiving water bodies used as stock and potable water sources. Workers may be exposed to pathogens resulting in illness.	■ Operate plants in accordance with all relevant regulatory requirements. ■ Routine inspection and maintenance of treatment plants. ■ Package treatment plants to include alarms to indicate malfunctions. ■ Use of Personal Protection Equipment (PPE) in the event of an incident.	Insignificant (1)	Possible (3)	Low (4)
Surface Coal Handling (including open cut mining)	Emission of contaminants	■ Combustion of fuels or other hydrocarbons. ■ Leakage of chemicals resulting explosion and evolution of vapour cloud.	■ Airborne emission of contaminants at potentially toxic concentrations causing chronic health effects (and potentially acute effects for more sensitive receptors).	■ Operational controls will include watering of roads, stockpile sprays and imposition of speed restrictions. (Further details on air quality are provided in Section 15 – Air Quality).	Minor (2)	Unlikely (2)	Low (5)

FACILITY / HAZARD	SCENARIO / EVENT	CAUSE / COMMENT	POSSIBLE CONSEQUENCES	RISK CONTROL MEASURES	ANALYSIS OF CONSEQUENCES	LIKELIHOOD OF HAZARDOUS INCIDENT	RISK ANALYSIS
	Spontaneous combustion of coal in ROM or product stockpiles	■ Exposure of coal to air (oxygen) for extended periods can result in spontaneous combustion.	■ Fire. ■ Airborne emission of contaminants.	■ Develop detailed risk profile based on analysis of coal properties and potential likelihood of occurrence. ■ Manage stockpiles. ■ Develop emergency response procedures. ■ Maintain firefighting equipment on-site.	Minor (2)	Rare (1)	Low (3)
	Coal dust spills along conveyors, trainload out	■ Poor design. ■ Mechanical failure.	■ Coal dust emissions causing impaired visibility or nuisance.	■ Handling and loading equipment designed to minimise spillage. ■ Routine maintenance and inspection of equipment. ■ Supervision of train loadout.	Insignificant (1)	Rare (1)	Low (1)
Airstrip	Aircraft crash during transit or take-off and landing	■ Unlicensed pilots operating on airstrip. ■ Damage to airstrip caused by wear and tear or extreme weather events. ■ Impaired visibility near airstrip from	■ Injury or death of passengers, or the public.	■ Designed, constructed and operated in accordance with all CASA legislation and regulations, including the need to obtain an aerodrome certification. ■ Use of fully licenced operators only (i.e. pilots). ■ Development and implementation of thorough inspection and maintenance protocols.	Major (5)	Rare (1)	Significant (15)

FACILITY / HAZARD	SCENARIO / EVENT	CAUSE / COMMENT	POSSIBLE CONSEQUENCES	RISK CONTROL MEASURES	ANALYSIS OF CONSEQUENCES	LIKELIHOOD OF HAZARDOUS INCIDENT	RISK ANALYSIS
		dust plumes due to open cut mining, haul roads, power station stack, train loading or weather. ■ Wildlife on airstrip.		■ All project employees will undergo aviation safety and an emergency response plan training. ■ Airstrip located away from on-site dust emission sources. ■ Project dust levels will adhere to the health and amenity objectives specified within the *Environmental Protection Policy (Air) 2008*. Dust is essentially invisible at these levels and therefore will not be an issue on visibility (refer *Air Quality Report* - Appendix M).			
Transport of materials and wastes to and from site	Catastrophic failure of transport containment	■ Mechanical impact. ■ Traffic accident in remote area. ■ Driver fatigue.	■ On dispersion, vapour may form a gas cloud. ■ Fire involving transport contents. ■ If ignited, may result in flash fire or UVCE. ■ Exploding vessels depending upon material transported. ■ Injury or death of	■ Safety inductions for employees. ■ Operator driving training programs. ■ Speed controls. ■ Equipment maintenance and inspection. ■ Radio communications in vehicles. ■ Development and implementation of a Site	High (4)	Rare (1)	Medium (10)

FACILITY / HAZARD	SCENARIO / EVENT	CAUSE / COMMENT	POSSIBLE CONSEQUENCES	RISK CONTROL MEASURES	ANALYSIS OF CONSEQUENCES	LIKELIHOOD OF HAZARDOUS INCIDENT	RISK ANALYSIS
			transport drivers or the public. ■ Depending on type of material being transported, contamination of surrounding land and waters.	Traffic Management Plan. ■ Use of licensed contractors for the transport of dangerous goods. ■ Provision of a one-off donation of a heavy vehicle rescue kit to QFRS in Charters Towers. ■ Consult with relevant stakeholders to determine the need or otherwise for additional driver rest areas along the primary project supply routes. ■ Coordinate project communication infrastructure upgrades with local emergency services and Adani Mining. ■ Engage with Adani Mining in relation to the proponent's participation in the Emergency Services Consultative Committee for the CCM&RP and the coordination of emergency response and sharing of resources where appropriate.			

FACILITY / HAZARD	SCENARIO / EVENT	CAUSE / COMMENT	POSSIBLE CONSEQUENCES	RISK CONTROL MEASURES	ANALYSIS OF CONSEQUENCES	LIKELIHOOD OF HAZARDOUS INCIDENT	RISK ANALYSIS
	Large leak from transport containment	■ Mechanical impact. ■ Corrosion. ■ Failure of tank or fittings, pump or pipework and ignition. ■ Traffic. accident.	■ Fire involving transport contents. ■ Exploding vessels depending upon material transported. ■ Toxic combustion products formed. ■ Contamination of receiving waters at potentially toxic levels with resultant health effects upon public health.	■ As for catastrophic failure of transport containment.	Minor (2)	Unlikely (2)	Low (5)
	Vehicle fire	■ Static electricity build up and spark due to fast filling. ■ Mechanical impact. ■ Failure of tank or fittings, pump or pipework and ignition. ■ Traffic accident.	■ Fire engulfing transport vehicle and spreading to surrounding area.	■ As for catastrophic failure of transport containment.	Moderate (3)	Unlikely (2)	Medium (9)

FACILITY / HAZARD	SCENARIO / EVENT	CAUSE / COMMENT	POSSIBLE CONSEQUENCES	RISK CONTROL MEASURES	ANALYSIS OF CONSEQUENCES	LIKELIHOOD OF HAZARDOUS INCIDENT	RISK ANALYSIS
Key Hazards Related to Employee Welfare							
Mine Facilities and Accommodation Village	Use of poor food hygiene practices	■ Lack of awareness in hygiene practice.	■ Contamination of food and illness among employees.	■ Maintain levels of staff training and awareness. ■ The provision and supply of food will be undertaken by licensed contractors operating in accordance with relevant food and hygiene legislation, including the *Australia New Zealand Food Standards Code 2005,* the *Queensland Food Production (Safety) Act 2000* and the *Food Act 1981.* ■ The design and construction of kitchen / mess facilities will be in accordance with appropriate Australian Standards, guidelines and legislation regarding food preparation facilities.	Insignificant (1)	Rare (1)	Low (1)

FACILITY / HAZARD	SCENARIO / EVENT	CAUSE / COMMENT	POSSIBLE CONSEQUENCES	RISK CONTROL MEASURES	ANALYSIS OF CONSEQUENCES	LIKELIHOOD OF HAZARDOUS INCIDENT	RISK ANALYSIS
Potable Water System	Failure to meet potable water quality objectives	■ Poor sterilisation practices. ■ Malicious contamination.	■ Contamination of water and illness among employees.	■ An on-site water treatment plant will treat water to a potable water standard in accordance with the *Australian Drinking Water Guidelines Paper 6 (Revised March 2015).* ■ Potable water quality will be monitored on a regular basis in accordance with the SHMS to ensure compliance with drinking water standards. ■ The water quality of the potable water will be managed and controlled in accordance with the SHMS.	Insignificant (1)	Rare (1)	Low (1)
Accommodation Village	Fire	■ Electrical fault. ■ Malicious act. ■ Bushfire.	■ Injury or illness of workers.	■ Design and construction in accordance with all relevant legislation. ■ Provision of smoke detectors and fire extinguishers. ■ Development of evacuation plan. ■ Training of all workers and contractors at the site on	Minor (2)	Unlikely (2)	Low (5)

FACILITY / HAZARD	SCENARIO / EVENT	CAUSE / COMMENT	POSSIBLE CONSEQUENCES	RISK CONTROL MEASURES	ANALYSIS OF CONSEQUENCES	LIKELIHOOD OF HAZARDOUS INCIDENT	RISK ANALYSIS
				emergency evacuation procedures and assembly areas and the conduct of fire drills. ■ Bushfire Management Plan to include protocols relating to accommodation village.			
Mine Facilities and Accommodation Village	Snakes	■ Contact with animal during duties.	■ Snake bite to employee.	■ Training and awareness for employees on dangers of animals should they be found to be present at or near site. ■ Use of appropriate PPE. ■ On-site first aid facilities.	Minor (2)	Rare (1)	Low (3)
	Livestock	■ Collision	■ Injury to workers and/or livestock	■ Fence stock from operational areas	Minor (2)	Rare (1)	Low (3)
	Disease vectors e.g. mosquitoes and vermin	■ Poor site hygiene and waste management practices. ■ Mine water storage, drainages, culverts etc creating breeding sites.	■ Infection of site workers.	■ Waste disposal bins will facilitate the collection of rubbish in a clean, safe and hygienic manner, prior to removal from site by licensed contractors or landfill disposal. ■ Refuse bins will be covered to contain odour, reduce leachate and prevent vermin. ■ Waste which is known to attract vermin will be stored	Insignificant (1)	Rare (1)	Low (1)

FACILITY / HAZARD	SCENARIO / EVENT	CAUSE / COMMENT	POSSIBLE CONSEQUENCES	RISK CONTROL MEASURES	ANALYSIS OF CONSEQUENCES	LIKELIHOOD OF HAZARDOUS INCIDENT	RISK ANALYSIS
				and handled in an appropriate manner. ■ Water management designed to avoid unnecessary ponding of water. ■ Appropriate chemical control measures will be utilised as appropriate to mitigate adverse health conditions. ■ Regular circulation of stored water will prevent the occurrence of stagnant areas.			
Accommodation Village	Transmission of disease e.g. measles or gastroenteritis	■ Lack of awareness or personal hygiene practice.	■ Infection of site workers.	■ Training and awareness for employees. ■ Development of protocols for coordination with local health care providers in the event of an outbreak of a communicable disease on the site.	Insignificant (1)	Rare (1)	Low (1)

22.7.1 Risk Management

The consequences and likelihood of each identified potentially hazardous incident were used to estimate the risk of a hazardous outcome being realised. The analysis includes the positive effects of risk control measures to be implemented. The highest risks derived under the PHA relate to loss of containment and combustion of dangerous goods, catastrophic failure of the power station, aircraft crashes and bushfires. These hazards have moderate to major consequences but generally have a low likelihood of occurrence, resulting in medium to significant risks.

The overall risk profile for the project assessed by the PHA is low due to the controls that have been included within the current design, the proposed SHMS development and the remoteness of the site in relation to populated areas and built infrastructure. The cumulative level of risk at identified sensitive receptors is considered to be comparable to the individual risk profile of each potential hazard and surrounding land uses (i.e. no significant cumulative risks have been identified).

22.8 CONSULTATION

As discussed in Section 22.3.1, a SMHS will be developed which will include Emergency Preparedness and Response (EPR) planning. Timely consultation with key stakeholders will be undertaken as part of the EPR planning, including consultation with local and regional representatives from emergency service providers including:

- QFES;
- Emergency Management Queensland;
- QPS; and
- QAS.

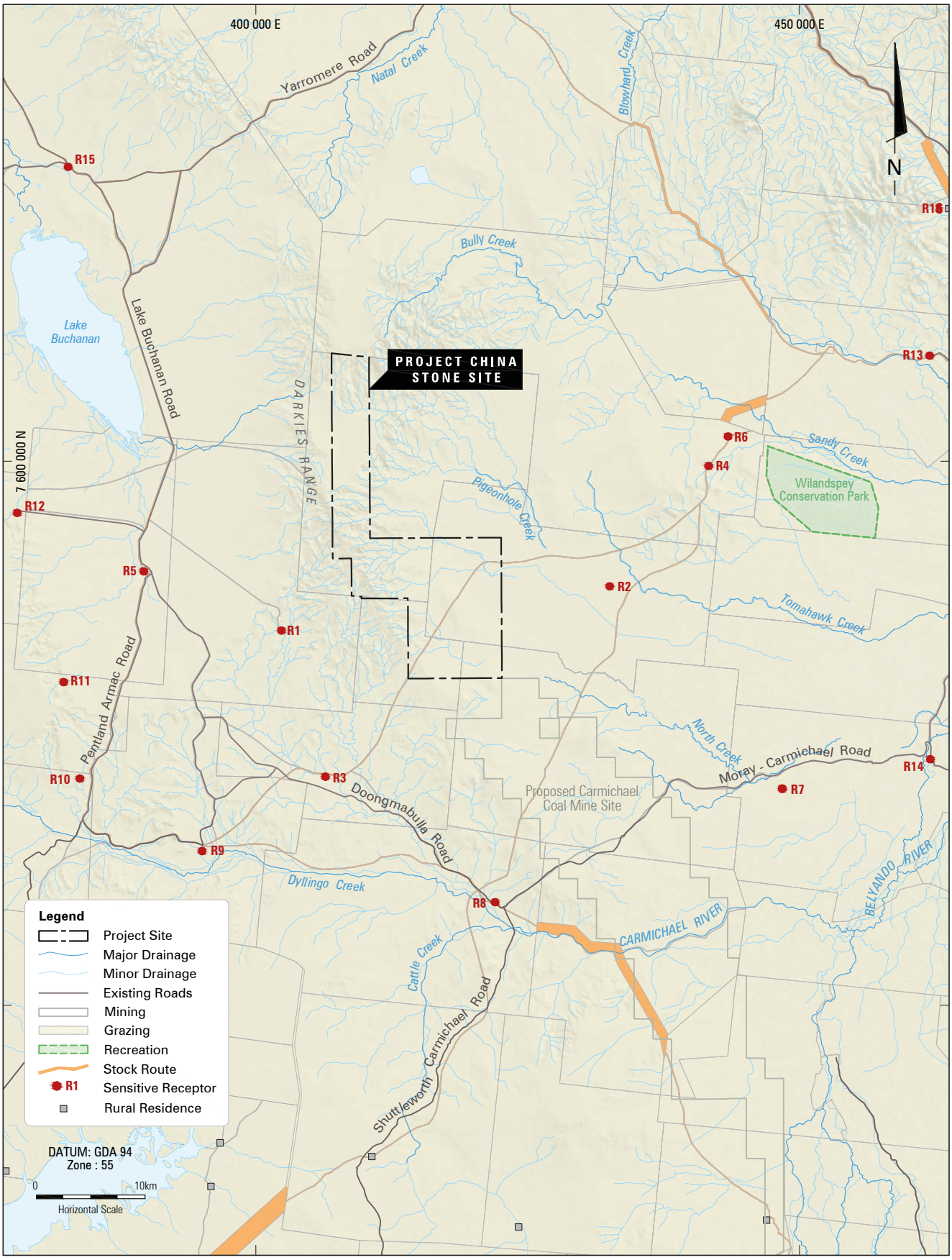
The proponent will include the emergency service providers in the regular review of the EPR planning. There will also be detailed consultation during the development of evacuation and access maps and during the development of an ERMP. A copy of the ERMP will be provided to the emergency service providers.

In the interests of ensuring that the emergency service providers are prepared should they be required to respond to an incident at the project site, the proponent will provide information as it becomes relevant or available. This includes:

- Information on equipment and materials used on-site to ensure compatibility with that of the emergency services;
- Evacuation and access maps of the mine site and accommodation village;
- Training sessions, site inductions and tours (as required);
- Notification of planned exercises, either practical or desktop, and discussion with the emergency service providers regarding any requirement for their participation in these exercises;
- Information on the status of the project; and
- Information on accident organisational responsibilities and authorities (and agreed procedures for handover of responsibilities).

These actions are designed to ensure a timely, effective and appropriate level of emergency preparedness and response, including emergency on-site care, on the part of the proponent and the public emergency services.

FIGURES



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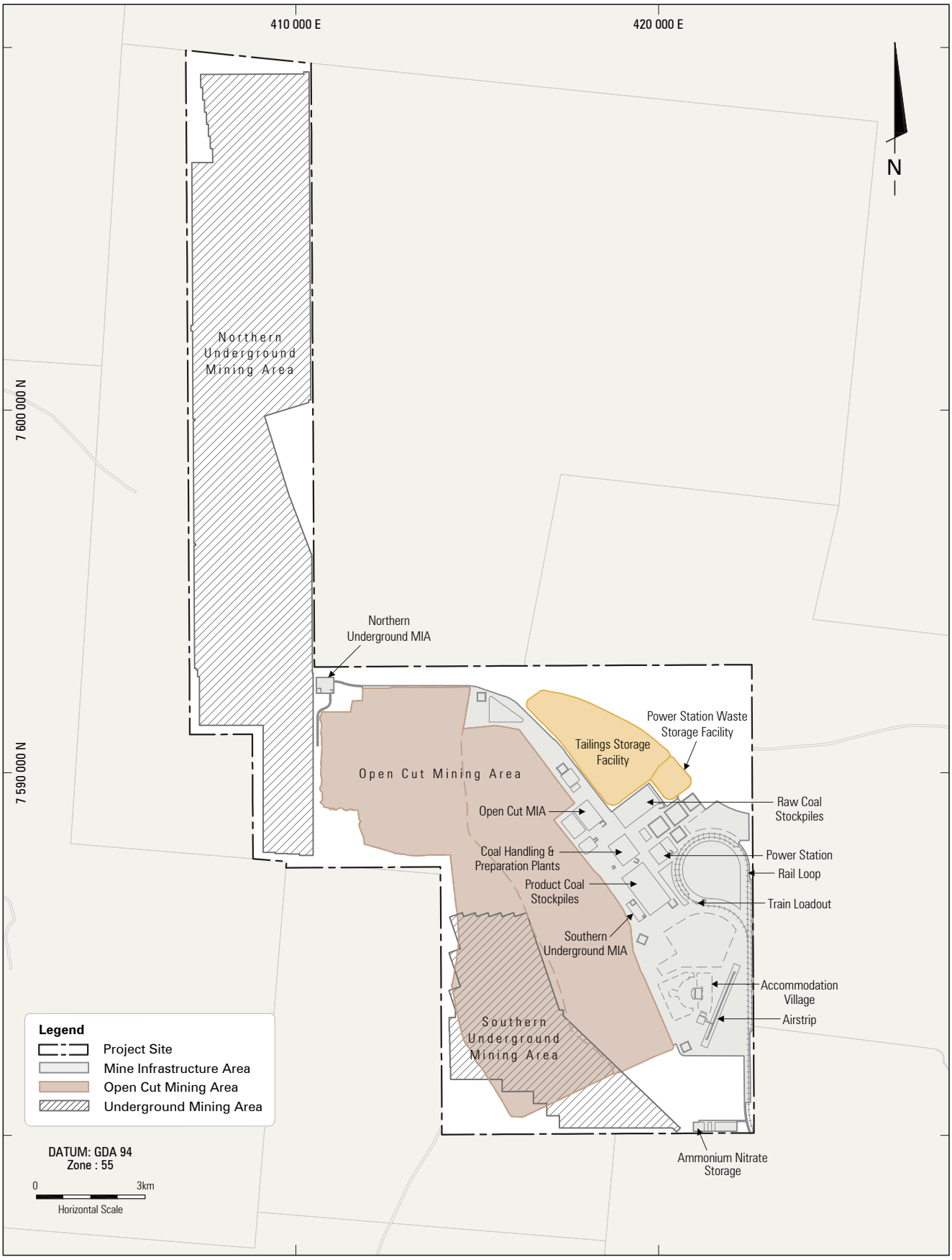
Land Use

FIGURE 22-1



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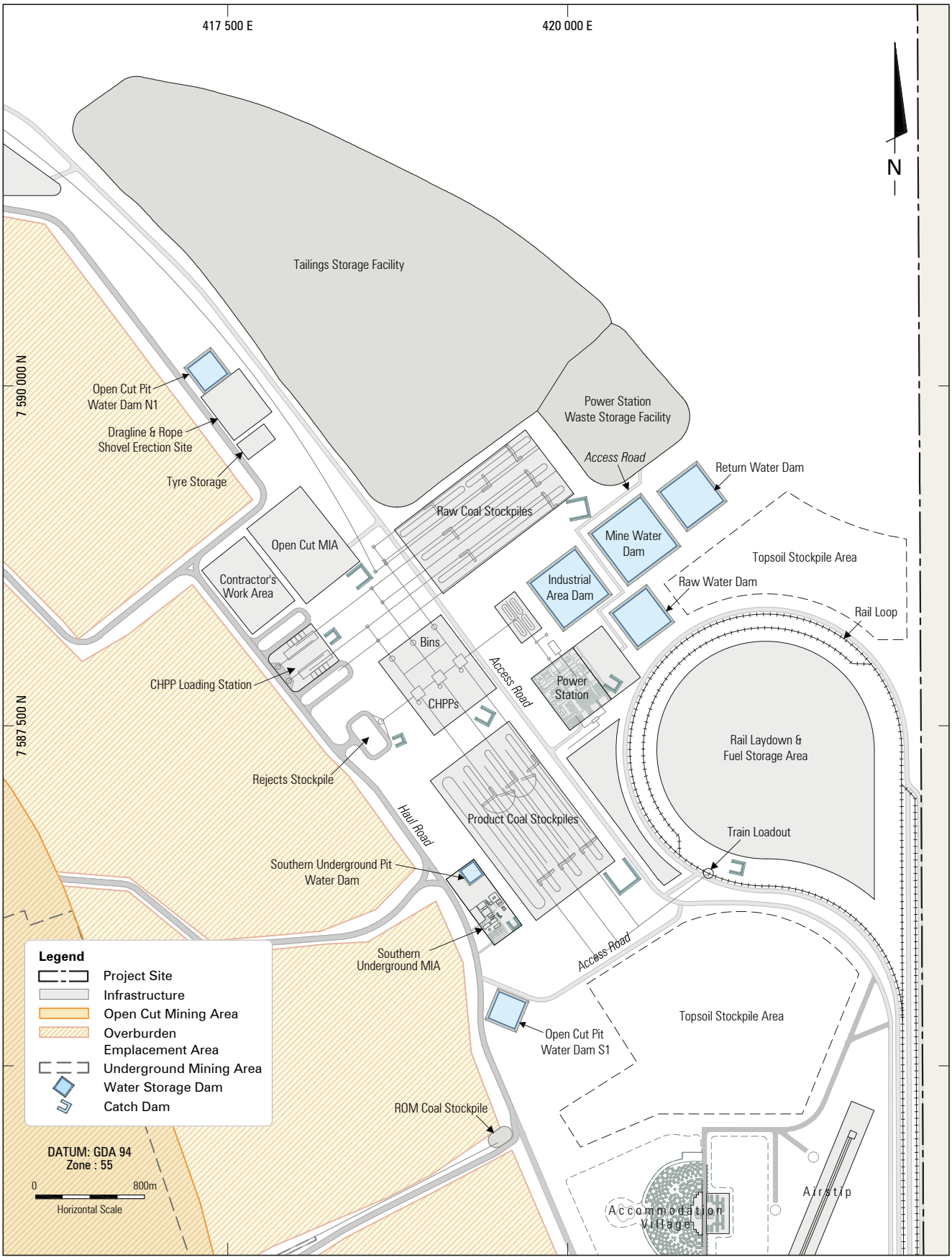
Project Layout

FIGURE 22-2



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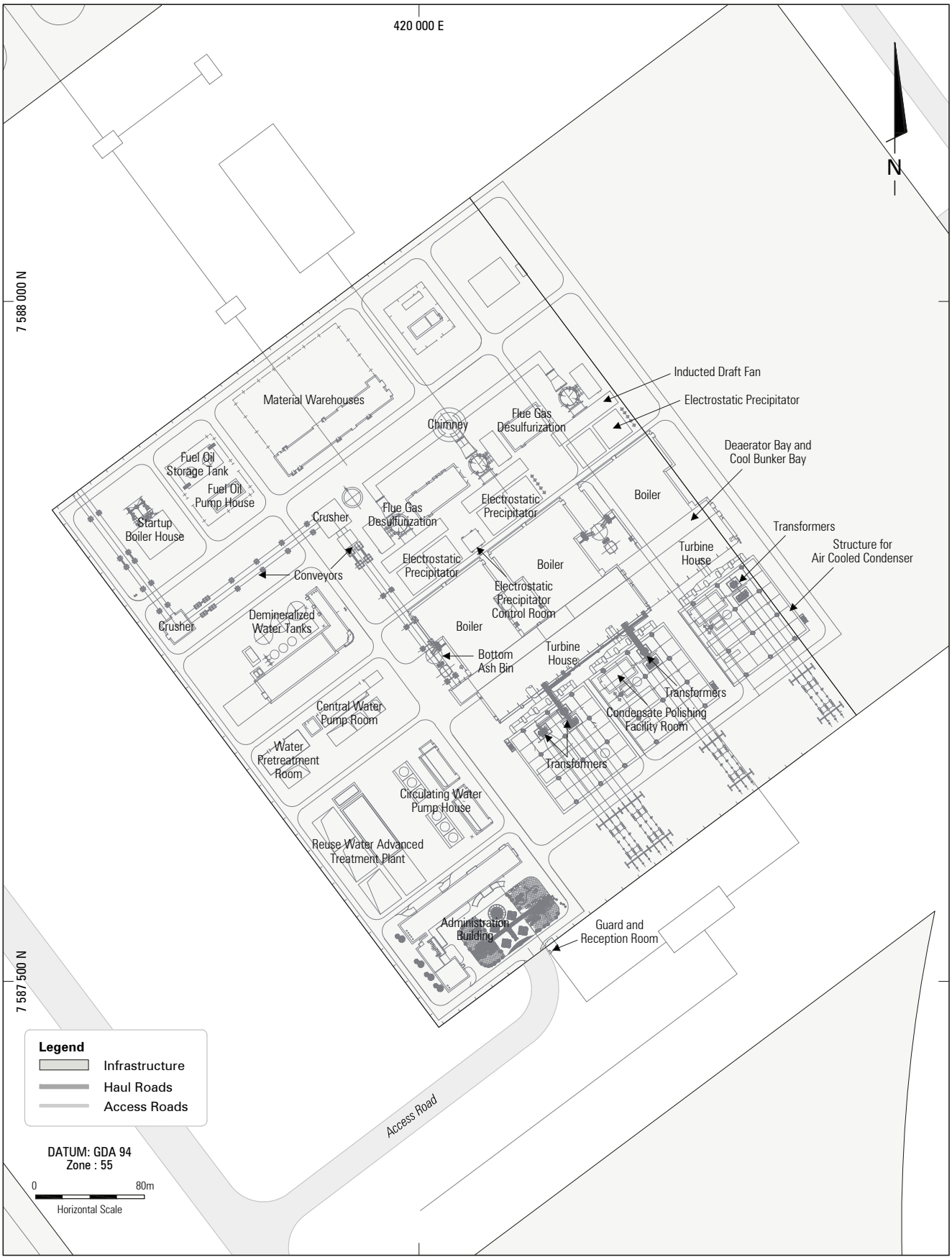
Project Layout -
Central Infrastructure Area Detail

FIGURE 22-3



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Project Layout - Power Station Detail

FIGURE 22-4