13. Environmental Management Plan (Mine)

SECTION A: ENVIRONMENTAL MANAGEMENT FRAMEWORK

13.1 Introduction

13.1.1 Project Background

The Carmichael Coal Mine and Rail Project (the Project) comprises of two major components:

- The Project (Mine): a greenfield coal mine over Exploration Permit for Coal (EPC)1690 and part of EPC1080, which includes both open cut and underground mining, on mine infrastructure and associated mine processing facilities (the Mine) and offsite infrastructure.
- The Project (Rail): a greenfield rail line connecting the Mine to the existing Goonyella rail system to provide for export of coal via the Port of Abbot Point and/or the Port of Hay Point (Dudgeon Point expansion).

The Project has been declared a 'significant project' under the *State Development and Public Works Organisation Act 1971* (SDPWO Act) and as such, an Environmental Impact Statement (EIS) is required for the Project. The Project is also a 'controlled action' and requires assessment and approval under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).

On 24 May 2011, the Coordinator-General issued the Final Terms of Reference (TOR) for the EIS (State of Queensland, 2011). The TOR set out the general and specific matters the project proponent must address when preparing the EIS. This document addresses Section 8 of the Final TOR relevant to the Project which required Adani to develop an Environmental Management Plan (EMP) for the Project.

13.1.2 Environmental Management for the Carmichael Coal Project

Adani operates within an established Health, Safety and Environment (HSE) Management System.

In relation to site and project specific requirements, the Adani Mining HSE Management System applies on a site-specific and project-specific basis and is managed by the HSE function on each site and overseen by the relevant area managers.

For projects and operating sites, the HSE management system requires:

- The establishment of systems and arrangements to ensure compliance with the Adani Mining HSE Management Standards.
- Utilising the Adani Mining HSE Compliance Guidelines for the development and implementation of procedures.
- Contributing to the implementation and on-going operation of the HSE Management System.

This EMP has been prepared in compliance with the requirements of the Adani HSE management system. It has also been developed to meet developed to meet requirements of Queensland Department of Environment and Heritage Protection (EHP) in relation to the issue of an environmental authority (mining lease).

In terms of ongoing environmental management, the Carmichael Coal project has been split into three components for the purposes of preparing environmental management plans:

- Mining activities, being all activities carried out within the mining leases. Environmental management of these activities is covered in this EMP (Mine)
- Off-site infrastructure, including:
  - Workers accommodation village
  - Dedicated airport
  - Off-site industrial area
  - Associated infrastructure including:
  - water supply, storage and transfer infrastructure
  - transmission lines
  - access roads
- Railway activities and associated maintenance facilities.

Each environmental management plan covers:

- Design and pre-construction requirements
- Construction phase activities
- Operation activities
- Decommissioning and rehabilitation.

This EMP (Mine) has been prepared to support an environmental impact assessment process for the Carmichael Coal Project under the EPBC Act and SDPWO Act and to provide the basis for issue of an environmental authority for the mining component of the Project. As such, the EMP reflects the findings and recommendations of studies undertaken for the EIS, and provides a framework for management of identified impacts and implementation of recommendations made in the EIS. The EMP will be further developed as detailed design of the Project continues and to achieve compliance with conditions of approvals obtained.

Depending on the selected contracting strategy for the construction and operation phases, contractors and subcontractors may be required to prepare stand-alone environmental management plans for those aspects of the project under their control. Such plans will be required to be consistent with this EMP.

As required by the continual improvement approach to environmental management, this EMP is a dynamic document and will be updated as required to reflect:

- Changing significance of impacts and hazards associated with the mining activity
- Changes in legal and other obligations
- Learnings and corrective actions from monitoring activities.

Reviews of the EMP and management review requirements are set out in Section 13.13

As the Carmichael Coal project has a proposed operating life of 90 years, it is likely that significant changes in legislation, policy and available techniques in relation to environmental management will occur during the life of the project. Annual review of the EMP will ensure that changes are adopted.

13.2 Project Description

The Project (Mine) is located in the northern part of the Galilee Basin, Central Queensland. The Mine will be developed over EPC1690 (incorporating Mining Lease Application (MLA) 70441) and part of EPC1080, located approximately 160 km north-west of the town of Clermont.

13.2.1 Onsite Infrastructure

Onsite Infrastructure is described as that within EPC1690 and EPC1080. It includes all infrastructure within the boundary of the mining tenement.

The Mine and onsite infrastructure includes:

- Open cut Mine (located within EPC1690)
- Underground Mine (northern, central and southern) (located within EPC1690)
- Mine Infrastructure Area (MIA) (located within EPC 1080)
- Out of pit waste rock dumps (mostly located within EPC1080)
- Mine water management dams (located within EPC1080)

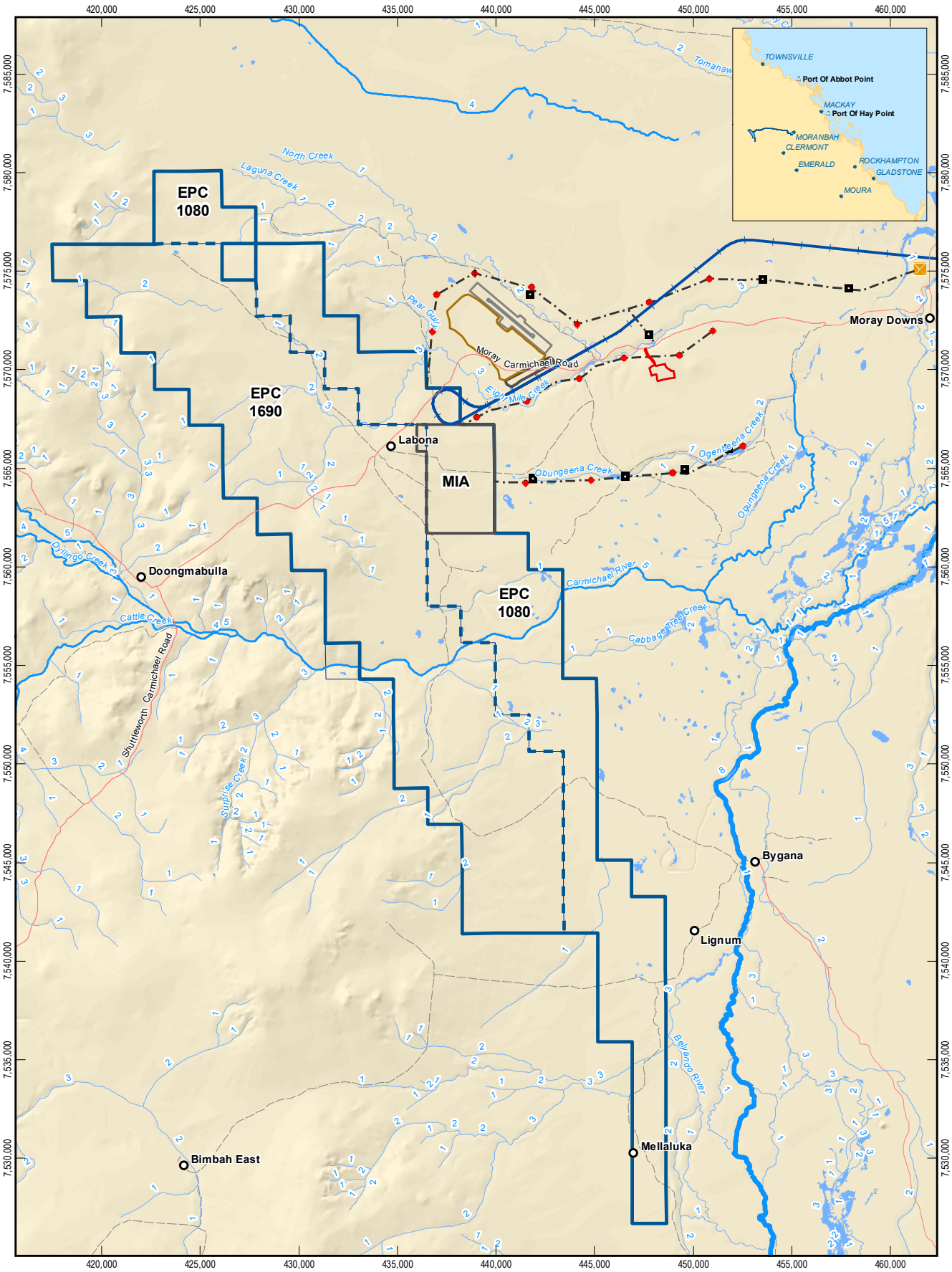
The open cut mine has a capacity of 40 Mtpa (product) and will be located along the east of EPC1690. The open cut mine will be predominantly truck shovel/excavator operation, supplemented by draglines and dozers for primary waste removal. A total of 16 open cut pits will be progressively mined. During the early stage of development of each pit, overburden will be transported to out of pit dumps on EPC1080, where it will be profiled and rehabilitated, and a proportion will be used to re-profile the high-wall of the final voids.

The underground mine will operate concurrently with the open cut pits, to provide for coal blending and ensure continuity of production. The underground mine comprises three independent underground longwall mines, producing 20 Mtpa (product), commencing from drifts located down dip of the final high-wall of the open cut mine. Each underground mine is serviced by above ground infrastructure.

The mine infrastructure area and out of pit dumps are located over in EPC1080. The need for the inclusion of EPC1080 was identified during mine planning, to avoid dumping of overburden over underground mining areas. All run of mine (ROM) coal will be transported by truck and/or overland conveyor to a centralised coal handling facility, where the high-ash (greater than 30 per cent ash) portion will be washed for blending with the bypass coal (un-washed coal). Coal will be stockpiled prior to loading on trains for transportation by rail.

The channel and riparian zone of the Carmichael River will be preserved and the adjacent pits protected from flooding events by a levee.

Figure 13-1 shows the proposed mine and associated infrastructure.



LEGEND

- Homestead
- Local Road
- Track
- Rail (West)
- Mine (Onsite)
- Mine Infrastructure Area
- Waterbodies
- Stream Order
  - 1; 2; 3
  - 4; 5; 6
  - 7; 8; 9
- Mine (Offsite)
  - Borehole
  - Storage Site (Instream)
  - Storage Facility (Offstream)
  - Pipeline Network
- Airport Location
- Rail Siding
- Industrial Area
- Workers Accommodation Village

1:275,000 (at A4)

0 1 2 3 4 5

Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

Adani Mining Pty Ltd

Carmichael Coal Mine and Rail Project

Job Number 41-25215
Revision A
Date 20-11-2012

Surface Water Resources

Figure: 13-1

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Data Source: DERM: DCDB, Stream Network (2010); DME: EPC 1690 (2010)/EPC 1080 (2011); © Copyright Commonwealth of Australia - Geoscience Australia: Mainland, Homestead, Locality, Road (2007); Adani: Alignment Opt9 Rev3 (2012); Gassman/Hyder: Mine (Offsite) (2012); Created by: BW, MS

The Mine infrastructure within the MIA includes the following:

- Central open-cut ROM hopper, sizing station, and raw coal handling
- Coal handling plant (CHP) facility and product coal stockpiles for the underground coal mine operation
- Train load-out facilities
- CHP facility and product coal stockpiles for the open cut coal operation
- Coal handling and preparation plant (CHPP) facility complete with coarse rejects handling system
- Tailings co-disposal system including tailings impoundments for operations
- Washed product coal stockpiles and reclaim systems
- CHPP industrial area, offices, and amenities for CHPP maintenance and operations
- Clean and dirty water management structures
- Environmental dam and other raw water storages
- Reticulation to mine facilities
- Light and heavy vehicle access roads

The surface infrastructure outside the MIA will include:

- Pit top facilities including offices, bathhouse maintenance facilities, ventilation, power and water services
- Clean and dirty water management structures at pit top
- Environmental dams and other raw water storages
- Reticulation details
- Vehicle access roads
- Open cut mine dump station facilities including sizing station and overland conveyors
- Explosives magazine and preparation facilities with security fencing and bunding
- Levees and other water management structures at the Carmichael River.

13.2.2 Mining Activities and Staging

The Project (Mine) life cycle consists of construction, operation and closure and decommissioning. Rehabilitation is progressive throughout mining activity. The construction and early operation stages overlap so that production can commence as soon as possible.

Table 13-1 provides an overview of Mining Activities and Staging.

Table 13-1 Overview of Mining Activities and Staging

Year(s)	Activities
Year 1	Prepare works for Mine onsite and offsite infrastructure
	Undertake redevelopment of Moray Carmichael Road from Gregory Developmental Road to Mine site
	Commence construction of workers accommodation village and access road from Moray Carmichael Road
	Commence construction of open cut, northern underground and central underground mines including overland conveyors and central ROM facilities
	Commence construction of permanent airport
	Commence construction of water supply and other external services
	Commence excavation of G Pit and J Pit box-cut (pits nomenclature is illustrative and may change)
Year 2	Continue construction of workers accommodation village
	Continue construction of mine infrastructure and associated infrastructure
	Produce first coal from northern underground and open cut
	Complete G Pit box-cut
2015	Complete on mine infrastructure and associated infrastructure
	Produce first coal from central underground
	Commence E Pit (west) and E Pit highwall diversion drain
2016	Complete G Pit
	Commence C Pit (west)
	Commence Dragline 1 in G Pit
2017	Construct Northern ROM and overland conveyor
	Commence A Pit (west) and A Pit dump diversion drain
	Complete tailings dam of approximately 130 Mm^3
2018 – 2027	2018 – Complete wash plant and commence coal washing: utilise tailings cells until J Pit inventory is mined out
	2020 – Mine out I Pit and commence rehabilitation
	2021 – Dragline 2 commences in both C and E Pits
	2027 – Commence H Pit and construct G Pit and H Pit highwall diversion drains
	2027 – Dragline 3 commences in A Pit
	2027 – Rehabilitation planning commences

Year(s)	Activities
2028 – 2037	2029 – Commence B Pit (west) 2033 – Commence D Pit (west) 2033 – Construct low low-level crossing of Carmichael River 2034 – Commence M Pit 2035 – Commence A Pit (east) 2035 – Rehabilitate A Pit (west) and profile spoil dump and west void 2036 – Rehabilitate C Pit (west) and spoil dump 2037 – Commence N Pit 2037 – Commence Southern Underground construction 2037 – Construct permanent G Pit and H Pit highwall diversion drains
2038 – 2047	2038 – Construct Carmichael River southern flood protection levee 2038 – Construct southern ROM 2039 – Commence production southern underground mine 2040 – Commence G Pit rehabilitation 2041 – Commence A Pit (west) rehabilitation 2041 – Commence C Pit (east) production 2044 – Dragline introduced into M Pit 2045 – Commence L Pit 2047 – Complete N Pit box-cut
2048 – 2057	No new pits commenced
2058 – 2067	2058 – Duplicate southern ROM capacity 2060 – Commence P Pit 2061 – J Pit rejects dam full. Move to G Pit and rehabilitate J Pit 2062 – Completion of northern and central underground mines 2062 – Rehabilitate northern and central underground Infrastructure and overland conveyor routes 2065 – Completion of southern underground mine 2065 – Rehabilitate southern underground infrastructure and overland conveyor route 2066 – Construct Carmichael River northern flood protection levee 2067 – Commence K Pit and O Pit
2068 – 2077	2070 – Commence B Pit (east) 2076 – Decommission Northern ROM
2077 – 2087	2084 – Complete north pit area (A Pit to E Pit) 2086 – Complete mining north of Carmichael River and commence final rehabilitation of active pits (mine infrastructure and haul road remain).

Year(s)	Activities
2088 – 2110	2102 – Complete mining in M Pit, N Pit and O Pits, to toes of out-of-pit spoil dumps. 2102 to 2110 – Rehabilitate mine site

Source: Runge Limited 2011

13.3 Environmental Management Framework

13.3.1 Environmental and Sustainability Policy

Adani is committed to the protection of the environment and to the sustainable management of its operations and activities. Adani operates within an established Health, Safety and Environment (HSE) Management System. This system has been developed to comply with relevant legislative standards for operation of coal mines within Queensland, and comprises an Environment and Sustainability Policy and HSE Management Standards. A copy of Adani's Environment and Sustainability Policy is attached in Volume 4 Appendix A.

The HSE management system will guide environmental management for the Project (Mine) by providing a framework to prevent or minimise environmental harm, ensure compliance and promote continuous improvement. Key components of the system include:

- Responsibility, authority and commitment
- Planning, objectives and legal obligations
- Training and competence
- Documentation, document control and records
- Incidents and performance measurement
- Communication, consultation and involvement
- Emergency preparedness and response
- Reviews, audits and inspections

All contractors and staff involved in the Project (Mine) will be required to adhere to Adani's Environment and Sustainability Policy and the key requirements of the HSE management system.

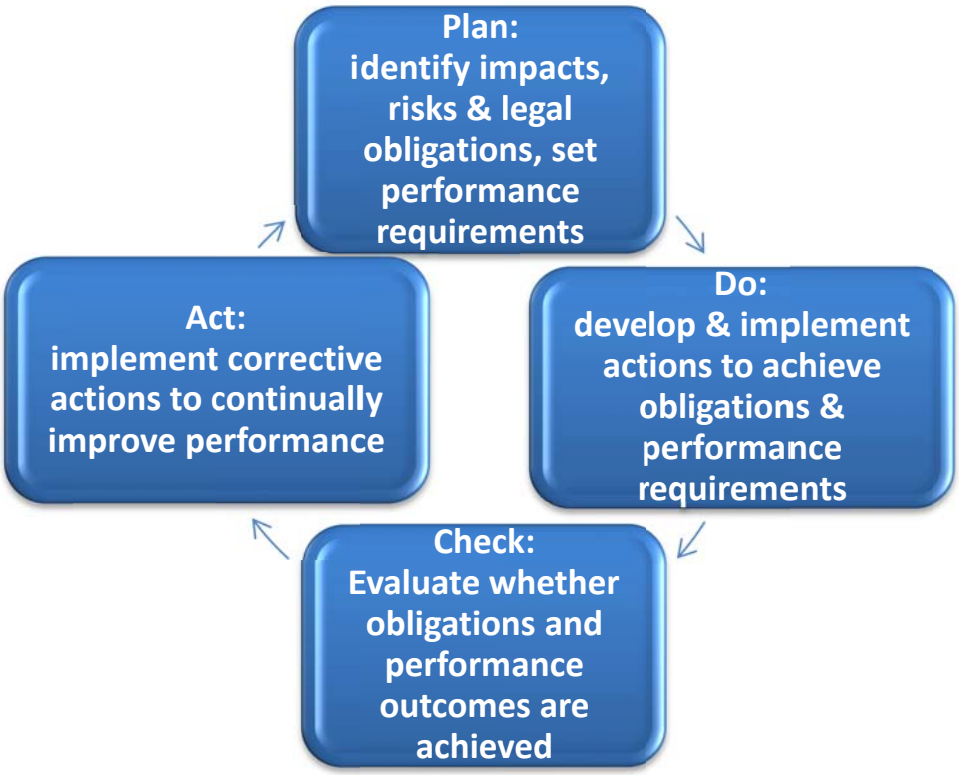
13.3.2 Planning for Environmental Management

Environmental management requires a continuous process of:

- identification of impacts and risks to the environment from the mining activity and setting targets for environmental performance and protection of environmental values
- developing controls and management actions to achieve targets
- monitoring the effectiveness of controls and management actions in protecting environmental values
- implementing corrective actions where environmental performance requirements have not been achieved.

This cycle, known as the plan-do-check-act cycle is shown in Figure 13-2.

Figure 13-2 Plan-Do-Check-Act Cycle



Sub plans (in Section B) developed for this EMP reflect this process by presenting:

- legislative framework relevant to the particular element
- information on key environmental values and sensitivities potentially impacted by the mining activity
- a summary of impacts potentially arising from construction and operation
- preliminary performance outcomes in relation to management of impacts on the environmental values
- management controls for the design, construction and operation phases of the mining activity
- a program of monitoring against performance indicators and suggested corrective actions in the event that monitoring indicates that performance requirements have not been met.

These sub plans sit within an overall framework of continuous review and improvement of environmental performance.

This EMP reflects the general requirements of an environmental management system. Mapping of contents against ISO14001 requirements is provided in Table 13-2.

Table 13-2– Mapping against EMS Requirements

ISO 14001 Requirement	How addressed
PLANNING	
Environmental policy	Volume 4 Appendix A contains Adani's Environment and Sustainability Policy
Roles and responsibilities	Section 13.4
Environmental aspects and impacts	Section B: Sub Plans Environmental values and potential impacts of construction and operation of the Carmichael Coal Mine are set out in the sub-plans for each element.
Legal and other obligations	Overarching legal and other obligations are in Section 13.5. Sub-plans for each element also include legislation relevant to these elements. Conditions of approvals not yet issued will be incorporated into the legal and other obligations register.
Objectives and targets	Section 13.6 Performance outcomes are also identified in sub-plans for each element. Monitoring requirements also include performance indicators for each monitoring requirement.
Environmental Management Program	An environmental management program has not yet been developed for the Carmichael Coal Mine
IMPLEMENTATION	
Operational control and procedures	Operational controls are set out in the individual sub-plans for each element
Training and competency	Training and competency requirements are included in Section 13.8.
Documentation and records	Documentation and record keeping is addressed in Section 13.10. Management controls in each sub-plan also specify evidence requirements in relation to implementation of each control.
CHECKING	
Checks and inspections	Requirements for checks and inspections are set out in Section 13.12.2
Monitoring	Monitoring requirements are set out in the sub-plans for each element
Auditing	Auditing requirements are provided in Section 13.12.3.

ISO 14001 Requirement	How addressed
ACTING	
Corrective actions	Corrective action requirements are set out in Section 13.7.
Management review	Management review requirements are set out in Section 13.13.1.

13.4 Roles and Responsibilities

13.4.1 Overview

Adani Compliance Guideline HSE-CG-001 sets out requirements for assigning roles and responsibilities in relation to HSE management.

Preliminary roles and responsibilities for design and pre-construction, construction and operation phases are presented in Sections 13.4.2, 13.4.3, and 13.4.4. These will be revised once organisational structures for each phase of the project and mining activity are confirmed.

In accordance with HSE-CG-001:

- Position descriptions will contain responsibilities and accountabilities for environmental compliance and management
- Performance against environmental compliance and management requirements will be part of the annual performance review and linked to remuneration and promotion of managers.

13.4.2 Design and Preconstruction

Table 13-3 Roles and Responsibilities – design and pre-Construction

Role	Responsibility
CEO	Endorse Environment and Sustainability Policy Ensure that adequate resources are available to meaningfully comply with the Environment and Sustainability Policy
Adani Senior Project Management	Ensure compliance with all legal requirements including requirements of EPBC approval, environmental authority and other approvals Ensure that requirements of this EMP are incorporated into engineering and procurement processes, and that these processes do not conflict with environmental performance requirements Ensure that adequate resources are available to meet all compliance requirements and implement the requirements of this EMP Demonstrate a visible and pro-active commitment to HSE issues as per item 4.1 and 4.2 of HSE-CG-128.

Role	Responsibility
Adani Contract Management Team	Manage environmental performance requirements in contracts, including penalties in the event on non-compliance Demonstrate a visible and pro-active commitment to HSE issues as per item 4.1 and 4.2 of HSE-CG-128.
Adani Environmental Manager and team	Provide advice to Adani management teams and personnel in relation to environmental requirements Integrate environmental management requirements into work procedures and practices Conduct audits and checks of compliance and environmental performance of contractors Manage technical studies and research activities relating to environmental assessment and management of the Project Raise corrective actions for any non-compliance with this EMP or in response to results of incident investigations Conduct incident investigations Report to Adani on environmental performance including compliance, non-compliance and incidents and near misses with potential or actual environmental harm. Further develop the EMP
Construction Managers and supervisors	Implement all relevant requirements of this EMP Integrate environmental management requirements into work procedures and practices Provide initial responses to emergencies involving potential environmental impacts Conduct incident investigations
Construction workers and all other staff	Comply with all relevant requirements of this EMP
Contractor Environmental Managers and Officers	Assist and support managers, supervisors and workers in implementing the EMP and achieving environmental compliance. Conduct monitoring, auditing and reporting activities required in this EMP. Assist with incident response and investigation where required to manage and address environmental impacts of incidents. Conduct induction training and tool box talks on environmental topics. Compile monthly and quarterly environmental reports.
Stakeholder Manager	Manage external relations with landholders and other stakeholders Coordinate investigation and response to complaints and incidents involving members of the public

13.4.3 Construction

Table 13-4 Roles and Responsibilities – Construction

Role	Responsibility
CEO	Endorse Environment and Sustainability Policy Ensure that adequate resources are available to meaningfully Comply with the Environment and Sustainability Policy Demonstrate a visible and pro-active commitment to HSE issues as per item 4.1 and 4.2 of HSE-CG-128.
Adani senior project management	Ensure compliance with all legal requirements including requirements of EPBC approval, environmental authority and other approvals Ensure that adequate resources are available within Adani and contractors to meet all compliance requirements and implement the requirements of this EMP Monitor close-out of corrective actions Review outcomes of incident investigations Demonstrate a visible and pro-active commitment to HSE issues as per item 4.1 and 4.2 of HSE-CG-128.
Adani Contract Management Team	Manage environmental performance requirements in contracts, including penalties in the event on non-compliance Demonstrate a visible and pro-active commitment to HSE issues as per item 4.1 and 4.2 of HSE-CG-128.
Adani Environmental Manager and team	Provide advice to Adani management teams and personnel in relation to environmental requirements Integrate environmental management requirements into work procedures and practices Conduct audits and checks of compliance and environmental performance of contractors Manage technical studies and research activities relating to environmental assessment and management of the Project Raise corrective actions for any non-compliance with this EMP or in response to results of incident investigations Conduct incident investigations Report to Adani on environmental performance including compliance, non-compliance and incidents and near misses with potential or actual environmental harm. Further develop the EMP

Role	Responsibility
Construction Managers and supervisors	Implement all relevant requirements of this EMP Integrate environmental management requirements into work procedures and practices Provide initial responses to emergencies involving potential environmental impacts Conduct incident investigations
Construction workers and all other staff	Comply with all relevant requirements of this EMP
Contractor Environmental Managers and Officers	Assist and support managers, supervisors and workers in implementing the EMP and achieving environmental compliance. Conduct monitoring, auditing and reporting activities required in this EMP. Assist with incident response and investigation where required to manage and address environmental impacts of incidents. Conduct induction training and tool box talks on environmental topics. Compile monthly and quarterly environmental reports.
Construction workers and all other staff	Comply with all relevant requirements of this EMP
Contractor Environmental Managers and Officers	Assist and support managers, supervisors and workers in implementing the EMP and achieving environmental compliance. Conduct monitoring, auditing and reporting activities required in this EMP. Assist with incident response and investigation where required to manage and address environmental impacts of incidents. Conduct induction training and tool box talks on environmental topics. Compile monthly and quarterly environmental reports.
Stakeholder Manager	Manage external relations with landholders and other stakeholders Coordinate investigation and response to complaints and incidents involving members of the public

13.4.4 Operation

Table 13-5 Roles and Responsibilities – Operation

Role	Responsibility
CEO	Endorse Environment and Sustainability Policy
	Ensure that adequate resources are available to meaningfully comply with the environmental policy Environment and Sustainability Policy
	Assign authorities and responsibilities for environmental compliance and performance
	Demonstrate a visible and pro-active commitment to HSE issues as per item 4.1 and 4.2 of HSE-CG-128.
Mine General Manager	Implement Environment and Sustainability Policy
	Ensure compliance with all legal requirements including requirements of EPBC approval, environmental authority and other approvals
	Monitor actioning and close out of non-conformances
	Ensure that adequate resources are available within Adani and contractors to meet all compliance requirements and implement the requirements of this EMP
	Ensure that all personnel and contractors understand environmental authorities, responsibilities and requirements
	Incorporate environmental performance and compliance requirements into job descriptions and performance reviews
	Demonstrate a visible and pro-active commitment to HSE issues as per item 4.1 and 4.2 of HSE-CG-128.
	Reward outstanding performance in relation to environmental performance
Mine area managers	Ensure that requirements of this EMP are incorporated into all aspects of site operation and maintenance and are implemented.
	Raise corrective actions for any non-compliance with this EMP or in response to results of incident investigations
	Conduct incident investigations
	Demonstrate a visible and pro-active commitment to HSE issues as per item 4.1 and 4.2 of HSE-CG-128.

Role	Responsibility
Procurement manager	Ensure that specifications include performance requirements in relation to energy and water efficiency and other measures to reduce resource consumption and waste generation Ensure that contractors hold necessary approvals and authorisations, particularly in relation to waste management services Review environmental performance credentials of potential contractors Demonstrate a visible and pro-active commitment to HSE issues as per item 4.1 and 4.2 of HSE-CG-128. Meet requirements of HSE-GE-021 in relation to purchasing.
Mine supervisors	Integrate environmental management requirements with work procedures and practices Raise corrective actions for any non-compliance with this EMP or in response to results of incident investigations Coordinate initial response to incidents with potential or actual environmental harm
Employees and contractors	Comply with all requirements of this EMP
Adani Environmental Manager and team	Provide advice to Adani managers and personnel in relation to environmental requirements Assist and support managers, supervisors and workers in implementing the EMP and achieving environmental compliance. Conduct monitoring, auditing and reporting activities required in this EMP. Assist with incident response and investigation where required to address environmental impacts of incidents. Conduct induction training and tool box talks on environmental topics. Compile monthly and quarterly environmental reports. Conduct audits and checks of compliance and environmental performance of contractors Track changes in legislation, policy and other obligations and ensure these are incorporated into environmental compliance and management requirements and communicated to relevant managers and staff Manage technical studies and research activities relating to environmental assessment and management of the Project Review, update and further develop the EMP

Role	Responsibility
Stakeholder Manager	Manage external relations with landholders and other stakeholders Coordinate investigation and response to complaints and incidents involving members of the public

13.5 Legal and other Obligations

13.5.1 Overview

Adani HSE Compliance Guideline HSE-CG-002 sets out system requirements in relation to legal and other obligations.

Evaluation of compliance with legal and other obligations will be through a compliance audit as specified in Section **Error! Reference source not found.** and a quarterly review of changes in legal and other obligations will be undertaken.

Relevant legislation is also identified in sub plans in this EMP.

13.5.2 Applicable Legislation and Policies

Applicable legislation, policies and other statutory instruments are shown in Table 13-6. Current versions of federal legislation can be obtained from (http://www.austlii.edu.au/au/legis/cth/consol_act/). Current versions of Queensland legislation can be obtained from (http://www.legislation.qld.gov.au/acts_sls/acts_sl.htm).

Table 13-6 Summary of Relevant Environmental Legislation – Mining Activities

Title	Relevance to the Mining Activity
Commonwealth Legislation	
Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)	The EPBC Act implements Australia's obligations to protect and conserve biodiversity and heritage under a range of international treaties and agreements. In relation to projects, the Act requires assessment and approval of actions that may have a significant impact on a range of matters of National Environmental Significance, including (as relevant to the Carmichael Coal Project) threatened species and ecological communities, migratory species, World Heritage areas and national heritage places. The Carmichael Coal Project has been declared a controlled action on 6 January 2011 due to the likely potential impacts on Matters of National Environmental Significance (NES) (EPBC Referral 2010/5736). Assessment is to be under a bilateral agreement in place with the Queensland government. Activities associated with the Project may not commence until approval is granted under the EPBC Act. Once approval is granted, this EMP will need to be updated to incorporate actions required to achieve compliance with approval conditions.

Title	Relevance to the Mining Activity
Native Title Act 1993	The *Commonwealth Native Title Act 1993* (NT Act) formalises the common law recognition of ancestral domain or native title, that is rights and interests over land and water possessed by Indigenous people in Australia under their traditional laws and customs. Native title had not previously been extinguished over much of the mining area and Adani is negotiating a land use agreement with the Wangan and Jagalingou People (registered claims (QUD85/04, QC04/6). It is expected that this agreement will contain actions for Adani in relation to native title.
Aboriginal and Torres Strait Islander Heritage Protection Act 1984	The *Aboriginal and Torres Strait Islander Heritage Protection Act* preserves and protects nominated areas and objects in Australia and in Australian waters which are of particular significance to Aboriginals in accordance with Aboriginal tradition. There are no such areas of objects within or adjacent to the proposed mine, and hence, requirements of this Act are not relevant to the mining activity.
National Greenhouse and Energy Reporting Act 2007	The *National Greenhouse and Energy Reporting Act 2007* sets up a range of reporting mechanisms to assist the Australian Government in understanding greenhouse gas emissions and energy consumption by corporations. This information is used to monitor emissions profiles, inform government policy, programs and other initiatives and meet National and international reporting obligations. Adani will be required to report under the NGER.
National Environment Protection Council Act 1994	The *National Environment Protection Act 1994* establishes the National Environment Protection Council (now known as the Environment Protection and Heritage Council). The Council is responsible for developing national environment protection measures (NEPM). The National Environment Protection (National Pollutant Inventory) Measure 1998 requires organisations to report on emissions of certain pollutants. Requirements relevant to Carmichael Coal Mine are discussed in Section 13.16.
Clean Energy Act 2011	The *Clean Energy Act 2011* establishes a mechanism for carbon pricing and trading. Adani will be required to trade carbon on the basis of coal production.
Energy Efficiency Opportunities Act 2006	The *Energy Efficiency Opportunities Act* (EEO Act) applies to businesses that use more than 0.5 PJ of energy per year. Participants in the program are required to assess their energy use and report publicly on the results of the assessment and the business response. Decisions on energy efficiency opportunities remain at the discretion of the business.

Title	Relevance to the Mining Activity
Queensland Legislation	
State Development and Public Works Organisation Act 1971 (SDPWO Act)	The SDPWO Act has a number of functions in relation to State planning and development including coordination of environmental assessments of significant projects. In relation to coordination of environmental assessments, the SDPWO Act establishes an EIS process for projects declared as Significant Projects under the Act. The Office of the Coordinator-General provides an overall facilitation and coordination process in relation to the setting of Terms of Reference for an EIS, and assessment of an EIS prepared by a proponent. In this role, the Office of the Coordinator General seeks advice from other State government agencies. Where a project is being assessed under the EPBC Act through a bilateral agreement, the Office of the Coordinator General also liaises with SEWPC. The Carmichael Coal Project was declared a Significant Project under the SDPWO Act and an EIS was prepared to meet the environmental coordination requirements for significant projects. Work associated with the Project cannot commence until approval, in the form of a Coordinator-General's report is granted. Once approval is granted, this EMP will need to be updated to incorporate actions required to achieve compliance with approval conditions.
Environmental Protection Act 1994 (EP Act)	The EP Act places emphasis on managing Queensland's environment within the principles of ecologically sustainable development. While concerned with all aspects of ecologically sustainable development, regulations, policies and other requirements under the EP Act focus on protection of air quality, acoustic quality and water quality as well as on waste management and land contamination. Hazardous waste dams are also regulated under the EP Act. The EP Act sets up a process for environmental approval of mining activities on mining leases and other mining tenure established under the *Mineral Resources Act 1989* (MR Act). Where a project is a Significant Project under the SDPWO Act, the EP Act allows for issue of an environmental authority (mining lease) once approval under the SDPWO Act is obtained. As the regulator for mining activities under the EP Act, EHP participates in the SDPWO Act EIS process, reviewing the EIS against policy and other requirements established under the EP Act, and assisting the Office of the Coordinator General in determining appropriate conditions for the environmental authority. Activities may not commence within the mining lease until an environmental authority is in place, and must then take place in compliance with conditions of the environmental authority. This EMP has been prepared to meet requirements under the EP Act and proposes conditions for an environmental authority (mining lease).

Title	Relevance to the Mining Activity
	This EMP will be updated to incorporate conditions of the environmental authority once the authority is issued. The EP Act also imposes a 'General Environmental Duty' requiring all individuals and organisations to take all reasonable and practical measures to avoid environmental harm.
Environmental Protection Regulation 2008 (EP Regulation)	Schedule 2 of the EP Reg lists 64 Environmentally Relevant Activities (ERAs) including waste disposal and sewage treatment. The regulations also provide a regulatory regime for minor issues involving environmental nuisance such as noise.
Environmental Protection (Waste Management) Regulation 2000	The *Environmental Protection (Waste Management) Regulation 2000*, implements various waste management matters covered by the EP Act. Relevant to the Carmichael Coal Mine, this regulation sets up a system for tracking of certain wastes that are hazardous to the environment. The system tracks wastes from the point of generation to the point of disposal through a docket system.
Environmental Protection (Water) Policy 2009 (EPP Water)	The EPP (Water) establishes environmental values in relation to water resources. The EPP and also sets up frameworks for water quality guidelines and prescribes specific water quality objectives for a number of basins in Queensland. Specific water quality objectives have not yet been prescribed for the Burdekin Basin, and hence, water quality objectives default to the objectives required to protect the environmental values of waters. Environmental values and water quality objectives derived for the Carmichael Coal Mine are discussed in Section 13.19.
Environmental Protection (Noise) Policy 2008 (EPP Noise)	The EPP Noise defines environmental values in relation to the acoustic environment and sets acoustic quality objectives. Environmental values and acceptable noise levels for the Carmichael Coal Mine are discussed in Section 13.18.
Environmental Protection (Air) Policy 2008 (EPP Air)	The EPP Air defines environmental values in relation to air quality and sets ambient air quality objectives. Environmental values and acceptable noise levels for the Carmichael Coal Mine are discussed in Section 13.16. .

Title	Relevance to the Mining Activity
Mineral Resources Act 1989 (MR Act)	The MR Act covers prospecting, exploration and mining of minerals in Queensland. The Carmichael Coal Mine will take place on mining leases issued under the MR Act and will be subject to a range of conditions including conditions in relation to land management and restoration. The process for granting a mining lease is linked to the process for issuing of an environmental authority under the EP Act and both the mining lease and environmental authority must be in place before mining and related activities can commence. Adani currently holds exploration permit (coal) 1690 and 1080 over the proposed mining and spoil placement areas. This EMP will need to be updated once a mining lease is issued to reflect relevant conditions of the mining lease.
Waste Reduction and Recycling Act 2011	The legislation establishes a framework for waste management and resource recovery practices in Queensland. The purpose of the new legislation is to promote waste avoidance and reduction and to encourage resource recovery and efficiency. The WRR Act does not impose any particular obligations on Adani in relation to the Carmichael Coal Mine, but does establish frameworks for introduction of a range of waste management strategies and initiatives such as waste levies, product stewardship programs and other resource recovery programs. These may have implications in relation to waste management services required by Carmichael Coal Mine.
Sustainable Planning Act 2009 (SP Act)	The SP Act provides a framework for development assessment and approval in Queensland, bringing together requirements of a range of legislation. Section 319 of the MR Act states that the SP Act does not apply to mining development.
Water Act 2000 (Water Act)	The Water Act provides for management and sustainable use of freshwater resources in Queensland, including surface waters and groundwater. The approach to sustainable management of water resources is through the development of a Water Resource Plan (WRP) and Resource Operations Plan (ROP) for each basin. The WRP and ROP set out the rules for allocation and use of water resources. The Carmichael Coal Mine is within the area covered by the *Water Resource (Burdekin Basin) Plan 2007*. Under the Water Act a licence is required for diversion of waterways and interfering with flow by impoundment of a waterway. A riverine protection permit is also required for works in a watercourse that are not carried out in compliance with the guideline *activities in a watercourse, lake or spring associated with a resource activity or mining operations* (WAM/2008/3435, DERM 2008).

Title	Relevance to the Mining Activity
Water Resource (Burdekin Basin) Plan 2007.	Water resource plans set out the requirements for sustainable management of water resources, when water may be taken with and without an allocation and matters to be considered when granting allocations.
Fisheries Act 1994	This Act regulates activities such as fishing, development in fish habitat areas, and damage to and destruction of marine plants in Queensland. There are no requirements under the Fisheries Act that are relevant to the Carmichael Coal Mine.
Aboriginal Cultural Heritage Act 2003	The Aboriginal Cultural Heritage Act 2003 establishes a 'cultural heritage duty of care', which requires that a person who carries out an activity must take all reasonable and practicable measures to ensure the activity does not harm Aboriginal cultural heritage. In order to discharge this duty of care, Adani has entered into cultural heritage management agreements with Wangan and Jagalingou People which contains measures for monitoring and managing cultural heritage items.
Queensland Heritage Act 1992	The *Queensland Heritage Act 1992* provides for the conservation and protection of places and items of historical and/or non-Indigenous cultural heritage. There are no places protected under this Act within the Carmichael Coal Mine.
Nature Conservation Act 1992 (NC Act) *Nature Conservation (Protected Plants) Conservation Plan 2000* *Nature Conservation (Wildlife Management) Regulation 2006*	The objective of the NC Act is to conserve nature which is to be achieved by an integrated and comprehensive conservation strategy for the whole of Queensland, involving amongst other things the protection of native wildlife and its habitat. A permit under the NC Act will be required for clearing of all native plants. A permit will also be required if a confirmed breeding place for a native animal is to be disturbed. The *Nature Conservation (Protected Plants) Conservation Plan 2000* sets out certain requirements in relation to permits to clear native plants. The *Nature Conservation (Wildlife Management) Regulation* sets out requirements in relation to permits for tampering with breeding places A permit is also required for fauna spotters involved in vegetation clearing activities to authorise taking of native animals that may require relocation.
Vegetation Management Act 1999 (VM Act)	The VM Act sets up a process for classifying remnant vegetation and for protecting and conserving remnant vegetation and associated ecological and biodiversity values. As permits under the VM Act are assessable development under the SP Act, a permit to clear native vegetation is not required under this Act (but is under the NC Act). However, the system set up under the VM Act for classifying remnant vegetation is relevant to the project as this classification is used within the Biodiversity Offsets Policy to determine biodiversity values requiring offsets.

Title	Relevance to the Mining Activity
Land Protection (Pest and Stock Route Management) Act 2002	The purpose of the *Land Protection (Pest and Stock Route Management) Act 2002* (LP Act) is to provide for pest management and for land and stock route network management. Under the LP Act landholders are required to manage certain declared weeds. Weed management is covered in Section 13.23. Several stock routes pass through the mine and will be closed and/or relocated. This is managed through the land tenure process and is not covered in this EMP.
Strategic Cropping Land Act 2011 (SCL Act)	The SCL Act protects areas identified as strategic cropping land, being areas of high quality agricultural land. There are no such areas within the Carmichael Coal Mine.
Clean Energy Act 2008	Applies to business using more than 30 TJ of energy, but less than 500TJ

13.5.3 Licences, Permits and Approvals

Adani is currently seeking approval for the Carmichael Coal Mine under the EPBC Act and SDPWO Act. This EMP has been prepared in support of these approval applications.

If these key approvals are issued, then Adani will be required to obtain a range of additional environmental approvals and permits as set out in Table 13-7. As permits and approvals are issued, Table 13-7 and relevant sub-plans in this EMP will be updated to reflect conditions of approval.

Table 13-7 Approvals Register

Legislation	Approval or Permit	Trigger
EPBC Act	Approval to undertake a controlled action	Potentially significant impacts on matters of national environmental significance
SDPWO Act	Coordinator-General's report	Declaration of the Carmichael Coal Mine as a Significant Project for which an EIS is required.
EP Act	Environmental authority	Conduct of a mining activity, and other environmentally relevant activities carried out on a mining lease.
EP Act	Registration certificate	Operator of a mining activity or an environmentally relevant activity
MR Act	Mining lease	Conduct of a mining activity
NC Act	Permit to take protected plants	Clearing of native vegetation
NC Act	Permit to take protected animals	Handling of native fauna encountered prior to or during vegetation clearing
NC Act	Permit to tamper with a breeding place	Required if any confirmed animal breeding places are disturbed by the mining activity

Legislation	Approval or Permit	Trigger
Water Act	Riverine protection permit	Disturbance to the bed and banks of a watercourse except in accordance with guideline *activities in a watercourse, lake or spring associated with a resource activity or mining operations* (WAM/2008/3435)
Water Act	Licence to interfere with flow by impounding water	Required if impoundment of any watercourse, lake or spring is to occur. Confirm with NRM whether this might apply to subsidence
Water Act	Licence to interfere with the course of flow	Required for watercourse diversions. Confirm with NRM whether this might apply to subsidence
Water Act	Licence to take groundwater	Mine dewatering

The environmentally relevant activities (ERAs) that will be conducted as part of this mining activity are shown in Table 13-8.

Table 13-8 Environmentally Relevant Activities

ERA number	ERA description (Refer to Schedule 2 and Schedule 6 – (Environmental Protection Regulation 2008)	Aggregate Environmental Score
ERAs defined in Schedule 2 of the Environmental Protection Regulation 2008		
8.1	Chemical Storage – storing a total of 50 t or more of chemicals of dangerous goods class 1 or class 2, division 2.3.	51
8.3(b)	Chemical Storage – 500 m³ or more of chemicals of class C1 or C2 combustible liquids under AS 1940 or dangerous goods class 3	85
8.5	Storing 200 m³ or more of chemicals that are liquids, other than chemicals mentioned in items 1 to 3, under subsection (1)(d)	31
14	Electricity Generation	TBC
15	Fuel Burning	TBC
16	Extractive and Screening Activities	TBC
17	Abrasive Blasting	16
18(a)	Boiler Making	Nil
21	Motor Vehicle Workshop Operation	TBC
31	Mineral processing (2) processing, in a year, the following quantities of mineral products, other than coke- (b) more than 100,000t	280
33	Crushing, milling, grinding or screening	Nil

ERA number	ERA description (Refer to Schedule 2 and Schedule 6 – (Environmental Protection Regulation 2008)	Aggregate Environmental Score
38	Surface Coating	TBC
43	Concrete Batching	TBC
50	Bulk Material Handling	TBC
56	Regulated waste transport	7
60	Waste Disposal	TBC
63	Sewage Treatment – operating sewage treatment works, other than no-release works, with a total daily peak design capacity 100 to 1500 equivalent persons.	53
65	Water Treatment	TBC
ERAs defined in Schedule 6 of the Environmental Protection Regulation 2008		
5.	Mining Black Coal	128

Note: Asphalt and concrete batching at present will be carried out as mobile and temporary ERAs. TBC – AES to be confirmed based on activity requirements.

13.5.4 Other Obligations

A range of other obligations are in place under legislation and are shown in Table 13-9.

Table 13-9 Other Obligations Register

Legislation	Obligation
EP Act	Notification of notifiable activities
NGER Act	Reporting of greenhouse gas emissions
EEO Act	Reporting of energy use and opportunities to reduce
Native Title Act	Indigenous land use agreement in place and implemented
NEPC Act	National Pollutant Inventory reporting
ACH Act	Cultural heritage management plan
LP Act	Management of Class 2 and 2 declared weeds
EP Act	Authorised officers under the EP Act must be allowed entry to the mine on request and must be given all reasonable assistance.
Queensland *Clean Energy Act 2008*	Conduct of an energy audit and preparation of an energy savings plan. Publication of information on energy savings plan
Forestry Act 1959	Notify NRM of forest and quarry products on State land within the mining lease

13.6 Performance Outcomes and Indicators

Performance outcomes and indicators are identified in each of the environmental management subplans within this EMP under Section B.

These objectives and targets have been developed in accordance with HSE Management Standard HSE-ST-02 Planning, Objectives and Legal Obligations. They aim to be:

- Specific to the project
- Quantified and measurable
- Realistic and achievable
- Focused on continual HSE improvement
- Consistent with, and related to, Adani's Environment and Sustainability Policy and the Adani HSE Management Standards
- Periodically reviewed and, if required, revised.

Performance indicators will be reviewed annually as part of the EMP annual review (Section 13.34.4).

13.7 Corrective Actions

Adani HSE Compliance Guideline HSE-CG-005 requires that Adani implements a corrective action process consisting of the following steps:

- identification of a problem (failure or deficiency);
- root cause analysis to identify causes and determine solutions;
- decision as to the appropriate action;
- application and documentation of corrective or preventative action; and
- follow-up and evaluation.

Corrective actions in relation to environmental management may arise from:

- Recommendations and outcomes of incident investigation reports, including investigations into incidents, near misses and non-compliances
- Reviews of monitoring results indicating that performance requirements are not being met and/or that trends indicate that environmental degradation may be occurring
- Checks and inspections (note that minor corrective actions identified through checks and inspections will generally be resolved on the spot) (see Section 13.34.6)
- Identification of hazards or improvement opportunities (see also HSE-CG-009)
- Audit recommendations (see Section 13.34.7)
- Complaints.

Corrective actions will be raised through Adani's HSE notification system or through a separate corrective action register if required for contractors not operating under Adani's HSE system. Completion and close out of corrective actions will be reported at Mine management meetings.

13.8 Training, Competency and Awareness

13.8.1 Overview

System requirement sin relation to HSE training and competency are set out in Adani HSE Compliance Guideline HAS-CG-003. In accordance with the compliance guideline, a training needs assessment will be undertaken once organisational structures are confirmed for each of the construction and operation phases of the mining activity. Interim requirements are set out in this Section.

Trainers will hold appropriate accreditations or be otherwise appropriately qualified and experienced in the training topic to deliver the training. The provision of training will be in accordance with the Adani's HSE Management Standard HSE-ST-03 - Training and Competence.

13.8.2 Induction Training

All employees and contractors other than short term visitors will receive environmental induction training on commencement, and then annual environmental awareness training, covering:

- An overview of environmental values of the site
- Key environmental impacts and risks associated with construction/operation
- Legislative and other responsibilities, including the general environmental duty;
- How to conduct task-based environmental risk assessment;
- Work permit requirements in relation to any non-routine works
- Waste management and minimisation, including segregation and storage of wastes;
- erosion and sediment control and protection of watercourses;
- fauna interactions;
- weed hygiene requirements
- Aboriginal cultural heritage awareness;
- storage and handling of environmentally hazardous materials;
- spill prevention and response;
- fire prevention and response
- energy and water conservation; and
- incident notification and reporting requirements.

A visitor induction will be given to visitors and short term contractors not engaging in ground-disturbing activities covering:

- general compliance obligations
- key environmental risks and impacts
- management and minimisation of waste
- Work permit requirements
- incident reporting and response.

13.8.3 Construction Training Matrix

A preliminary training matrix has been developed for construction activities and is shown in Table 13-10.

Table 13-10 Construction Training and Competency Matrix

Training	CEO	Adani senior project management	Adani Contract Management Team	Adani Environmental Manager and team	Construction Managers and supervisors	Construction workers and all other staff	Contractor Environmental Managers and Officers	Emergency Response teams	Visitors
Short induction								AR	M
Adani HSE Management System	M	M	M	M	M		M	AR	
Legal and other obligations	M	M		M	M		M	M	
Degree qualification – environmental management				M			M		
Dangerous goods storage and handling				M	M	AR	M	M	
Waste management and minimisation			M	M	M	AR	M		
Spill prevention and response				M	M	M	M	M	
Fire fighting				AR	AR	AR	AR	M	
Vegetation clearing and in-stream work procedures				M	M	M	M		
Erosion and sediment control				M	M	M	M		

Training	CEO	Adani senior project management	Adani Contract Management Team	Adani Environmental Manager and team	Construction Managers and supervisors	Construction workers and all other staff	Contractor Environmental Managers and Officers	Emergency Response teams	Visitors
Energy and water conservation, including vehicle operation to minimise energy consumption			M	M	M	AR	M		
Cultural heritage awareness and monitoring		M		M	M	M	M		
Work permit requirements		M		M	M	M	M		
Introductory training – new or substantially amended procedures		AR	AR	AR	AR	AR	M		
Tool box talks – environmental topics including minor changes to compliance and management requirements and procedures	AR	M	M	M	M	M	M		AR

M = mandatory

AR = As relevant to work requirements

13.8.4 Operations Training Matrix

A preliminary training matrix has been developed for operation activities and is shown in Table 13-11.

Table 13-11 Operation Training and Competency Matrix

Training	Australian Manager	Mine General Manager	Mine Area Managers	Procurement Manager	Mine supervisors	Employees and contractors	Environmental Managers and Officers	Emergency Response Teams	Visitors
General induction	M	M	M	M	M	M	M	M	
Annual environmental awareness training		M	M	M	M	M	M	M	
Short induction									M
Adani HSE Management System		M	M	AR	M		M	M	
Legal and other obligations	M	M	M	AR	M	AR	M	M	
Degree qualification – environmental management							M		
Dangerous goods storage and handling		AR	M		AR	AR	M	M	
Waste management and minimisation		M	M	M	M	M	M		

Training	Australian Manager	Mine General Manager	Mine Area Managers	Procurement Manager	Mine supervisors	Employees and contractors	Environmental Managers and Officers	Emergency Response Teams	Visitors
Spill prevention and response		M	M		M	M	M	M	
Fire fighting		AR	AR		AR	AR	AR	M	
Vegetation clearing and in-stream work procedures			M		M	AR	M		
Erosion and sediment control			M		M	AR	M		
Energy and water conservation, including vehicle operation to minimise energy consumption		M	M	M	M	AR	M		
Cultural heritage awareness and monitoring		M	M		AR	AR	M		
Work permit requirements		M	M		M	M	M		
Tool box talks – environmental topics including minor changes to compliance and management requirements and procedures	AR	M	M	M	M	M	M	M	M
Introductory training – new or substantially amended procedures		M	M	M	M	M	M		

M = mandatory

AR = As relevant to work requirements

13.9 Communication and Reporting

13.9.1 External

External reporting is expected to be required in response to legislative requirements. Initial reporting requirements are set out in Table 13-12 and this will be updated based on conditions of approval.

Table 13-12 External Environmental Reporting Requirements

Reporting Trigger	Report Content	Report Recipient	Adani Responsibility
Annual return under environmental authority	Compliance with environmental authority requirements	DEHP	Mine General Manager
NGER	Energy consumption	Clean Energy Regulator	Mine General Manager
NPI	Pollutant emissions	DEHP	Mine General Manager
Incidents causing actual or potential environmental harm	Incident investigation and corrective actions	DEHP	Environmental Manager

The Social Impact Management Plan (SIMP) contains a broader stakeholder engagement plan, including:

- Engagement with local and regional emergency services representatives
- Complaints and inquiries.

In accordance with the Corporations Act 2001, Adani's annual report will include compliance with environmental requirements.

13.9.2 Internal – Adani Corporate

Corporate communications will take place in accordance with HSE system requirements.

13.9.3 Internal – Site

Within the Carmichael Coal Mine, communications regarding environmental matters will include:

- Environmental compliance, incidents, initiatives and corrective actions as agenda items in all management meetings
- Regular toolbox talks on environmental matters
- Environmental inductions and other training as described in Section 13.8.2.

- Incorporation of environmental risk assessment and management into all risk assessment activities
- Posting of information on environmental issues, impacts and performance on noticeboards
- Inclusion of environmental performance and issues in weekly, monthly and annual reports.

13.10 Documentation, Document Control and Records

Document control in relation to environmental management will be through the site HSE system as set out in HSE-CG-008. This EMP and all associated sub plans, documents and registers will be controlled documents subject to unique document identifiers and version control. The corrective action register will be managed through a database to ensure that updates on the status of corrective actions are available to managers and supervisors.

Other documentation and records to be retained will include:

- Incident investigation reports
- Completed site checklists
- Records of training and induction
- Audit reports
- All monitoring records.

Monitoring records in relation to the environmental authority must be retained for five years and must be available for provision to the administering authority within 10 business days of any request.

The document control and records management system will meet the requirements of Adani's HSE Management Standard HSE-ST-04 Documentation, Document Control and Records.

13.11 Work Permits

In accordance with HSE-CG-036, any non-routine activities that might adversely affect the environment must not be performed without a work permit.

Non-routine works which have potential to cause environmental harm may include:

- any ground disturbing activity
- activities involving use of environmentally hazardous substances
- activities in areas of native vegetation
- activities in or immediately adjacent to streams and watercourses
- activities within or adjacent to Category A or B environmentally sensitive areas
- activities that might generate hazardous wastes or large quantities of non-hazardous wastes
- activities carried out in close proximity to residential dwellings.

The following matters will be covered as part of the process of issue of a work permit:

- any legislative approval requirements and whether these approvals are in place
- conditions of approvals or permits that might apply to the activity

- whether there are any cultural heritage, flora or fauna monitoring requirements
- opportunities to minimise waste generation or energy consumption
- measures to prevent environmental impacts, including:
  - impacts on environmentally sensitive areas
  - accidental clearing of vegetation
  - erosion and sediment release
  - accidental release of hazardous substances to land, water or air
  - measures to prevent noise or dust emissions exceeding the environmental authority or other legislated requirements
  - improper disposal of waste
- any requirements in relation to incident response, such as spill kits and PPE.

During construction, environmental and approval requirements will be part of a quality system to ensure that all relevant approvals and other requirements are in place before construction commences.

13.12 Monitoring and Reporting

13.12.1 Summary of Environmental Monitoring Requirements

Environmental monitoring requirements are set out in each sub plan within this EMP. Table 13-13 provides a contextual summary of the required monitoring programs across the various project phases.

Table 13-13 – Summary of Monitoring Requirements

Element	Pre-construction	Construction	Operation
Meteorology	✓	✓	✓
Air quality	✓	✓	✓
Greenhouse gas and energy		✓	✓
Noise and vibration		✓	✓
Surface water	✓	✓	✓
Groundwater	✓	✓	✓
Mine waste			✓
General and hazardous waste		✓	✓
Terrestrial ecology	✓	✓	✓
Aquatic ecology	✓	✓	✓

Element	Pre-construction	Construction	Operation
Scenic amenity		✓	✓
Erosion and sediment control		✓	✓
Contaminated land		✓	✓
Topsoil management		✓	✓
Cultural heritage	✓	✓	✓
Subsidence areas			✓
Transport		✓	✓

13.12.2 Checks and Inspections

13.12.2.1 Design and Preconstruction

During the design and pre-construction phase, monthly reviews will be undertaken against requirements of this EMP. A design checklist will be developed to document how design and pre-construction requirements have been met.

13.12.2.2 Construction and Operations

A site inspection will be conducted weekly by Adani's environmental team. Inspections will be carried out to assess project activities against compliance requirements set out in the Environmental Authority and this EMP.

Inspections will be documented on a checklist that will record whether the performance requirement for each item was achieved and corrective actions required to achieve the performance requirement. Where the non-conformance does not present a significant risk of environmental harm, and can be corrected promptly, the corrective action will be closed out on the checklist. Where the risk of environmental harm is more significant and/or the corrective action cannot be undertaken promptly, the action will be recorded in the corrective action register.

Where an incident or near miss is observed during checks, the incident investigation and reporting procedure will be followed.

Environmental inspection processes will meet the requirements of Adani's HSE Management Standard HSE-ST-18 Reviews, Audits and Inspections.

13.12.3 Audits

13.12.3.1 Overview

Adani HSE Compliance Guideline HSE-CG-004 sets out requirements for audits of performance. An audit program has been developed to meet these requirements.

The following standards may be relevant to auditing activities:

- AS/NZS ISO 14012-1996 Guidelines for Environmental - Qualification Criteria for Environmental Auditors
- AS/NZS ISO 14015-2003 Environmental Management – Environmental Assessment of Sites and Organizations
- AS/NZS ISO/IEC 17021:2011 Conformity assessment - Requirements for bodies providing audit and certification of management systems
- AS/NZS ISO 19011-2003 Guidelines for Quality and/or Environmental Management Systems Auditing
- ISO 19011:2011 Guidelines for auditing management systems.

Draft audit reports will be reviewed by the Environmental Manager. Once an audit report is finalised:

- Audit reports will be circulated to the mine manager and area managers
- Recommendations will be entered into the corrective action register
- Findings will be discussed at management meetings
- Where relevant, findings will be presented as tool box talks
- Reports and findings will be tabled at management reviews (Section 13.13.1)
- Any non-compliances that are required to be reported under legislation or conditions of approval will be reported.

Audits may be carried out in conjunction with audits for the off-site infrastructure.

13.12.3.2 Construction

Auditing during construction will depend on the contracting strategy selected and whether contractors and subcontractors operate under Adani's HSE system or the contractor's own environmental management system.

If contractors/subcontractors are utilising their own environmental management systems, Adani will conduct audits on a six monthly basis, or for shorter duration contracts, at least once during the contract duration. These audits will cover:

- Contractor's compliance with legal and other obligations
- Whether contractor's management plans have appropriately identified environmental impacts and risks
- Whether roles, responsibilities and training and competency requirements have been identified and followed
- Whether adequate management and control strategies are in place to achieve compliance with legal requirements and performance requirements documented in this EMP
- Whether management and control strategies are being implemented
- Monitoring approaches and outcomes, and identification and implementation of corrective actions
- Adequacy of record keeping and reporting.

It would also be expected that contractors will have internal and external audit programs.

If contractors and subcontractors are utilising Adani's HSE system, system compliance audits will be conducted based on audit requirements identified in Section 13.12.3.

13.12.3.3 Operation

Environmental audit processes will meet the requirements of Adani's HSE Management Standard HSE-ST-18 Reviews, Audits and Inspections. A preliminary audit schedule for the Carmichael Coal Mine off-site infrastructure has been developed and is shown in Table 13-14. Where audit outcomes and recommendations require corrective actions, these will be entered into the corrective action register.

Table 13-14 – Preliminary Audit Schedule

Audit Type	Scope	Frequency
System audit	Audit against Adani EHS system requirements ISO 14001 accreditation audit	As agreed with certification body, externally no less than annually
Compliance audit	Confirm that legal and other obligations have been correctly and fully identified and that appropriate management and control strategies are in place and being implemented to meet requirements, including conditions of approval.	Bi-annual or if significant legislative changes occur
Waste audit	Review waste generation types and quantities and waste management practices and identify opportunities to further minimise waste generation or to reduce the environmental impacts associated with waste management.	Bi-annual
Energy audit	Review energy consumption and identify opportunities to reduce energy consumption and/or associated greenhouse gas emissions. If greenhouse gas emission reduction programs are in place, review progress against commitments made. The audit must meet the requirements of AS/NZS 3598-2000 Energy Audits and requirements under the NGER Act and any other legislative requirements in relation to energy consumption and greenhouse gas emission reporting.	Annual

Audit Type	Scope	Frequency
Environmental monitoring review	Review results of environmental monitoring activities. Identify whether environmental performance requirements are achieved, and whether degradation of values or resources has occurred that may be attributable to the mining activity. Identify further investigations and/or corrective actions.	Annual
General environmental audit	◗ Environmental impacts and risks have been correctly identified ◗ Management controls are effective in managing the impacts and risks identified ◗ EMP is consistent with environmental authority conditions ◗ Environmental management requirements are being implemented and evidence is available.	Six Monthly

13.13 Reviews

13.13.1 Management Review

Adani's HSE management system requires HSE management reviews to be carried out at least twice per year (HSE-CG-011). Participants are to include Adani's senior management team.

In relation to the environmental component of the management review, the management review will examine:

- Adequacy and effectiveness of the EMP
- Compliance with Adani HSE management system
- Opportunities for improvement
- Opportunities for waste minimisation.

Inputs to the management review will include:

- Results of monitoring and audits
- Status of achievement of performance requirements and indicators
- Summary of environmental incidents, non-compliances and complaints
- Status of corrective actions
- Communications and complaints
- Follow up of actions from previous management review

- Significant changes affecting environmental management, including legislation and policy changes.

Decisions and actions arising from the management review will be documented and actions will be entered into the corrective action register.

13.14 EMP Reviews

13.14.1 Annual Review

The EMP will be reviewed at least annually and updated to reflect:

- Changes in legislative requirements (including conditions of approvals)
- Environmental performance
- Outcomes of audits
- Outcomes of incident investigations
- Changes in external and internal policies, standards and guidelines
- Changes in requirements of Adani HSE management system
- Any organisation changes such as changes in organisational structure
- Outcomes of the management review.

The review will ensure the continuing suitability, adequacy and effectiveness of the EMP and the HSE Management System. The review will include assessing opportunities for improvement.

Intermediate updates may also be undertaken in response to corrective actions or other changes that need to be addressed urgently.

Amendments to the EMP will be communicated to all staff through management meetings and tool box talks.

13.14.2 Review of Legal and Other Obligations

Legal and other obligations will be reviewed quarterly and whenever a major legislation or policy change occurs. The EMP will be updated as required to maintain compliance and any new requirements will be communicated to managers and staff through management meetings, special communications and tool box talks.

13.15 General Environmental Authority Conditions

13.15.1 Department Interest: General

Financial assurance

A1 Provide to the administering authority financial assurance for the amount and in the form acceptable to the administering authority in accordance with the most recent edition of the administering authority's Guideline – *Calculating financial assurance for mining projects*, before the proposed mining activities can commence or be varied.

A2 The amount of financial assurance must be reviewed by the holder of this Environmental Authority when a plan of operations is amended or replaced or the Environmental Authority is amended.

A2 The financial assurance is to remain in force until the administering authority is satisfied that no claim on the assurance is likely.

NOTE: Where progressive rehabilitation is completed and acceptable to the administering authority, progressive reductions to the amount of financial assurance will be applicable where rehabilitation has been completed in accordance with the acceptance criteria defined within this EA.

Prevent and/or minimise likelihood of environmental harm

A3 In the carrying out of the environmentally relevant activities, the Environmental Authority holder must take all reasonable and practicable measures to prevent and / or minimise the likelihood of environmental harm caused. Any environmentally relevant activity, that, if carried out incompetently, or negligently, may cause environmental harm, in a manner that could have been prevented, shall be carried out in a proper manner in accordance with the conditions of this Environmental Authority.

Coal Extraction

A4 The Environmental Authority holder is approved for a coal extraction rate of up to 60 million tonnes per annum (mtpa) of product coal in accordance with this Environmental Authority.

Maintenance of measures, plant and equipment

A5 The Environmental Authority holder must:

a) install all measures, plant and equipment necessary to ensure compliance with the conditions of this Environmental Authority;

b) maintain such measures, plant and equipment in a proper and efficient condition; and

c) operate such measures, plant and equipment in a proper and efficient manner.

A6 No change, replacement or alteration of any plant or equipment is permitted if the change, replacement or alteration increases, or is likely to substantially increase, the risk of unlawful environmental harm caused by the mining activities.

NOTE: Change in this case does not refer to trivial changes e.g. a larger and stronger item of equipment replaces a small and out-dated item of equipment, it takes up a slightly larger area (i.e. Creating a larger area of disturbance, covered by the plan of operations).

Monitoring and records

A7 Except where specified otherwise in another condition of this authority, all monitoring records or reports required by this Environmental Authority must be kept for a period of not less than 5 years.

A8 Upon request from the administering authority, copies of monitoring records and reports must be made available and/or provided to the administering authority's nominated office within 10 business days or by an alternative timeframe agreed between the administering authority and the holder.

A9 Any management or monitoring plans, systems or programs required to be developed and implemented by a condition of this Environmental Authority must be reviewed for effectiveness in minimising the likelihood of environmental harm on a programmed basis, and amended promptly if required, unless a particular review date and amendment program is specified in the plan, system or program.

Notification of emergencies, incidents and exceptions

A10 All reasonable actions are to be taken to minimise environmental harm, or potential environmental ham, resulting from any emergency, incident or circumstances not in accordance with the conditions of this Environmental Authority.

A11 The holder of this Environmental Authority must notify the administering authority by written notification within 24 hours, after becoming aware of any emergency, incident or information about circumstances which results or may result in environmental harm not in accordance with the conditions of this Environmental Authority or a contravention of the conditions of this Environmental Authority.

A12 The notification in condition A11 must include, but not be limited to, the following:

a) the Environmental Authority number and name of the holder;

b) the name and telephone number of the designated contact person;

c) the location of the emergency or incident;

d) the date and time of the emergency or incident;

e) the time the holder of the Environmental Authority became aware of the emergency or incident;

f) where known:

   (i) the estimated quantity and type of substances involved in the emergency or incident;

   (ii) the actual or potential cause of the emergency or incident;

   (iii) a description of the nature and effects of the emergency or incident including environmental risks, and any risks to public health or livestock;

g) any sampling conducted or proposed, relevant to the emergency or incident;

h) immediate actions taken to prevent or mitigate any further environmental harm caused by the emergency or incident; and

i) what notification of stakeholders who may be affected by the emergency or incident has occurred or is being undertaken.

A13 Not more than 14 business days following the initial notification of an emergency, incident or information about circumstances which result or may result in environmental harm or the release of contaminants, written advice must be provided to the administering authority in relation to:

a) results and interpretation of any samples taken and analysed; and

b) proposed actions to prevent a recurrence of the emergency or incident.

Activity

A15 All land subject to mining activities must be rehabilitated to a non-polluting, safe, stable and self sustaining landform.

A16 Contaminants must not be released to the receiving environment unless they are in accordance with the contaminant limits authorised by this Environmental Authority.

A17 This Environmental Authority authorises environmental harm referred to in the conditions. Where no condition exists or this Environmental Authority is silent on matter, the lack of a condition or silence does not authorise environmental harm.

A18 The only mining activities to be carried out under this Environmental Authority are the mining activities defined within the parameters in Table 13-1: Mining Activities and identified in Volume 2 Section 2 Project Description

NOTE: Variation of mining activities to those identified within the conceptual designs is considered to be in accordance with these conditions as long as the variation is not significantly different to the conceptual design or causes a significant increase in environmental harm.

Definitions

A19 Words and phrases used throughout this Environmental Authority are defined in the Definitions section of this authority. Where a definition for a term used in this Environmental Authority is sought and the term is not defined within this Environmental Authority, the definitions in the *Environmental Protection Act 1994,* its regulations and policies must be used.

13.16 Air Quality

13.16.1 Legislative Framework

Air quality is managed through a framework established under the *Environmental Protection Act 1994*:

- The EP Act includes general objectives in relation to preserving environmental values in relation to air quality
- Under the EP Act, the *Environmental Protection (Air) Policy* 2008 (EPP (Air)) is established and sets out objectives in relation to air quality
- Under the EP Act, mining activities are required to hold an environmental authority. In issuing an environmental authority, the regulator must have regard to the extent to which the activity meets the objectives established under the EPP (Air). The environmental authority will then contain conditions in relation to air quality.

Occupational exposure to air contaminants is managed through the *Coal Mining Safety and Health Act 1999* (CMSH Act) and is not discussed further in this EMP.

The Commonwealth government has also established non-statutory air quality standards in the National Environmental Protection Measure (Ambient Air Quality).

The national pollutant inventory is established through a national environmental protection measure under the Federal *National Environment Protection Council Act 1994*. Carmichael Coal mine will trigger thresholds for reporting a range of air emissions under this scheme.

13.16.2 Environmental Values

Broad environmental values in relation to air quality are established in the EPP (air):

(a) the qualities of the air environment that are conducive to protecting the health and biodiversity of ecosystems; and

(b) the qualities of the air environment that are conducive to human health and wellbeing; and

(c) the qualities of the air environment that are conducive to protecting the aesthetics of the environment, including the appearance of buildings, structures and other property; and

(d) the qualities of the air environment that are conducive to protecting agricultural use of the environment.

In relation to the proposed mining activity, the key contaminant of concern is particulate matter. Relevant air quality objectives in relation to particulate matter at sensitive receptors is shown in Table 13-15.

Table 13-15 Ambient Air Quality Objectives (1) and the Criterion for Dust Deposition (2)

Pollutant	Objective	Averaging period
Total suspended particulates	90 µg/m^3	Annual
Particulate matter <10 µm (PM10)	50 µg/m^3	24 hour (3)
Particulate matter <2.5 µm (PM2.5)	25 µg/m^3	24 hour
Particulate matter <2.5 µm (PM2.5)	8 µg/m^3	Annual
Dust deposition	120 mg/m^2/day	Monthly

1. From EPP Air
2. Typical standard applied by Queensland Department of Environment and Heritage
3. Five exceedences are allowed per year

The proposed mine is located in an isolated rural area with a small number of sensitive receptors as follows:

- Off-site industrial precinct (Adani) 4 km east of the ML boundary
- Workers Accommodation Village (Adani) 12 km east of the ML boundary
- Bygana homestead 4.9 km east of the ML boundary
- Lignum homestead 1.4 km east of the ML boundary
- Mellaluka homestead 9.8 km south of the ML boundary
- Doongmabulla homestead 6.6 km west of the ML boundary
- Carmichael homestead 11.8 km west of the ML boundary.

Particulate matter levels in the area are typical of moderate-low rainfall rural areas. Sources of atmospheric dust include wind blown erosion (crustal dust) and smoke from fires.

13.16.3 Potential Impacts

13.16.3.1 Construction

Table 13-16 Potential Environmental Impacts – Construction

Activity	Potential Environmental Impact
Vegetation clearing and earthworks	Particulate levels are not expected to exceed air quality and dust deposition objectives at sensitive receptors during construction

13.16.3.2 Operations

Table 13-17 Potential Environmental Impacts – Operation

Activity	Potential Environmental Impact
Mining, hauling and stockpiling of coal	Particulate levels are not expected to exceed air quality and dust deposition objectives at sensitive receptors during operation PM10 and PM2.5 objectives may be exceeded at the off-site industrial area and airport at some stages of mining. Dust deposition may be exceeded at the off-site industrial area at some stages of mining It is possible that Lignum homestead may be affected by dust as the mine extends southwards. It is possible that PM2.5 levels may be exceeded at Doongmabulla homestead at some stages of mining

13.16.4 Performance Outcome

Meet EPP (Air) objectives for dust emission at sensitive receptors as per Table 13-15.

Not cause nuisance from dust deposition at sensitive receptors

13.16.5 Proposed Controls

13.16.5.1 Design, Procurement and Pre-construction

Control	Responsibility	Timing	Evidence
Install a meteorological monitoring station	Environmental manager	Prior to commencement of construction	Meteorological station in place
Plan construction activities and sequencing such that the area of exposed soils is minimised	Construction manager	Prior to commencement of construction	Earthworks schedule
Design temporary and permanent stockpiles (topsoil, spoil and coal) to minimise cross sectional area presented to the prevailing wind direction wherever space permits	Design manager	Prior to finalisation of detailed design	Design checklist
Design dust suppression systems for coal stockpiles (ROM and product)	Design manager	Prior to finalisation of detailed design	Design checklist
Include coal spillage detectors and train wash systems at the train load out	Design manager	Prior to finalisation of detailed design	Design checklist
Include partial enclosure on crushers and train load out.	Design manager	Prior to finalisation of detailed design	Design checklist
Identify obligations for national pollutant inventory (NPI) reporting and ensure that mechanisms are in place to collect required data.	Environmental Manager	Prior to commencement of construction	Monitoring records

13.16.5.2 Construction

Control	Responsibility	Timing	Evidence
Regularly service vehicles, plant and equipment such that exhaust systems and fuel consumption comply with manufacturers' specifications	Construction manager(s)	As per manufacturer's specifications	Vehicle logs
Minimise areas of exposed soil where possible	Construction manager	Ongoing	Earthworks schedule Visual inspection
Stabilise topsoil stockpiles if left in place for longer than four weeks. Methods may include covering and planting of native grasses or sterile grasses.	Construction manager	Ongoing	Topsoil management register Visual inspection
Utilise water sprays to control dust on access tracks, work areas and stockpiles. Water may be sourced from raw water supply or treated wastewater. If treated wastewater is used, further protocols may be required to minimise worker exposure to water droplets	Construction manager	Ongoing	Visual inspection

13.16.5.3 Operations

Control	Responsibility	Timing	Evidence
Plan mining activities so that exposed soil is minimised	Mine manager	Annual mine planning review	Mine plan
Operate coal stockpile dust suppression systems such that minimal dust generation is observed	Mine manager	Ongoing	Visual inspection
Stabilise topsoil stockpiles if left in place for longer than four weeks. Methods may include covering and planting of native grasses or sterile grasses.	Mine manager	Ongoing	Topsoil management register

Control	Responsibility	Timing	Evidence
Use chemical sprays or sealants on unsealed haul roads where possible	Mine manager	Ongoing	Visual inspection
Utilise water sprays to control dust on haul roads, access tracks, work areas and stockpiles. Water may be sourced from raw water supply or treated wastewater. If treated wastewater is used, further protocols may be required to minimise worker exposure to aerosols, depending on treatment level	Mine manager	Ongoing	Visual inspection
Progressively rehabilitate disturbed areas and ex-pit stockpiles as per rehabilitation plan (Section 13.34)	Mine manager	Ongoing	Rehabilitation register
During high wind speed conditions: ◗ Avoid blasting if possible ◗ Reduce drop heights on draglines if required to reduce dust emissions	Mine manager	In high wind conditions	Visual inspection
Record emissions required to be reported under the National Pollutant Inventory reporting scheme on the waste register	Mine manager	Ongoing	Waste register

13.16.6 Monitoring and Corrective Action

Table 13-18 Air Quality Monitoring and Corrective Action

Monitoring action	Responsibility	Frequency	Performance Requirement	Potential Corrective Action
Dust deposition monitoring at three downwind and one upwind location, with locations to be moved as mining progresses	Environmental Manager	Ongoing, data collected monthly	Dust deposition does not exceed 120 mg/m^2/day (monthly average)	Investigate potential causes Develop mitigation measures to address dust deposition. This may include actions taken at the receptor location. Monitor ambient dust levels to check that residential receptors are not exposed to respirable dust levels in excess of EPP (Air) objectives.
Ambient air quality (PM10) at the workers accommodation village, a suitable upwind location and downwind location on the boundary, to be moved as mining progresses.	Environmental Manager	Continual as mining approaches these locations	PM2.5 and PM10 as per Table 13-15.	Investigate possible causes using an interactive dust emissions model Develop mitigation measures to address ambient dust levels. This may include actions taken at the receptor location.

Monitoring action	Responsibility	Frequency	Performance Requirement	Potential Corrective Action
Visually monitor coal stockpiles for dust lift off.	Supervisors Environmental officers	Ongoing	Dust lift off is not travelling beyond the lease boundary Water sprays are in operation and effective	Re-configure water spray system to achieve better coverage Increase application of water sprays Reduce vehicle speeds on haul roads
Visually monitor spoil stockpiles for dust lift off	Supervisors Environmental officers	Ongoing	Dust lift off is not travelling beyond the lease boundary Water sprays are in operation and effective	Re-configure water spray system to achieve better coverage Increase application of water sprays Stabilise surfaces through temporary or permanent revegetation
Visually monitor haul roads for dust lift off	Supervisors Environmental officers	Ongoing	Dust lift off is not travelling beyond the lease boundary Chemical suppressants or sealants are regularly applied	Increase application of chemical suppressants or sealants Reduce vehicle speeds on haul roads Consider sealing haul roads

Monitoring action	Responsibility	Frequency	Performance Requirement	Potential Corrective Action
Visually monitor minor access roads and other disturbed areas for dust lift off	Supervisors Environmental officers	Ongoing	Dust lift off is not travelling beyond the lease boundary Water trucks are actively applying water	Increase application of water sprays Rehabilitate or stabilise surfaces
Monitor meteorological conditions (temperature, wind, rainfall)	Environmental officer	Ongoing	NA	None required
Review meteorological data for changes from baseline or trends	Environmental officer	Annual	Significant changes from baseline	If significant changes or trends are emerging, check design aspects that respond to meteorological conditions, including sizing and operation of water management systems. Make adjustments as necessary to address climate changes

Monitoring action	Responsibility	Frequency	Performance Requirement	Potential Corrective Action
Inspect train loading	TLO supervisor	Each train	Wagons are not overloaded External aspects of trains and wagons do not generate dust	Remove overloaded material Adjust settings on automated load out equipment Clean trains/wagons
Monitor air emissions as required under the NPI scheme	Environmental Manager	Annual	NPI report is submitted	NA

13.16.7 Proposed Environmental Authority Conditions

Dust nuisance

B1 The release of dust and/or particulate matter resulting from the mining activity must not cause an environmental nuisance at any sensitive or commercial place.

B2 Dust and particulate matter must not exceed any of the following levels when measured at any sensitive or commercial place:

a) Dust deposition of 120 milligrams per square metre per day, averaged over one month, when monitored in accordance with the most recent version of Australian Standard AS 3580.10.1 *Methods for sampling and analysis of ambient air – Determination of particulate matter – Deposited matter – Gravimetric method*;

b) A concentration of particulate matter with an aerodynamic diameter of less than 10 micrometres (PM10) suspended in the atmosphere of 50 micrograms per cubic metre over a 24 hour averaging time, can be exceeded no more than five (5) times per year at a sensitive or commercial place downwind of the operational land when monitored in accordance with the most recent version of Australian Standard AS 3580.9.6 *Methods for sampling and analysis of ambient air - Determination of suspended particulate matter – PM (sub) 10 high volume sampler with size-selective inlet – Gravimetric method*;

If monitoring indicates exceedence of the relevant limits in Condition **B2**, then the Environmental Authority holder must:

a) address the complaint including the use of appropriate dispute resolution if required; and

b) immediately implement dust abatement measures so that emissions of dust from the activity do not result in further environmental nuisance.

Dust Management Plan

B3 As part of the Environmental Management Plan required for the project approval, the holder shall include a Dust Management Plan to outline measures to minimise and manage any impacts from the operation of the project on local air quality. The Plan shall include, but not necessarily be limited to:

a) identification of major sources of dust emissions that may occur as result of the operation of the project;

b) description of the procedures to manage the dust emissions from the sources identified;

c) identifying adverse meteorological conditions likely to produce elevated levels of PM10 at a sensitive or commercial place due to the mining activities;

d) protocols for regular maintenance of plant and equipment, to minimise the potential for fugitive dust emissions; and

e) description of procedures to be undertaken if any non-compliance is detected.

Odour nuisance

B4 The release of noxious or offensive odour(s) or any other noxious or offensive airborne contaminant(s) resulting from the mining activity must not cause an environmental nuisance at any nuisance sensitive or commercial place.

B5 When requested by the administering authority odour monitoring must be undertaken within a reasonable and practicable timeframe nominated by the administering authority to investigate any complaint (which is neither frivolous nor vexatious nor based on mistaken belief in the opinion of the authorised officer) of environmental nuisance at any sensitive or commercial place and the results must be notified within 14 days to the administering authority following completion of monitoring.

B6 If the administering authority determines the odour released to constitute an environmental nuisance the Environmental Authority holder must:

a) address the complaint including the use of appropriate dispute resolution if required; and

b) immediately implement odour abatement measures so that emissions of odour from the activity do not result in further environmental nuisance.

Meteorological monitoring

B7 The Environmental Authority holder must maintain a permanent automatic meteorological station to continuously measure and record wind speed, wind direction, temperature, relative humidity and daily rainfall.

B8 The holder must record, compile and keep all monitoring records obtained from the automatic meteorological station.

13.17 Greenhouse Gas Emissions

13.17.1 Legislative Framework

The legislative framework relevant to energy, carbon and greenhouse gas management includes:

- Commonwealth *Clean Energy Act 2011* – establishes the carbon pricing mechanism and deals with assistance for emissions intensive trade-exposed industries and the coal fired electricity generation sector;
- Commonwealth *Energy Efficiency Opportunities Act 2006* – sets out requirements for large energy using businesses, and allows for regulations to provide detailed requirements for assessment, reporting, verification and other elements of the Australian Government energy efficiency program;
- Commonwealth *National Greenhouse and Energy Reporting Act 2007* establishes a national system for reporting greenhouse gas emissions, energy consumption and production by corporations from 1 July 2008; and
- Queensland *Clean Energy Act 2008* – an Act to improve the efficiency and management of the use of energy, and the conservation of energy, in relation to particular businesses and other activities.

13.17.2 Environmental Values

Environmental values in relation to greenhouse gas emissions are not site specific, but rather, relate to global accumulation of greenhouse gases at levels that may cause climate change.

13.17.3 Potential Impacts

13.17.3.1 Construction

Table 13-19- Potential Environmental Impacts – Construction

Activity	Potential Environmental Impact
Operation of vehicles, plant and equipment using diesel or electricity	◗ Emissions of greenhouse gases to the atmosphere
Waste generation	◗ Loss of embodied energy and resources
Vegetation clearing	◗ Release of carbon stored in vegetation
Wastewater treatment	◗ Release of methane

13.17.3.2 Operations

Table 13-20 Potential Environmental Impacts – Operation

Activity	Potential Environmental Impact
Operation of vehicles, plant and equipment using diesel or electricity	◗ Emissions of greenhouse gases to the atmosphere
Waste generation	◗ Loss of embodied energy and resources
Vegetation clearing	◗ Release of carbon stored in vegetation
Use of explosives	◗ Release of carbon dioxide
Wastewater treatment	◗ Release of methane
Overbudren removal and exposure of coal to atmosphere	◗ Release of methane

13.17.3.3 Performance Outcome

Minimise the greenhouse gas emissions intensity arising from construction and operation of the Carmichael coal mine

13.17.4 Proposed Controls

13.17.4.1 Design, Procurement and Pre-construction

Table 13-21 Greenhouse Gas Emissions – Design, Procurement and Preconstruction Controls

Control	Responsibility	Timing	Evidence
Consider the following guidelines and rating schemes when designing buildings, infrastructure and other components of the mine: ◗ Building Code of Australia requirements, including insulation, building materials and energy efficiency ◗ National Australian Built Environment Rating System (NABERS) ◗ Australian Green Infrastructure Council rating scheme ◗ Green Building Council of Australia rating scheme.	Design manager	During design	Design checklist Building and infrastructure specifications
Incorporate fuel and material efficiency requirements into the procurement strategy, including: ◗ appropriate sizing, maintenance and selection of equipment ◗ purchase of used equipment where this leads to reduced greenhouse gas emissions over the equipment life ◗ minimisation of packaging ◗ consideration of the energy efficiency ratings of equipment. ◗ equipment, plant and vehicles that can use biodiesel	Procurement team	During procurement of equipment, plant and vehicles	Equipment, plant and vehicle specifications

Control	Responsibility	Timing	Evidence
Consider fuel consumption when planning transportation of materials and minimise transport distances wherever possible.	Procurement team	During procurement of equipment, plant and vehicles	Equipment, plant and vehicle specifications
Consider use of green power from the grid or on-site renewable energy generation	Design manager	During design	Design checklist Building and infrastructure specifications
Register Carmichael Coal Mine with the National Greenhouse and Energy Reporting scheme	Environmental Manager	Prior to commencement of mining activities	Registration
Register Carmichael Coal Mine in the Liable Entities Database	Environmental Manager	Prior to commencement of mining activities	Registration

13.17.4.2 Construction

Table 13-22 Greenhouse Gas Emissions - Construction Controls

Control	Responsibility	Timing	Evidence
Driver and operator training in relation to efficient operation of vehicles, plant and equipment	Construction manager	As required	Training register
Operation of vehicles, plant and equipment to minimise diesel	All staff	Ongoing	Diesel fuel consumption

Control	Responsibility	Timing	Evidence
consumption and wear and tear on parts			
Regularly service vehicles, plant and equipment such that exhaust systems and fuel consumption comply with manufacturers' specifications.	Construction manager and contractors	Ongoing	Vehicle maintenance records
Minimise transportation distances within the site wherever possible	Construction manager and contractors	Ongoing	Diesel fuel consumption
Operate and maintain air conditioning systems in accordance with manufacturer's instructions and Guide to Best Practice Maintenance & Operation of HVAC Systems for Energy Efficiency (Council of Australian Governments National Strategy on Energy Efficiency January 2012)	Construction manager and contractors	Ongoing	Maintenance records
Select vehicle size for worker transport to match group size and use buses for transporting larger groups	Construction manager and contractors	Ongoing	Diesel fuel consumption

13.17.4.3 Operations

Table 13-23 Greenhouse Gas Emissions - Operational Controls

Control	Responsibility	Timing	Evidence
Driver and operator training in relation to efficient operation of vehicles, plant and equipment	Mine manager	As required	Training register
Operation of vehicles, plant and equipment to minimise diesel consumption and wear and tear on parts	All staff	Ongoing	Diesel fuel consumption

Control	Responsibility	Timing	Evidence
Regularly service vehicles, plant and equipment such that exhaust systems and fuel consumption comply with manufacturers' specifications.	Area managers	Ongoing	Vehicle maintenance records
Minimise transportation distances within the site wherever possible	Area managers	Ongoing	Diesel fuel consumption
Operate and maintain air conditioning systems in accordance with manufacturer's instructions and Guide to Best Practice Maintenance & Operation of HVAC Systems for Energy Efficiency (Council of Australian Governments National Strategy on Energy Efficiency January 2012)	Area managers	Ongoing	Maintenance records
Select vehicle size for worker transport to match group size and use buses for transporting larger groups	Area managers	Ongoing	Diesel fuel consumption
Prepare and submit NGER reports	Environmental manager	Annually	Report
Prepare and submit reports under *Queensland Clean Energy Act 2008*	Environmental manager	Annually	Report
Purchase carbon units under the emissions trading scheme or offset emissions. Surrender carbon units to the Clean Energy Regulator.	CEO	Annually	Carbon credits

13.17.4.4 Monitoring and Corrective Action

Table 13-24 Greenhouse Gas Emissions - Monitoring and Corrective Action

Monitoring action	Responsibility	Frequency	Performance Requirement	Corrective Action
Conduct energy audits (see also Section 13.12.3)	Environmental manager	Annual or as required by legislation	Continuous improvement in energy use reduction	Review results and identify opportunities to reduce

Monitoring action	Responsibility	Frequency	Performance Requirement	Corrective Action
				energy consumption and greenhouse gas emissions
Monitor or all scope 1 emissions: ◗ Diesel consumption (litres) ◗ Explosives use (mass used) ◗ Wastewater treatment (volume treated) ◗ Fugitive methane emissions (per tonne of coal mined) ◗ Vegetation cleared (are and type)	Environmental manager	Annually	Accurate and auditable account of all scope 1 emissions	Improve monitoring and estimation methods
Monitor scope 2 emissions (electricity consumption)	Environmental manager	Annually	Accurate and auditable account of all scope 2 emissions	NA

13.17.5 Proposed Environmental Authority Conditions

No environmental authority conditions are proposed in relation to greenhouse gas emissions

13.18 Noise and Vibration

13.18.1 Legislative Framework

Ambient and environmental noise is managed through a framework established under the *Environmental Protection Act 1994*:

- The EP Act includes general objectives in relation to preserving environmental values in relation to air quality
- Under the EP Act, the *Environmental Protection (Noise) Policy 2008* (EPP (Noise)) is established and sets out objectives in relation to ambient noise levels and the acoustic environment
- Under the EP Act, mining activities are required to hold an environmental authority. In issuing an environmental authority, the regulator must have regard to the extent to which the activity protects the acoustic environment as defined in the EPP (Noise). The environmental authority will then contain conditions in relation to noise.
- The EP Act also contains some requirements in relation to noise nuisance, however these are unlikely to be applicable at this location given the absence of sensitive receptors.

Occupational exposure to noise is managed through the *Coal Mining Safety and Health Act 1999* (CMSH Act) and is not discussed further in this EMP.

13.18.2 Environmental Values

Environmental values for the acoustic environment that are to be protected or enhanced are established in the EPP (Noise) as follows:

(a) the qualities of the acoustic environment that are conducive to protecting the health and biodiversity of ecosystems; and

(b) the qualities of the acoustic environment that are conducive to human health and wellbeing, including by ensuring a suitable acoustic environment for individuals to do any of the following—

(i) sleep;

(ii) study or learn;

(iii) be involved in recreation, including relaxation and conversation; and

(c) the qualities of the acoustic environment that are conducive to protecting the amenity of the community.

The proposed mine is located in an isolated rural area with a small number of sensitive receptors as follows:

- Off-site industrial precinct (Adani) 4 km east of the ML boundary
- Workers Accommodation Village (Adani) 12 km east of the ML boundary

- Bygana homestead 4.9 km east of the ML boundary
- Lignum homestead 1.4 km east of the ML boundary
- Mellaluka homestead 9.8 km south of the ML boundary
- Doongmabulla homestead 6.6 km west of the ML boundary
- Carmichael homestead 11.8 km west of the ML boundary.

The existing noise environment is consistent with the quiet rural setting with background noise levels as shown in Table 13-25.

Table 13-25 Summary of Noise Monitoring Results

Location	Background L_{A90} dB(A)			Ambient L_{Aeq} dB(A)		
	Day (7 am to 6 pm)	Evening (6 pm to 10 pm)	Night (10 pm to 7 am)	Day (7 am to 6 pm)	Evening (6 pm to 10 pm)	Night (10 pm to 7 am)
Location A Doongmabulla	31	31	27	48	41	43

13.18.3 Potential Impacts

13.18.3.1 Construction

Table 13-26 Potential Environmental Impacts – Construction

Activity	Potential Environmental Impact
Civil works during construction	Noise levels are predicted to be below background noise levels at all locations except Lignum homestead, where construction noise may be faintly audible when works are taking place in the east of the ML. Livestock and native animals are not expected to be affected by noise
Construction related traffic	Noise from construction-related traffic is predicted to be within guideline levels but incremental increases in traffic noise levels may be perceptible at locations close to Gregory Developmental Road and along the Moray-Carmichael Road.
Pile driving, rock breaking and heavy equipment operation	Vibration levels are not predicted to affect any sensitive receptors.

13.18.3.2 Operations

Table 13-27 Potential Environmental Impacts – Operation

Activity	Potential Environmental Impact
Mining operations	Night time noise criteria may be exceeded at Lignum homestead, otherwise noise related impacts are not expected at any sensitive receptors Low frequency noise is not predicted to cause problems Impacts of noise on livestock are not predicted Livestock and native animals are not expected to be affected by noise
Operation related traffic	Noise from operation-related traffic is predicted to be within guideline levels but incremental increases in traffic noise levels may be perceptible at locations close to Gregory Developmental Road and along the Moray-Carmichael Road.
Blasting	Airblast overpressure levels from blasting may exceed criteria when blasting occurs near the mine boundary. Bygana and Lignum homesteads and the off-site mine industrial precinct may be affected. Ground vibration levels associated with blasting are not expected to affect any sensitive receptors or structures.

13.18.4 Performance Outcome

Impacts from noise are managed to meet acoustic quality objectives at homesteads surrounding the mine. Acoustic quality objectives are set as follows:

Table 13-28 Noise Acoustic Quality Objectives

Noise level dB(A)	Monday to Saturday			Sundays and public holidays		
	7am - 6pm	6pm - 10pm	10pm - 7am	9am - 6pm	6pm - 10pm	10pm - 9am
Noise measured at a 'Noise sensitive place'						
$L_{A10, adj, 10 mins}$	B/g + 5	B/g + 5	B/g + 0	B/g + 5	B/g + 5	B/g + 0
$L_{A1, adj, 10 mins}$	B/g + 10	B/g + 10	B/g + 5	B/g + 10	B/g + 10	B/g + 5
Noise measured at a 'Commercial place'						
$L_{A10, adj, 10 mins}$	B/g + 10	B/g + 10	B/g + 5	B/g + 10	B/g + 10	B/g + 5
$L_{A1, adj, 10 mins}$	B/g + 15	B/g + 15	B/g + 10	B/g + 15	B/g + 15	B/g + 10

Impacts from airblast overpressure are managed to meet acoustic quality objectives and avoid disturbance to homesteads surrounding the mine.

13.18.5 Proposed Controls

13.18.5.1 Design, Procurement and Pre-construction

Table 13-29 Noise and Vibration – Design, Procurement and Preconstruction Controls

Control	Responsibility	Timing	Evidence
Ensure buildings and other structures at the off-site industrial area and within the mining lease are designed to withstand predicted airblast overpressure and ground vibration levels associated with blasting	Design manager	During detailed design	Design checklist

13.18.5.2 Construction

Table 13-30 Noise and Vibration Construction Controls

Control	Responsibility	Timing	Evidence
If a noise or vibration complaint is received, follow the complaints and inquiries procedure set out in Section 13.33.	Stakeholder Manager	As required	Incident register

13.18.5.3 Operations

Table 13-31 Noise and Vibration Operational Controls

Control	Responsibility	Timing	Evidence
If a noise or vibration complaint is received, follow the complaints and inquiries procedure set out in Section 13.33.	Stakeholder Manager	As required	Incident register

Control	Responsibility	Timing	Evidence
Prior to blasting, undertake a dilapidation survey of homestead buildings and structures where potential impacts may occur	Mine manager	Prior to blasting	Dilapidation reports
Provide notification to landholders of upcoming blasting activities within one kilometre of the lease boundary or five kilometres of homesteads on a weekly basis	Community liaison manager (notified by mine manager)	Weekly when blasting	Community consultation register
Prior to blasting within one kilometre of the lease boundary, establish a flyrock exclusion zone within adjacent properties and check with landholders that the area is not occupied by humans	Community liaison manager (notified by mine manager)	When blasting	Community consultation register

13.18.6 Monitoring and Corrective Action

Table 13-32 Noise and Vibration monitoring and Corrective Action

Monitoring Action	Responsibility	Frequency	Performance Requirement	Corrective Action
Undertake noise or vibration monitoring in response to a complaint	Environmental manager	In response to a complaint	Noise levels do not exceed objectives in Table 13-28	Implement noise attenuation or mitigation measures. Measures may include those in AS2436:2010 *Guide to noise and vibration control on construction, demolition and maintenance sites*. Measures may also be taken at the sensitive receptor with

Monitoring Action	Responsibility	Frequency	Performance Requirement	Corrective Action
				agreement from the complainant
Airblast overpressure monitoring at lease boundary and/or closest sensitive receptor	Mine manager	During initial blasting activities in proximity to these locations	Airblast overpressure does not exceed 115 dB(linear)	Consider the following mitigation measures: ◗ Reduce maximum instantaneous charge using delays, reduced hole diameter and/or deck loading ◗ Change the burden and spacing by altering the drilling pattern and/or delay layout, or altering the hole inclination ◗ Ensuring stemming depth and type is adequate ◗ Avoid blasts during temperature inversions or heavy cloud conditions ◗ Relocate residents for the period of blasting
Check for structural damage	Mine manager	After blasting in proximity to	No further structural damage	Make good any verified

Monitoring Action	Responsibility	Frequency	Performance Requirement	Corrective Action
at sensitive receptors		these receptors or on receipt of a complaint	compared to dilapidation survey report	damage in consultation with the landholder.

13.18.7 Proposed Environmental Authority Conditions

D1 The holder of this Environmental Authority must ensure that noise generated by the mining activities does not cause the criteria in *Table 13-33: Noise Limits* to be exceeded at a sensitive or commercial place.

Noise monitoring

D2 When requested by the administering authority, noise monitoring must be undertaken to investigate any complaint of noise nuisance, and the results notified within 14 days to the administering authority. Monitoring must include:

a) $L_{A\ 10,\ adj,\ 10\ mins}$

b) $L_{A\ 1,\ adj,\ 10\ mins}$

c) the level and frequency of occurrence of impulsive or tonal noise;

d) atmospheric conditions including wind speed and direction;

e) effects due to extraneous factors such as traffic noise; and

f) location date and time of recording.

Table 13-33 Noise Limits

Noise level dB(A)	Monday to Saturday			Sundays and public holidays		
	7am - 6pm	6pm - 10pm	10pm - 7am	9am - 6pm	6pm - 10pm	10pm - 9am
Noise measured at a 'Noise sensitive place'						
$L_{A10,\ adj,\ 10\ mins}$	B/g + 5	B/g + 5	B/g + 0	B/g + 5	B/g + 5	B/g + 0
$L_{A1,\ adj,\ 10\ mins}$	B/g + 10	B/g + 10	B/g + 5	B/g + 10	B/g + 10	B/g + 5
Noise measured at a 'Commercial place'						
$L_{A10,\ adj,\ 10\ mins}$	B/g + 10	B/g + 10	B/g + 5	B/g + 10	B/g + 10	B/g + 5
$L_{A1,\ adj,\ 10\ mins}$	B/g + 15	B/g + 15	B/g + 10	B/g + 15	B/g + 15	B/g + 10

Vibration nuisance

D5 Vibration from the licensed activities must not cause an environmental nuisance, at any sensitive or commercial place.

D6 When requested by the administering authority, vibration monitoring must be undertaken within a reasonable and practicable timeframe nominated by the administering authority to investigate any complaint (which is neither frivolous nor vexatious nor based on mistaken belief in the opinion of the authorised officer) of environmental nuisance at any sensitive or commercial place, and the results must be notified within 14 days to the administering authority following completion of monitoring.

D7 Vibration monitoring must include the following descriptors, characteristics and conditions:

a) location of the blast(s) within the mining area;

b) atmospheric conditions including temperature, relative humidity and wind speed and direction; and

c) location, date and time of recording.

D8 If monitoring indicates exceedence of the relevant limits in *Table 13-34: Vibration Limits*, then the Environmental Authority holder must:

a) address the complaint including the use of appropriate dispute resolution if required; and

b) immediately implement vibration abatement measures so that vibration from the activity does not result in further environmental nuisance.

Table 13-34 Vibration Limits

Location	Vibration measured
Sensitive or commercial place	5 mm/s peak particle velocity for nine (9) out of ten (10) consecutive blasts and not greater than 10 mm/s peak particle velocity at any time

Airblast Overpressure

D9 Blasting activities must be carried out in such a manner that if blasting noise should propagate to a noise-sensitive place, then

a) the airblast overpressure must be not more than 115dB(linear) peak for nine out of any 10 consecutive blasts initiated, regardless of the interval between blasts; and

b) the airblast overpressure must not exceed 120dB(linear) peak for any blast.

13.19 Surface Water

13.19.1 Legislative Framework

There are two key pieces of legislation that govern surface water resources in Queensland.

The EP Act establishes the frameworks for managing water quality such that environmental values in relation to water quality are protected. This includes:

- The Environmental Protection (Water) Policy 2008 which:
  - Identifies environmental values and management goals for Queensland waters (surface water and groundwater)
  - Establishes water quality goals and guidelines for waters
  - Provides guidance on making consistent, equitable and informed decisions about waters
  - Includes requirements for monitoring of ambient water quality.

- Requirements for assessment and approval of activities (environmentally relevant activities) that might result in a discharge to surface waters or other impact on surface waters.
- Provisions in relation to compliance with approval conditions in relation to impacts of activities on surface water resources
- Specific offences relating to contamination of surface waters.

The *Water Act 2000* regulates the sustainable use of water resources, including allocation of water resources for environmental benefits as well as activities that impact on the integrity of watercourses. Water resource plans (WRPs) define the availability of water for each basin in Queensland, and frameworks and mechanisms for sustainably managing water supply and demand. Resource operations plans then set out rules in relation to the allocation of water resources and other decisions made under the WRP. The Carmichael Coal Mine is within the area covered by the *Water Resource (Burdekin Basin) Plan 2007*.

Water supply for the Carmichael Coal mine from outside the mining lease is covered in the EMP for off-site infrastructure. Within the mining lease:

- A water licence is required in relation to the diversion of a watercourse
- A riverine protection permit is required in relation to works that disturb the bed and banks of a watercourse.

A watercourse is defined in the Water Act as a river, creek or other stream, including a stream in the form of an anabranch or a tributary, in which water flows permanently or intermittently, regardless of the frequency of flow events—

(a) in a natural channel, whether artificially modified or not; or

(b) in an artificial channel that has changed the course of the stream.(Water Act Section 48).

In practice, Department of Natural Resources and Mines (NRM) will generally determine which of the waterways and drainage lines on the site constitute a watercourse under the Water Act definition.

By agreement between EHP and the Department of Energy and Water Supply, dams on a mining lease that contain hazardous substances are administered by EHP and are included in the Environmental Authority (Mining Lease). This will include:

- Mine affected water storages
- Ex-pit tailings storage facility
- Some sediment dams

13.19.2 Environmental Values

13.19.2.1 Surface Water Resources

Topography across the mining area typically slopes towards the east and north-east from a north-west to south-east trending ridge line, west of the lease boundary and running parallel to it.

The mining area is bisected by the Carmichael River which is a tributary of the Belyando River in the Suttor-Belyando subcatchment of the Burdekin River. Tributaries within the Carmichael River catchment include Cattle Creek, Dylingo Creek and Surprise Creek which converge into the Carmichael River just upstream of the Study Area boundary. The river also receives discharge from

the Doongmabulla Spring complex eight kilometres to the west of the Study Area. The Carmichael River has an effluent flow path south to Cabbage Tree Creek during flood events. Cabbage Tree Creek is therefore an ephemeral distributary creek of the Carmichael River.

While part of the mining area drains into the Carmichael River, the majority of the mining area drains from west to east in a series of minor, ephemeral watercourses, some of which become discontinuous downstream of the mine but ultimately flow to the Belyando River. Most of these are unnamed. Eight Mile Creek drains part of the mining area north of the Carmichael River.

There are a number of farm dams across the mining area. Some of these capture overland flow, some are in-stream and some are for storing groundwater.

13.19.3 Scheduled Environmental Values

The following environmental values are to be protected:

- Aquatic ecosystems – slightly to moderately disturbed
- Primary industries – irrigation
- Primary industries – stock watering
- Cultural and spiritual values

13.19.4 Water Quality

Limited information is available on water quality. Water quality objectives have not been set in the EPP (Water) for the Burdekin Basin and hence, objectives have been adopted from a range of sources as shown in Table 13-35. Both guideline water quality objectives and current baseline water quality monitoring will be used to inform the establishment of representative water quality objectives for the Project (Mine).

Table 13-35 Indicative Water Quality Objectives (Guidelines)

Parameter	Units	Aquatic Ecosystems[#]		Primary Industries*	
		Upland streams	Lakes and reservoirs	Irrigation	Stock Watering
Physical Parameters					
Dissolved oxygen	% saturation	90 - 110	90 - 110	-	-
pH		6.5 - 7.5	6.5 - 8.0	-	-
Electrical Conductivity	µS/cm	168^	168^	-	-
Turbidity	NTU	25	1 - 20	2 - 15	-
Biological					
Chlorophyll a	µg/L	-	5	-	-
Faecal coliforms	cfu/100 mL			10 (direct contact) 1000 (indirect contact)	1000
Nutrients					
Ammonia as N	µg/L	10	10	-	-
Nitrate (as N)	mg/L	0.158	0.158	-	400
Nitrite (as N)	mg/L	-	-	-	30
Nitrogen (Total)	µg/L	250	350	5000 - 125000	-

Parameter	Units	Aquatic Ecosystems[#]		Primary Industries*	
		Upland streams	Lakes and reservoirs	Irrigation	Stock Watering
Organic Nitrogen	µg/L	225	330		
Phosphorus	mg/L	0.03	0.01	0.05 - 12	-
Reactive Phosphorus as P	mg/L	0.015	0.005	-	-
Major Ions					
Calcium	mg/L	-	-	-	1,000
Magnesium	mg/L	-	-	-	2,000
Fluoride	mg/L	-	-	1 - 2	2
Sulphate	mg/L	-	-	-	1,000
TDS	mg/L	-	-	-	2,500
Metals and Metalloids*					
Aluminium	mg/L	0.055	0.055	5 - 20	5
Arsenic	mg/L	-	-	0.1 - 2	0.5
Beryllium	mg/L	-	-	0.1 - 0.5	-
Boron	mg/L	0.37	0.37	0.5	5
Cadmium	mg/L	0.0002	0.0002	0.01 - 0.05	0.01

Parameter	Units	Aquatic Ecosystems[#]		Primary Industries*	
		Upland streams	Lakes and reservoirs	Irrigation	Stock Watering
Chromium (III+VI)	mg/L	0.001	0.001	0.1 - 1	1
Cobalt	mg/L			0.05 - 0.1	1
Copper	mg/L	0.0014	0.0014	0.2 - 5	1
Iron	mg/L			0.2 - 10	-
Lead	mg/L	0.0034	0.0034	2 - 5	0.1
Manganese	mg/L	1.9	1.9	0.2 - 10	-
Mercury	mg/L	0.00006	0.00006	0.002	0.002
Molybdenum	mg/L			0.01 - 0.05	0.15
Nickel	mg/L	0.011	0.011	0.2 - 2	1
Selenium	mg/L	0.005	0.005	0.02 - 0.05	0.02
Silver	mg/L	0.00005	0.00005	-	-
Uranium	µg/L	-	-	10 - 100	200
Vanadium	mg/L	-	-	0.1 - 0.5	-
Zinc	mg/L	0.008	0.008	2 - 5	20

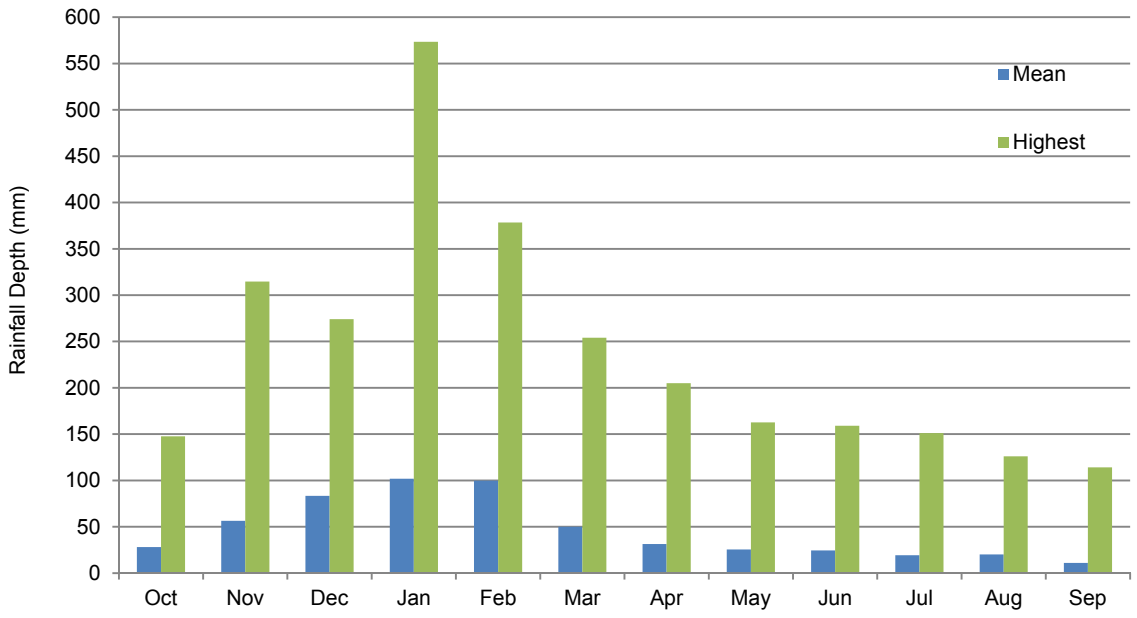
Parameter	Units	Aquatic Ecosystems[#]		Primary Industries*	
		Upland streams	Lakes and reservoirs	Irrigation	Stock Watering
Polycyclic Aromatic Hydrocarbons					
Naphthalene	µg/L	16	16	-	-

[#] from the QWQG (DERM, 2009a); * from the ANZECC guidelines (ANZECC and ARMCANZ, 2000), range values for irrigation WQOs represent long-term trigger values (LTV) and short term trigger values (STV); ^ 75th percentile for Belyando-Suttor salinity zone (DERM 2009a).

13.19.5 Rainfall and Evaporation

Average rainfall in the area is in the order of 550 mm/annum, with the bulk of rain falling in the summer months. Rainfall can vary significantly from year to year. Evaporation far exceeds rainfall, averaging around 1,200 mm/annum.

Figure 13-3 Monthly Rainfall – Moray Downs Station, 36071 1914 – 2010[1]



13.19.6 Potential Impacts

13.19.6.1 Construction

Table 13-36 Potential Environmental Impacts – Construction

Activity	Potential Environmental Impact
Vegetation clearing, topsoil stripping and general earthworks	◗ Release of sediments to water through erosive processes (refer Section 13.28)
Draining of existing farm dams	◗ Potential for release of poor quality (low dissolved oxygen, high turbidity, high salinity) water to downstream environments
Ex-pit spoil disposal	◗ Change in surface topography and runoff characteristics ◗ Release of sediments to water through erosive processes ◗ Acidification if acid generating materials are exposed to oxidising

[1] Minimum rainfall values are negligible and so have been excluded at this scale

Activity	Potential Environmental Impact
	conditions ◗ Saline runoff if saline wastes are exposed
Watercourse diversion	◗ Changes in downstream flows ◗ Replacement of natural watercourses with artificial watercourses
Underground mining	◗ Alteration of surface topography through creation of a series of subsidence troughs running roughly north-south ◗ Interception of overland flows ◗ Ponding in troughs ◗ Potential surface water infiltration to groundwater through subsidence cracks
Wastewater generation and treatment	◗ If improperly managed, release of nutrients, pathogens and other contaminants to downstream waters (refer Section 13.21).
Dewatering of pits and underground workings	◗ Generation of mine affected water (MAW), discharge of which may cause high salinity and potentially introduce other contaminants to downstream areas
Operation of MIA, including coal handling and processing and workshops	◗ Generation of MAW, which may contain suspended solids, hydrocarbons and potentially other contaminants
Mining activities within a floodplain	◗ Flooding of mine workings and subsequent generation of large volumes of flood affected waters
Structures within a flood plain	◗ Increased afflux and flooding extent and duration upstream ◗ Reduced flood flows downstream
Storage and handling of hydrocarbons and other environmentally hazardous materials	◗ Contamination of surface water resources (refer Section 13.22)

13.19.7 Performance Outcome

Environmental values relating to aquatic ecosystems, stock and domestic use and cultural and spiritual values are maintained.

13.19.8 Proposed Controls

13.19.8.1 Mine Water Management System Overview

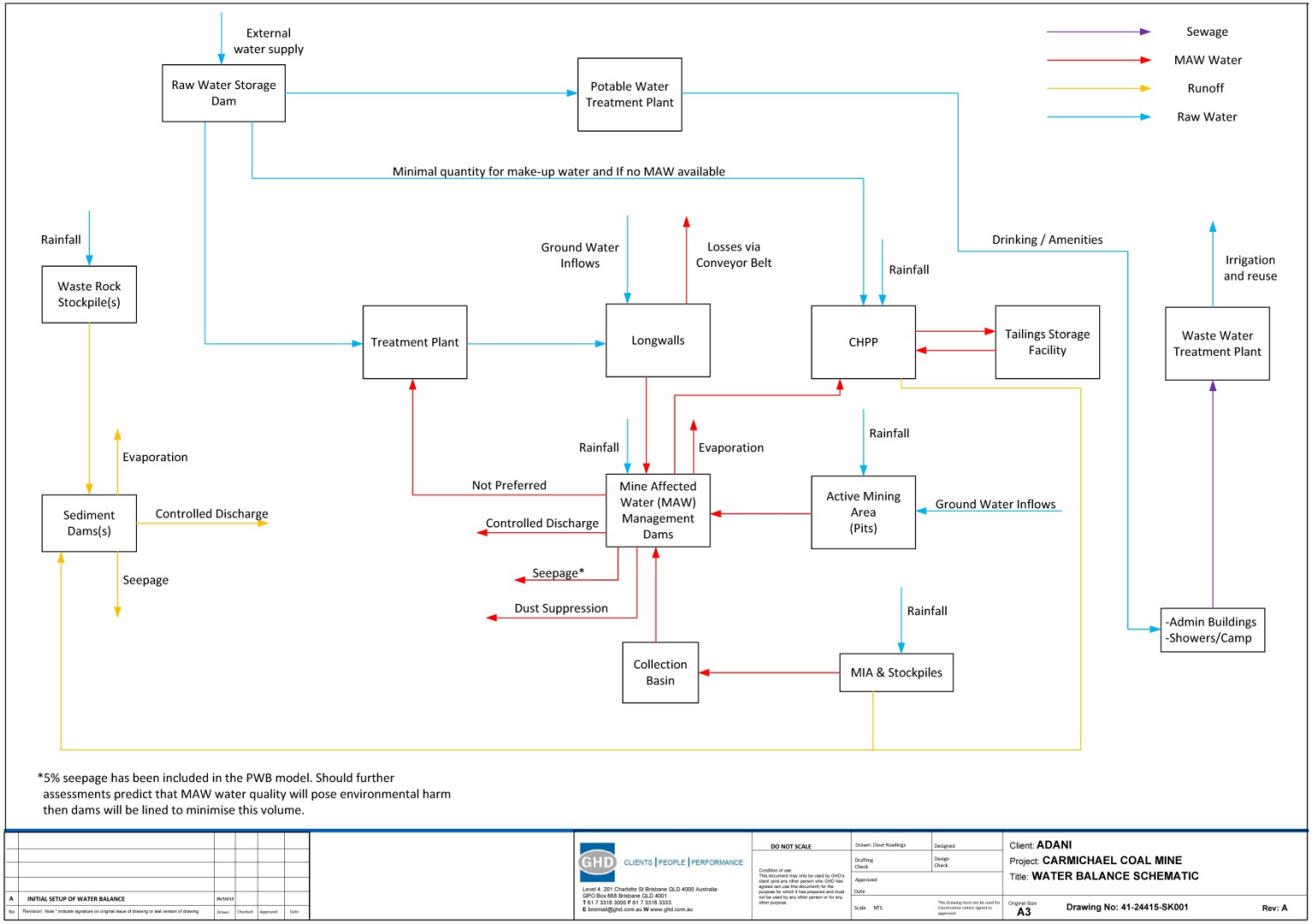
The mine water management system is based on segregation of water into clean, dirty and mine affected streams as follows:

- Clean water streams will be waters that are unaffected by the mining or associated activities, and will include:
  - Water captured from undisturbed areas of the site, or
  - Water from catchments upstream of the proposed mine
  - Runoff from rehabilitated areas once rehabilitation criteria have been achieved with respect to vegetation cover and runoff water quality.
  - Groundwater from any advanced dewatering ahead of open cut or underground mining.
- Dirty water streams will be those that have come into contact with disturbed areas but not into contact with mining activities. This may include:
  - Stormwater runoff from waste dump areas where this contains sediment only
  - Stormwater from the MIA area that has not been in contact with coal, vehicle and equipment maintenance workshops, waste storage areas and fuel or chemical storage areas
- Treated wastewater from sewage treatment plants
- Mine affected water streams will consist of
  - Any water from direct dewatering of open cut pits or underground mines
  - Water that has been in contact with coal, including decant water from tailings storage facility, water from the coal processing plant and stormwater from coal stockpiles
  - Runoff from vehicle and equipment maintenance areas, waste storage areas and fuel or chemical storage areas

Clean water will be managed by diverting around disturbed areas or disturbed areas, or conveying through the proposed mine in watercourse diversions. Where groundwater is produced from advanced dewatering, this may not be suitable for direct release to surface watercourses and will be stored in a dam for reuse or discharge under controlled conditions.

Dirty water will potentially be contaminated with sediment and will be directed to sediment dams where settlement will occur. Most sediment will be designed to capture flows up to the 1:20 AEP rain event. Water from any car parking areas or hardstand areas will also be directed through an oil/water separation system. Water from sediment dams may be used for dust suppression and other uses as required. Mine affected water will be directed to one of up to five mine affected water dams to be constructed in stages as the mine progresses (see Figure 13-4). Mine affected water from the MIA areas will be passed through a sediment pond to allow coarse sediment to settle out. Mine water management is presented schematically in Figure 13-4.

Figure 13-4 Mine Water Balance Schematic



13.19.8.2 Design, Procurement and Pre-construction

Table 13-37 Surface Water – Design, Procurement and Preconstruction Controls

Control	Responsibility	Timing	Evidence
Revise mine plan area in the vicinity of Cabbage Tree Creek to avoid the need for diversion of the creek.	Mine manager	Before operation	Revised mine plan
Review climate forecasts and adopt appropriate measures in design criteria for dams, levees, diversions and other water management structures	Design manager	During design	Design checklist
Develop a comprehensive water balance model for the mining operation. Utilise the water balance model to optimise sizing of MAW dams, sediment ponds and discharge infrastructure as well as raw water supply requirements.	Design manager	Before operation	Model in place
Review water supply against environmental flow objectives for the Belyando Suttor sub-basin and against environmental impacts and of each source and determine optimal configuration that minimise loss of aquatic ecosystem habitat and water resources.	Design manager	During design	Water supply strategy
Review optimal location for MAW controlled discharge on either Carmichael River or Belyando River. Review should include consideration of: ◗ Availability of sufficient dilution flows to control salinity ◗ Potential effects of discharges from proposed mines upstream of the Carmichael Coal Mine ◗ Ability to achieve high volume discharge by gravity.	Design manager	Before construction	Design checklist Updated environmental authority (mining)

Control	Responsibility	Timing	Evidence
Seek confirmation from NRM regarding designation of watercourses under the Water Act.	Environment Manager	Pre Construction	Confirmation on file
Prepare a water management plan in accordance with the guideline *Preparation of Water Management Plans for Mining Activities* (DERM, 2009),	Environment Manager	Pre Construction	Water management plan in place
Review levee designs to ensure correct placement and side slope stability	Design manager	When designing levees	Design checklist
Review potential impacts on downstream flows from diversion works and raw water supply and check that environment flow objectives for the Belyando – Suttor sub-basin are met.	Design manager	Pre Construction	Design checklist
Prepare detailed design for diversions, taking into account: ◗ Hydraulic requirements including energy dissipation ◗ Creation of a geomorphologically stable channel ◗ Potential for environmental values to be reinstated ◗ Potential erosion at outlet point Current relevant guidelines are *Watercourse Diversions Guidelines – Central Queensland Mining Industry (*DERM, 2011*)*.	Design manager	When designing diversions	Design checklist
Design all watercourse crossings to maintain flow and minimise afflux where this may affect sensitive receptors or infrastructure.	Design manager	When designing crossings	Design checklist
Conduct further modelling to optimise size of sediment basins	Design manager	When designing sediment basins	Design checklist

Control	Responsibility	Timing	Evidence
Prepare a Receiving Environment Monitoring Program (REMP), including: ◗ Establishing of background and impact monitoring locations for water and sediment quality ◗ Determination of trigger levels and water quality objectives ◗ A program for routine monitoring of water and sediment quality ◗ A program for continuous monitoring of key parameters that would indicate uncontrolled releases or other mine-related impacts ◗ Procedures for checking results against trigger levels and implementing corrective actions where trigger levels are reached	Environment Manager	Prior to commencement of construction	REMP in place
Establish water quality and sediment monitoring network upstream and downstream of mining activities. Collect at least 12 months of baseline data and determine water quality objectives and triggers using methods set out in Queensland Water Quality Guidelines (DERM 2009) and Australia and New Zealand Water Quality Guidelines (ANZECC and ARMCANZ, 2000)	Environmental Manager	12 months prior to construction	
Prepare a procedure for controlled discharge of MAW. The procedure should include: ◗ Set water quality objectives in relation to controlled discharge of MAW, including: – Any upper limits on salinity in the receiving water, above which the discharge should cease – Any upper limits on salinity in MAW above discharge should not be	Environmental Manager	Prior to operation	Controlled discharge procedure

Control	Responsibility	Timing	Evidence
allowed – Any other water quality related triggers that may be required to protect environmental values of the receiving water. ◗ Monitoring requirements before, during and after a discharge event ◗ Reporting requirements in relation to a discharge event			
Design all dams to comply with Manual for Assessing Hazard Categories and Hydraulic Performance of Dams (Queensland DERM 2012) and Guideline Structures which are dams or levees constructed as part of environmentally relevant activities (DEHP 2012). Factors to be considered in design to include: ◗ dams designed and located to have the smallest practical catchment; ◗ dams should be designed to accept waste inputs for the operational year and inputs from the critical wet season; ◗ the spillway should be designed and maintained to withstand the peak flow from the critical design storm (the critical design storm has a duration that produces the peak discharge for the catchment); ◗ the gradients of earth embankment batters should be stable; ◗ where the foundation material differs from the embankment fill material, the batters should be chosen conservatively to be consistent with the weaker material classification; ◗ the dam design should provide adequate measures to minimise seepage through the dam wall and to groundwater;	Design manager	During detailed design	Design checklist

Control	Responsibility	Timing	Evidence
◗ the dam design should prevent any erosion of the downstream face of the dam and spillway to avoid surface scour which may lead to failure of the wall; ◗ the contents of the ANCOLD Guidelines and Tailings Dam Design Construction and Operation October 1999; and ◗ the contents of Department of Mines and Energy, Technical Guidelines for Environmental Management of Exploration and Mining in Queensland, January 1995.			
Submit design plans for tailings storage facility (TSF), MAW dams and sediment dams to the regulatory (DEHP)	Design manager	Prior to constructing a dam	Correspondence
Design TSF such that any overflows are directed to MAW dams	Design manager	During detailed design	Design checklist
Design all structures to meet the flood design criteria set out in Table 13-38 or other criteria as determined by detailed design and risk assessment	Design manager	During detailed design	Design checklist
Seek confirmation from NRM regarding designation of watercourses under the Water Act.	Environment Manager	Pre Construction	
Preparation of Water Management Plans for Mining Activities (DERM, 2009),	Environment Manager	Pre Construction	

Table 13-38 Flood Design Criteria

Component	Required Flood Immunity	Comments
Open cut pits and underground mine access portals	1,000 year ARI	
Stream diversions and levees (embankment crest level)	1,000 year ARI + 500 mm freeboard	Minor stream diversions may be designed to a lower design criteria where this does not compromise operations.
Diesel storages and other hazardous chemical storages	100 year ARI	
Above ground tailings storage facilities (embankment crest level)	1,000 year ARI	Based on preliminary hazard assessment using DERM 2012.
Conveyors	100 year ARI	An additional 500 mm of freeboard to be provided to the lower belt
MIA, CHPP and all stockpiles	100 year ARI.	
Internal drainage within MIAs	50-100 year ARI	
Mine affected water storages (embankment crest level)	100 year ARI + 500 mm freeboard	Based on preliminary hazard assessment using DERM 2012.
Sediment dams	100 year ARI + 500 mm freeboard	
Roads used for evacuation	50 year ARI	

Component	Required Flood Immunity	Comments
Haul roads	50 year ARI	
Minor access roads throughout mine site	5 year ARI	
Carmichael-Moray Road realignment and other public roads	IRC Design Standard	Local public roads currently flood in most wet seasons.

13.19.8.3 Construction

Table 13-39 Surface Water – Construction Controls

Control	Responsibility	Timing	Evidence
If dams are required to be drained: ◗ Test water quality (pH, DO, turbidity and EC) ◗ Utilise water for dust suppression as a first preference ◗ If water cannot be used for dust suppression, then manage as follows: o If EC is less than 700 us/cm, pH is in the range 6-8.5, turbidity is less than 50 NTU and DO is above 4 mg/l, water may be pumped to the downstream watercourse. Pump rate should be such that water does not overflow the channel, scouring does not occur and suspended sediment from the base of the storage is not suspended. Monitor turbidity levels through and cease discharge if turbidity exceeds 50NTU. – If DO is below 4 mg/L, discharge to watercourse may be possible with aeration, however care must be taken not to stir	Construction manager	When draining dams	Water quality data and discharge records, permit to disturb.

Control	Responsibility	Timing	Evidence
up sediment from the bottom of the storage such that turbidity exceeds 50NTU. – If EC is less than 1200 us/cm, use water for irrigation of pasture areas or rehabilitation trials. Water is to be irrigated such that ponding and runoff does not occur – If EC is more than 1200 us/cm, pH is outside the range 6-8.5, or turbidity exceeds 50 NTU, transfer to another storage for later use.			
Do not take water from the Carmichael River for use during construction	All	At all times	No water taken from Carmichael River
Do not commence construction of dams until either: ◗ An acknowledgement letter has been received from the regulator (DEHP) in respect of the proposed design and ◗ 28 days has passed since the letter of acknowledgement was received and no further correspondence has been received	Construction manager	When constructing a dam	Correspondence from regulator
Obtain certification from a registered professional engineer of Queensland (RPEQ) with appropriate skills in dam design that the dam is constructed in accordance with the design. Submit certification to the regulator (DEHP)	Design manager	On completion of any dam	Certification

13.19.5.1 Operations

Table 13-40 Surface Water - Operational Controls

Control	Responsibility	Timing	Evidence
Prepare a dam operating dam for MAW and sediment dams, or incorporate operating requirements into the Plan of Operations. Operating plan is to include: ◗ Annual dam surveillance inspections when dam is at a low level ◗ Water quality monitoring ◗ Operational requirements in relation to water levels, transfers between storages and reuse of MAW ◗ Requirements for recording mine water management transfers and use	Mine manager	Before operating MAW and sediment dams	Dam operating plan
Implement the dam operating plan	Mine manager	Ongoing	Monitoring and surveillance records, mine water management records
Transfer all MAW to MAW dams. MAW is not to be placed in sediment basins or directly discharged.	Mine manager	Ongoing	Mine water management records
Utilise MAW for the following uses in preference to raw water: ◗ Dust suppression ◗ CHPP (except where raw water is required for particular processes) ◗ Vehicle washing.	Area managers	Ongoing	Mine water management records

Control	Responsibility	Timing	Evidence
When using MAW for dust suppression in areas that drain to sediment basins catchments, apply at a rate that does not cause runoff or ponding	Area manager	At all times	Inspection checklist
Groundwater from advanced dewatering may be discharged to the receiving environment if analysis indicates that this will not cause water quality objectives to be exceeded immediately downstream of the point of discharge. If groundwater is not suitable for discharge it will be directed to MAW dams.	Mine manager	Ongoing	Monitoring records
Review and update mine water management plan	Mine manager	Every five years or more frequently if required to address non-compliance	Updated plan
Review and update REMP	Environmental Manager	Every five years or more frequently if required to address non-compliance	Updated plan
Include maintenance of the following items in mine maintenance schedule: ◗ Oil water separators ◗ MIA stormwater systems ◗ Pumps and pipes ◗ Controlled discharge infrastructure.	Mine manager	As per maintenance schedule	Maintenance records

13.19.9 Monitoring and Corrective Action

Table 13-41 Noise and Vibration monitoring and Corrective Action

Monitoring action	Responsibility	Frequency	Corrective Action
Prepare a dam operating dam for MAW and sediment dams, or incorporate operating requirements into the Plan of Operations. Operating plan is to include: ◗ Annual dam surveillance inspections when dam is at a low level ◗ Water quality monitoring ◗ Operational requirements in relation to water levels, transfers between storages and reuse of MAW ◗ Requirements for recording mine water management transfers and use	Mine manager	Before operating MAW and sediment dams	Dam operating plan
Implement the dam operating plan	Mine manager	Ongoing	Monitoring and surveillance records, mine water management records
Transfer all MAW to MAW dams. MAW is not to be placed in sediment basins or directly discharged.	Mine manager	Ongoing	Mine water management records
Utilise MAW for the following uses in preference to raw water: ◗ Dust suppression ◗ CHPP (except where raw water is required for particular processes)	Area managers	Ongoing	Mine water management records

Monitoring action	Responsibility	Frequency	Corrective Action
◗ Vehicle washing.			
When using MAW for dust suppression in areas that drain to sediment basins catchments, apply at a rate that does not cause runoff or ponding	Area manager	At all times	Inspection checklist
Groundwater from advanced dewatering may be discharged to the receiving environment if analysis indicates that this will not cause water quality objectives to be exceeded immediately downstream of the point of discharge. If groundwater is not suitable for discharge it will be directed to MAW dams.	Mine manager	Ongoing	Monitoring records
Review and update mine water management plan	Mine manager	Every five years or more frequently if required to address non-compliance	Updated plan
Review and update REMP	Environmental Manager	Every five years or more frequently if required to address non-compliance	Updated plan
Include maintenance of the following items in mine maintenance schedule: ◗ Oil water separators ◗ MIA stormwater systems ◗ Pumps and pipes Controlled discharge infrastructure.	Mine manager	As per maintenance schedule	Maintenance records

13.19.10 Proposed Environmental Authority Conditions

Contaminant release

W1 Contaminants that will, or have the potential to cause environmental harm must not be released directly or indirectly to any waters as a result of the authorised mining activities, except as permitted under the conditions of this environmental authority.

W2 Unless otherwise permitted under the conditions of this environmental authority, the release of mine affected water to waters must only occur from the release points specified in Table 13-42 and depicted in Figure XX attached to this environmental authority (to be provided).

W3 The release of mine affected water to internal water management infrastructure installed and operated in accordance with a water management plan that complies with conditions W32–W37 inclusive is permitted.

Table 13-42 Indicative Release and Monitoring Points

Release point (RP)	Latitude (decimal degree, GDA94)	Longitude (decimal degree, GDA94)	Mine affected water source and location	Monitoring point	Receiving waters description
RP1	XXXX	XXXX	Mine Affected Water controlled discharge outlet	Monitoring tap at outlet	TBA (Carmichael River or Belyando River)
RP2	XXXX	XXXX	XXXX	Spillway	TBA
RP3	XXXX	XXXX	XXXX	Spillway	TBA
RP4	XXXX	XXXX	XXXX	Spillway	TBA
RP5	XXXX	XXXX	XXXX	Spillway	TBA
RP6	XXXX	XXXX	XXXX	Spillway	TBA

Release point (RP)	Latitude (decimal degree, GDA94)	Longitude (decimal degree, GDA94)	Mine affected water source and location	Monitoring point	Receiving waters description
RP7	XXXX	XXXX	XXXX	Spillway	TBA
RP8	XXXX	XXXX	XXXX	Spillway	TBA
RP9	XXXX	XXXX	XXXX	Spillway	TBA
RP10	XXXX	XXXX	XXXX	Spillway	TBA
RP11	XXXX	XXXX	XXXX	Spillway	TBA
RP12	XXXX	XXXX	XXXX	Spillway	TBA
RP13	XXXX	XXXX	XXXX	Spillway	TBA
RP14	XXXX	XXXX	XXXX	Spillway	TBA

W4 The release of mine affected water to waters in accordance with condition W2 must not exceed the release limits stated in Table 13-43 when measured at the monitoring points specified in Table 1 for each quality characteristic.

Table 13-43 Indicative Mine affected water release limits

Release limits	Quality characteristic	Frequency
Electrical conductivity (µS/cm)	Release limits specified in Table XX for variable flow criteria.	Continuous during release
pH (pH Unit)	6.0 (minimum)	Daily during release (the first sample must be taken

Release limits	Quality characteristic	Frequency
	9.0 (maximum)	within two hours of commencement of release)
Turbidity (NTU)	To be derived from baseline monitoring data receiving waters water	Daily during release (first sample within two hours of commencement of release)
Sulphate (SO 2-) (mg/L)	Release limits specified in Table XX for variable flow criteria.	Daily during release* (first sample within two hours of commencement of release)

W5 The release of mine affected water to waters from RP1 must be monitored at the locations specified in Table 1 for each quality characteristics and at the frequency specified in Table 2 and Table 3.

Table 13-44 Indicative Release contaminant trigger investigation levels

Quality Characteristics	Trigger levels (ug/L)	Monitoring frequency
Aluminium	55	Commencing within 2 hours of commencement of release, and then every 24 hours while release continues
Arsenic	13	
Cadmium	0.2	
Chromium	1	
Copper	2	
Iron	300	
Lead	4	

Quality Characteristics	Trigger levels (ug/L)	Monitoring frequency
Mercury	0.2	
Nickel	11	
Zinc	8	
Boron	370	
Cobalt	90	
Manganese	1900	
Molybdenum	34	
Selenium	10	
Silver	1	
Uranium	1	
Vanadium	10	
Ammonia	900	
Nitrate	1100	
Petroleum hydrocarbons (C6-C9)	20	
Petroleum hydrocarbons (C10-	100	

Quality Characteristics	Trigger levels (ug/L)	Monitoring frequency
C36)		
Fluoride	2000	

1. All metals and metalloids must be measured as total (unfiltered) and dissolved (filtered). Trigger levels for metal/metalloids apply if dissolved results exceed trigger.

2. The quality characteristics required to be monitored as per Table 3 can be reviewed once the results of two years monitoring data is available, or if sufficient data is available to adequately demonstrate negligible environmental risk. It may be determined that a reduced monitoring frequency is appropriate or certain quality characteristics can be removed from Table 3 by amendment.

W6 If quality characteristics of the release exceed any of the trigger levels specified in Table 3 during a release event, the environmental authority holder must compare the down stream results in the receiving waters to the trigger values specified in Table 3 and where the down stream results exceed the trigger values specified Table 3 for any quality characteristic, compare the results of the down stream site to the data from background monitoring sites and;

a) if the result is less than the background monitoring site data, then no action is to be taken; or
b) if the result is greater than the background monitoring site data, complete an investigation into the potential for environmental harm and provide a written report to the administering authority in the next annual return, outlining:
i) details of the investigations carried out; and

ii) actions taken to prevent environmental harm.

Note: Where an exceedance of a trigger level has occurred and is being investigated, in accordance with W6 2(b) of this condition, no further reporting is required for subsequent trigger events for that quality characteristic.

W7 If an exceedance in accordance with condition W6 2(b) is identified, the holder of the authority must notify the administering authority within 14 days of receiving the result.

Mine affected water release events

W8 The holder must ensure a stream flow gauging station(s) is installed, operated and maintained to determine and record stream flows at the locations and flow recording frequency specified in Table 4.

W9 Notwithstanding any other condition of this environmental authority, the release of mine affected water to waters in accordance with condition W2 must only take place during periods of natural flow events in accordance with the receiving water flow criteria for discharge specified in Table 4 for the release point(s) specified in Table 1.

W10 The release of mine affected water to waters in accordance with condition W2 must not exceed the electrical conductivity and sulphate release limits or the maximum release rate for each receiving water flow criteria for discharge specified in Table 4 when measured at the monitoring points specified in Table 1 or cause the downstream limits specified in Table 13-45 to be exceeded.

Table 13-45 Indicative Mine affected water release during flow events

Receiving waters	Release point (RP)	Gauging station	Gauging station latitude (decimal degree, GDA94)	Gauging station longitude (decimal degree, GDA94)	Receiving water flow recording frequency	Receiving water flow criteria for discharge (m^3/s)	Maximum release rate	Electrical conductivity and sulphate release limits
TBA (Carmichael River or Belyando River)	RP1	Gauging Station 1	XXXX	XXXX	Continuous	Low flow <5 m^3/s	1 m^3/s	Electrical conductivity (µS/cm): 1000 $^{2-}$Sulphate (SO_4): 250 mg/L
						Medium flow	NA if downstream	Electrical conductivity (µS/cm)

Receiving waters	Release point (RP)	Gauging station	Gauging station latitude (decimal degree, GDA94)	Gauging station longitude (decimal degree, GDA94)	Receiving water flow recording frequency	Receiving water flow criteria for discharge (m^3/s)	Maximum release rate	Electrical conductivity and sulphate release limits
						5 m^3/s to 50 m^3/s	triggers are met	TBA, based on achieving a limit of 1000µs/cm at Gregory Developmental Road SO_4^{2-} Sulphate (mg/L) TBA, based on achieving a limit of 250 mg/L at Gregory Developmental Road
						High flow > 50 m^3/s	NA if downstream triggers are met	Electrical conductivity (µS/cm) TBA, based on achieving a limit of 1000µs/cm at Gregory Developmental Road SO_4^{2-} Sulphate

Receiving waters	Release point (RP)	Gauging station	Gauging station latitude (decimal degree, GDA94)	Gauging station longitude (decimal degree, GDA94)	Receiving water flow recording frequency	Receiving water flow criteria for discharge (m^3/s)	Maximum release rate	Electrical conductivity and sulphate release limits
								(mg/L) TBA, based on achieving a limit of 250 mg/L at Gregory Developmental Road

W11 The daily quantity of mine affected water released from RP1 must be measured and recorded.

W12 Releases to waters must be undertaken so as not to cause erosion of the bed and banks of the receiving waters, or cause a material build up of sediment in such waters.

Notification of release event

W13 The environmental authority holder must notify the administering authority as soon as practicable and no later than 24 hours after commencing to release mine affected water to the receiving environment. Notification must include the submission of written advice to the administering authority of the following information:

a) release commencement date/time;

b) expected release cessation date/time;

c) release point(s);

d) release volume (estimated);

e) receiving water(s) including the natural flow rate; and

f) any details (including available data) regarding likely impacts on the receiving water(s).

Note: Notification to the administering authority must be addressed to the Manager and Project Manager of the local administering authority via email or facsimile.

W14 The environmental authority holder must notify the administering authority as soon as practicable (nominally within 24 hours after cessation of a release event) of the cessation of a release notified under condition W13 and within 28 days provide the following information in writing:

a) release cessation date/time;

b) natural flow volume in receiving water;

c) volume of water released;

d) details regarding the compliance of the release with the conditions of agency interest—water of this environmental authority (i.e. contamination limits, natural flow, discharge volume);

e) all in-situ water quality monitoring results; and

f) any other matters pertinent to the water release event.

Note: Successive or intermittent releases occurring within 24 hours of the cessation of any individual release can be considered part of a single release event and do not require individual notification for the purpose of compliance with conditions W13 and W14, provided the relevant details of the release are included within the notification provided in accordance with conditions W13 and W14.

Notification of release event exceedance

W15 If the release limits defined in Table 2 are exceeded, the holder of the environmental authority must notify the administering authority within 24 hours of receiving the results.

W16 The authority holder must, within 28 days of a release that exceeds the conditions of this authority, provide a report to the administering authority detailing:
a) the reason for the release;

b) the location of the release;

c) all water quality monitoring results;

d) any general observations;

e) all calculations; and

f) any other matters pertinent to the water release event.

Monitoring of water storage quality

W17 Water storages stated in Table 5 which are associated with the release points must be monitored for the water quality characteristics specified in Table 6 at the monitoring locations and at the monitoring frequency specified in Table 13-46.

Table 13-46 Indicative Water storage monitoring

Water storage description	Latitude (decimal degree, GDA94)	Longitude (decimal degree, GDA94)	Monitoring location	Frequency of monitoring
Mine Affected Water Dam 1	XXXX	XXXX	TBA	Quarterly
Mine Affected Water Dam 2	XXXX	XXXX	TBA	Quarterly
Mine Affected Water Dam 3	XXXX	XXXX	TBA	Quarterly
Mine Affected Water Dam 4	XXXX	XXXX	TBA	Quarterly
Mine Affected Water Dam 5	XXXX	XXXX	TBA	Quarterly
Sediment Pond N1	XXXX	XXXX	TBA	Quarterly
Sediment Pond N2	XXXX	XXXX	TBA	Quarterly
Sediment Pond N3	XXXX	XXXX	TBA	Quarterly
Sediment Pond N4	XXXX	XXXX	TBA	Quarterly
Sediment Pond N5	XXXX	XXXX	TBA	Quarterly
Sediment Pond N6	XXXX	XXXX	TBA	Quarterly
Sediment Pond N7	XXXX	XXXX	TBA	Quarterly
Sediment Pond N8	XXXX	XXXX	TBA	Quarterly

Water storage description	Latitude (decimal degree, GDA94)	Longitude (decimal degree, GDA94)	Monitoring location	Frequency of monitoring
Sediment Pond S1	XXXX	XXXX	TBA	Quarterly
Sediment Pond S2	XXXX	XXXX	TBA	Quarterly
Sediment Pond S3	XXXX	XXXX	TBA	Quarterly
Sediment Pond S4	XXXX	XXXX	TBA	Quarterly
Sediment Pond S5	XXXX	XXXX	TBA	Quarterly

W18 In the event that waters storages defined in Table 5 exceed the contaminant limits defined in Table 6, the holder of the environmental authority must implement measures, where practicable, to avoid any uncontrolled discharge.

Table 13-47 Indicative onsite water storage contaminant limits

Quality characteristic	Test value	Contaminant limit
pH (pH unit)	Range	less than 4, greater than 9[2]
Electrical conductivity (µS/cm)	Maximum	10000

W19 Receiving environment monitoring and contaminant trigger levels

The quality of the receiving waters must be monitored at the locations specified in Table 8 for each quality characteristic and at the monitoring frequency stated in Table 7.

Table 13-48 Indicative Receiving waters contaminant trigger levels

Quality characteristic	Trigger level	Monitoring frequency
pH	6.5–8.5	Daily during any release
Electrical conductivity (µS/cm)	1000	
Turbidity (NTU)	To be determined.	
Sulphate (SO^{2-}) (mg/L)	250	
Sodium (mg/L)	To be determined	

Table 13-49 Indicative Receiving water upstream background sites and downstream monitoring points

Monitoring point	Receiving waters location description	Latitude (GDA 94)	Longitude (GDA 94)
Upstream background monitoring points			
Monitoring point US1	TBA	XXXX	XXXX

Downstream monitoring points			
Monitoring point DS1	Belyando River at Gregory Developmental Road	XXXX	XXXX

W20 If quality characteristics of the receiving water at the downstream monitoring points exceed any of the trigger levels specified in Table 7 during a release event the environmental authority holder must compare the down stream results to the upstream results in the receiving waters and:

a) where the downstream result is the same or a lower value than the upstream value for the quality characteristic then no action is to be taken; or

b) where the down stream results exceed the upstream results complete an investigation into the potential for environmental harm and provide a written report to the administering authority in the next annual return, outlining:

  – details of the investigations carried out; and
  – actions taken to prevent environmental harm.

Note: Where an exceedance of a trigger level has occurred and is being investigated, in accordance with W20(2) of this condition, no further reporting is required for subsequent trigger events for that quality characteristic.

Receiving environment monitoring program (REMP)

W21 The environmental authority holder must develop and implement a REMP to monitor, identify and describe any adverse impacts to surface water environmental values, quality and flows due to the authorised mining activity. This must include monitoring the effects of the mine on the receiving environment periodically (under natural flow conditions) and while mine affected water is being discharged from the site.

For the purposes of the REMP, the receiving environment is the waters of the Carmichael River and Belyando River from upstream of the MAW Discharge point to the Belyando River at the Gregory Developmental Road. The REMP should encompass any sensitive receiving waters or environmental values downstream of the authorised mining activity that will potentially be directly affected by an authorised release of mine affected water.

W22 The REMP must:

a) assess the condition or state of receiving waters, including upstream conditions, spatially within the REMP area, considering background water quality characteristics based on accurate and reliable monitoring data that takes into consideration temporal variation (e.g. seasonality);

b) be designed to facilitate assessment against water quality objectives for the relevant environmental values that need to be protected;

c) include monitoring from background reference sites (e.g. upstream or background) and downstream sites from the release (as a minimum, the locations specified in Table 8);

d) specify the frequency and timing of sampling required in order to reliably assess ambient conditions and to provide sufficient data to derive site specific background reference values in accordance with the Queensland Water Quality Guidelines 2006. This should include monitoring during periods of natural flow irrespective of mine or other discharges;

e) include monitoring and assessment of dissolved oxygen saturation, temperature and all water quality parameters listed in Table 2 and 3);

f) include, where appropriate, monitoring of metals/metalloids in sediments (in accordance with ANZECC & ARMCANZ 2000, BATLEY and/or the most recent version of AS5667.1 Guidance on Sampling of Bottom Sediments);

g) include, where appropriate, monitoring of macroinvertebrates in accordance with the AusRivas methodology;

h) apply procedures and/or guidelines from ANZECC and ARMCANZ 2000 and other relevant guideline documents;

i) describe sampling and analysis methods and quality assurance and control; and

j) incorporate stream flow and hydrological information in the interpretations of water quality and biological data.

W23 A REMP Design Document that addresses each criterion presented in conditions W21 and W22 must be prepared and submitted to the administering authority no later than 3 months after the date of issue of this environmental authority [include for new sites or expansion projects, remove for existing mine sites which already have REMP Design Documents]. Due consideration must be given to any comments made by the administering authority on the REMP Design Document and subsequent implementation of the program.

W24 A report outlining the findings of the REMP, including all monitoring results and interpretations in accordance with conditions W21 and W22 must be prepared annually and made available on request to the administrating authority. This must include an assessment of background reference water quality, the condition of downstream water quality compared against water quality objectives, and the suitability of current discharge limits to protect downstream environmental values.

Water general

W28 All determinations of water quality and biological monitoring must be:

a) performed by a person or body possessing appropriate experience and qualifications to perform the required measurements;

b) made in accordance with methods prescribed in the latest edition of the Department of Environment and Heritage Protection's Monitoring and Sampling Manual;

c) **Note:** Condition W28 requires the Monitoring and Sampling Manual to be followed and where it is not followed because of exceptional circumstances this should be explained and reported with the results.

d) collected from the monitoring locations identified within this environmental authority, within XX hour of each other where possible;

e) carried out on representative samples; and

f) analysed at a laboratory accredited (e.g. NATA) for the method of analysis being used.

W29 The release of any contaminants as permitted by this environmental authority, directly or indirectly to waters, other than internal water management infrastructure that is installed and operated in accordance with a water management plan that complies with conditions W32 to W37 inclusive:

a) must not produce any visible discolouration of receiving waters; and

b) must not produce any slick or other visible or odorous evidence of oil, grease or petrochemicals nor contain visible floating oil, grease, scum, litter or other objectionable matter.

Annual Water Monitoring Reporting

W30 The following information must be recorded in relation to all water monitoring required under the conditions of this environmental authority and submitted to the administering authority in the specified format with each annual return:

a) the date on which the sample was taken;

b) the time at which the sample was taken;

c) the monitoring point at which the sample was taken;

d) the measured or estimated daily quantity of mine affected water released from all release points;

e) the release flow rate at the time of sampling for each release point;

f) the results of all monitoring and details of any exceedances of the conditions of this environmental authority; and

g) water quality monitoring data must be provided to the administering authority in the specified electronic format upon request.

Temporary interference with waterways

W31 Temporarily destroying native vegetation, excavating, or placing fill in a watercourse, lake or spring necessary for and associated with mining operations must be undertaken in accordance with EHP's guideline Activities in a Watercourse, Lake or Spring Associated with Mining Activities.

Water management plan

W32 A Water Management Plan must be developed by an appropriately qualified person and implemented prior to commencement of mining activities.

W33 The Water Management Plan must:

a) provide for effective management of actual and potential environmental impacts resulting from water management associated with the mining activity carried out under this environmental authority; and

b) be developed in accordance with EHP's guideline Preparation of Water Management Plans for Mining Activities (EM324) and include:

- a study of the source of contaminants;
- a water balance model for the site;
- a water management system for the site;
- measures to manage and prevent saline drainage;
- measures to manage and prevent acid rock drainage ;
- contingency procedures for emergencies; and

– a program for monitoring and review of the effectiveness of the water management plan.

W34 The water management plan must be reviewed each calendar year and a report prepared by an appropriately qualified person. The report must:

a) assess the plan against the requirements under condition W33;

b) include recommended actions to ensure actual and potential environmental impacts are effectively managed for the coming year; and

c) identify any amendments made to the water management plan following the review.

W35 The holder of this environmental authority must attach to the review report required by condition W34, a written response to the report and recommended actions, detailing the actions taken or to be taken by the environmental authority holder on stated dates:

a) to ensure compliance with this environmental authority; and

b) to prevent a recurrence of any non-compliance issues identified.

W36 The review report required by condition W34 and the written response to the review report required by condition W35 must be submitted to the administering authority with the subsequent annual return under the signature of the appointed signatory for the annual return.

W37 A copy of the water management plan must be provided to the administering authority on request.

Assessment of dam hazard category

W38 The hazard category of any structure for containing hazardous wastes must be assessed by a suitably qualified and experienced person:

a) in accordance with the Manual for Assessing Hazard Categories and Hydraulic Performance of Dams (EM635); and

b) in any of the following situations:

– prior to the design and construction of the structure; or

– prior to any change in its purpose or the nature of its stored contents; and

– in accordance with the *Manual for Assessing Hazard Categories and Hydraulic Performance of Dams (EM635).*

W39 A hazard assessment report and certification must be prepared for any structure assessed and the report may include a hazard assessment for more than one structure.

The holder must, on receipt of a hazard assessment report and certification, provide to the administering authority one paper copy and one electronic copy of the hazard assessment report and certification.

Certification must be provided by the suitably qualified and experienced person who undertook the assessment, in the form set out in the *Manual for Assessing Hazard Categories and Hydraulic Performance of Dams (EM635).*

W40 The holder must take reasonable and practical measures so that each dam associated with the mining activity is designed, constructed, operated and maintained in accordance with accepted engineering standards and is fit for the purpose for which it is intended.

Design and construction of a regulated structure

W41 All regulated structures must be designed by, and constructed[4] under the supervision of, a suitably qualified and experienced person in accordance with the requirements of the *Manual for Assessing Hazard Categories and Hydraulic Performance of Dams (EM635)*.

W42 Construction of a regulated structure is prohibited unless the holder has:

a) submitted a hazard category assessment report and certification to the administering authority;

b) commissioned a suitably qualified and experienced person to prepare a design plan for the structure; and

c) received the certification from a suitably qualified and experienced person for the design and design plan and the associated operating procedures in compliance with the relevant condition of this authority.

Certification must be provided by the suitably qualified and experienced person who oversees the preparation of the design plan, in the form set out in the *Manual for Assessing Hazard Categories and Hydraulic Performance of Dams (EM635)*.

Operation of a regulated structure

W43 Operation of a regulated structure is prohibited unless: the holder has submitted to the administering authority:

a) one paper copy and one electronic copy of the design plan and certification of the 'design plan' and

b) a set of 'as constructed' drawings and specifications, and

c) certification of those 'as constructed drawings and specifications' in accordance with condition W42, and

d) where the regulated structure is to be managed as part of an integrated containment system for the purpose of sharing the DSA volume across the system, a copy of the certified system design plan.

e) the requirements of this authority relating to the construction of the regulated structure have been met;

W44 Each regulated structure must be maintained and operated in a manner that is consistent with the current design plan, the current operational plan, and the associated certified 'as constructed' drawings for the duration of its operational life until decommissioned and rehabilitated.

Mandatory reporting level

W45 The Mandatory Reporting Level (the MRL) must be marked on a regulated dam in such a way that during routine inspections of that dam, it is clearly observable.

W46 The holder must, as soon as practical and within forty-eight (48) hours of becoming aware, notify the administering authority when the level of the contents of a regulated dam reaches the MRL.

W47 The holder must, immediately on becoming aware that the MRL has been reached, act to prevent the occurrence of any unauthorised discharge from the regulated dam.

Annual inspection report

W48 Each regulated structure must be inspected each calendar year by a suitably qualified and experienced person. At each annual inspection, the condition and adequacy of all components of the regulated structure must be assessed:

a) against the most recent hazard assessment report and design plan (or system design plan); against recommendations contained in previous annual inspections reports;

b) against recognised dam safety deficiency indicators;

c) for changes in circumstances potentially leading to a change in hazard category;

d) for conformance with the conditions of this authority; for conformance with the 'as constructed' drawings;

e) for the adequacy of the available storage in each regulated dam, based on an actual observation or observations taken, of accumulated sediment, state of the containment barrier and the level of liquids in the dam (or network of linked containment systems);

f) for evidence of conformance with the current operational plan.

W49 A suitably qualified and experienced person must prepare an annual inspection report containing details of the assessment and including recommended actions to ensure the integrity of the regulated structure. The suitably qualified and experienced person who prepared the annual inspection report must certify the report in accordance with the *Manual for Assessing Hazard Categories and Hydraulic Performance of Dams (EM635)*.

W50 The holder must:

a) upon receipt of the annual inspection report, consider the report and its recommendations and take action to ensure that the regulated structure will safely perform its intended function; and

b) within twenty (20) business days of receipt of the annual inspection report, notify the administering authority in writing, of the recommendations of the inspection report and the actions being taken to ensure the integrity of each regulated structure.

W51 A copy of the annual inspection report must be provided to the administering authority upon request and within ten (10) business days6.

Design storage allowance

W52 On the anniversary of each year, storage capacity must be available in each regulated dam (or network of linked containment systems with a shared DSA volume), to meet the Design Storage Allowance (DSA) volume for the dam (or network of linked containment systems).

The holder must, as soon as possible and within forty-eight (48) hours of becoming aware that the regulated dam (or network of linked containment systems) will not have the available storage to meet the DSA volume on 1 November of any year, notify the administering authority.

W53 The holder must, immediately on becoming aware that a regulated dam (or network of linked containment systems) will not have the available storage to meet the DSA volume on 1 November of any year, act to prevent the occurrence of any unauthorised discharge from the regulated dam or linked containment systems.

W54 Regulated structures location and performance

Each regulated structure named in Column 1, of Schedule D - Table 1 must be wholly located within the control points noted in columns 2 and 3 of Schedule D - Table 13-50, below, for that structure.

Table 13-50 Schedule D (Regulated Structures)

Name of regulated structure	Latitude (GDA 94)	Longitude (GDA 94)	Unique Location Identification – Levees
Tailings storage facility	XXXX (1)	XXXX	NA
Mine Affected Water Dam 1	XXXX	XXXX	NA
Mine Affected Water Dam 2	XXXX	XXXX	NA
Mine Affected Water Dam 3	XXXX	XXXX	NA
Mine Affected Water Dam 4	XXXX	XXXX	NA
Mine Affected Water Dam 5	XXXX	XXXX	NA
Sediment Pond N1	XXXX	XXXX	NA
Sediment Pond N2	XXXX	XXXX	NA
Sediment Pond N3	XXXX	XXXX	NA
Sediment Pond N4	XXXX	XXXX	NA
Sediment Pond N5	XXXX	XXXX	NA
Sediment Pond N6	XXXX	XXXX	NA
Sediment Pond N7	XXXX	XXXX	NA
Sediment Pond N8	XXXX	XXXX	NA

Name of regulated structure	Latitude (GDA 94)	Longitude (GDA 94)	Unique Location Identification – Levees
Sediment Pond S1	XXXX	XXXX	NA
Sediment Pond S2	XXXX	XXXX	NA
Sediment Pond S3	XXXX	XXXX	NA
Sediment Pond S4	XXXX	XXXX	NA
Sediment Pond S5	XXXX	XXXX	NA
Carmichael River South Levee	XXXX	XXXX	XXXX
Carmichael River North Levee	XXXX	XXXX	XXXX
Eight Mile Creek Levee	XXXX	XXXX	XXXX

(1) A minimum of three control points is required to constrain the location of all activities associated with the regulated structure.

W55 Each regulated dam named in column 1 of Schedule D—Table 13-51, must be consistent with the details noted in columns 2 through to and including 7 of Schedule D - Table 13-51, below, for that dam.

Table 13-51 Schedule D – (Basic Details of Regulated Dams)

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7
Name of Regulated dam[1]	Hazard Category	Surface area of dam at spillway (ha)	Max. volume of dam at spillway (m^3)	Max. depth of dam[2] at spillway (m)	Spillway Level (mAHD)	Use of dam[3]
Tailings storage facility	XXXX	XXXX	XXXX	XXXX	XXXX	Storage of tailings
Mine Affected Water	High	XXXX	XXXX	XXXX	XXXX	Storage of mine affected water
Mine Affected Water	High	XXXX	XXXX	XXXX	XXXX	Storage of mine affected water
Mine Affected Water	High	XXXX	XXXX	XXXX	XXXX	Storage of mine affected water
Mine Affected Water	High	XXXX	XXXX	XXXX	XXXX	Storage of mine affected water
Mine Affected Water	High	XXXX	XXXX	XXXX	XXXX	Storage of mine affected water
Sediment Pond N1	Low	XXXX	XXXX	XXXX	XXXX	Sediment capture from spoil stockpile

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7
Name of Regulated dam[1]	Hazard Category	Surface area of dam at spillway (ha)	Max. volume of dam at spillway (m^3)	Max. depth of dam[2] at spillway (m)	Spillway Level (mAHD)	Use of dam[3]
Sediment Pond N2	Low	XXXX	XXXX	XXXX	XXXX	Sediment capture from spoil stockpile
Sediment Pond N3	Low	XXXX	XXXX	XXXX	XXXX	Sediment capture from spoil stockpile
Sediment Pond N4	Low	XXXX	XXXX	XXXX	XXXX	Sediment capture from spoil stockpile
Sediment Pond N5	Low	XXXX	XXXX	XXXX	XXXX	Sediment capture from spoil stockpile
Sediment Pond N6	Low	XXXX	XXXX	XXXX	XXXX	Sediment capture from spoil stockpile
Sediment Pond N7	Low	XXXX	XXXX	XXXX	XXXX	Sediment capture from spoil stockpile
Sediment Pond N8	Low	XXXX	XXXX	XXXX	XXXX	Sediment capture from spoil stockpile
Sediment Pond S1	Low	XXXX	XXXX	XXXX	XXXX	Sediment capture from spoil stockpile
Sediment Pond S2	Low	XXXX	XXXX	XXXX	XXXX	Sediment capture from spoil stockpile
Sediment Pond S3	Low	XXXX	XXXX	XXXX	XXXX	Sediment capture from spoil stockpile
Sediment Pond S4	Low	XXXX	XXXX	XXXX	XXXX	Sediment capture from spoil stockpile
Sediment Pond S5	Low	XXXX	XXXX	XXXX	XXXX	Sediment capture from spoil stockpile

W56 Each regulated dam named in column 1 of Schedule D – Table 13-50, must meet the hydraulic performance criteria noted in columns 2 through to and including 4 of Schedule D - Table 13-52, below, for that dam.

Table 13-52 Schedule D – (Hydraulic Performance of Regulated Dams)

Name of regulated dam	Spillway capacity (AEP)	Design storage allowance	Mandatory Reporting Level
Tailings storage facility	XXXX	XXXX	XXXX
Mine Affected Water Dam 1	XXXX	XXXX	XXXX
Mine Affected Water Dam 2	XXXX	XXXX	XXXX
Mine Affected Water Dam 3	XXXX	XXXX	XXXX
Mine Affected Water Dam 4	XXXX	XXXX	XXXX
Mine Affected Water Dam 5	XXXX	XXXX	XXXX
Sediment Pond N1	XXXX	XXXX	XXXX
Sediment Pond N2	XXXX	XXXX	XXXX
Sediment Pond N3	XXXX	XXXX	XXXX
Sediment Pond N4	XXXX	XXXX	XXXX
Sediment Pond N5	XXXX	XXXX	XXXX
Sediment Pond N6	XXXX	XXXX	XXXX
Sediment Pond N7	XXXX	XXXX	XXXX
Sediment Pond N8	XXXX	XXXX	XXXX
Sediment Pond S1	XXXX	XXXX	XXXX
Sediment Pond S2	XXXX	XXXX	XXXX
Sediment Pond S3	XXXX	XXXX	XXXX
Sediment Pond S4	XXXX	XXXX	XXXX
Sediment Pond S5	XXXX	XXXX	XXXX

Each regulated levee named in column 1 of Schedule D – Table 13-50, must be consistent with the details noted in columns 2 through to and including 6 of Schedule D - Table 13-53, below, for that levee.

Table 13-53 Schedule D – (Basic Details of Regulated Levees)

Name of regulated levee	Design AEP	Design Flood Level	Minimum Levee level	Local ID
Carmichael River South Levee	1000	XXXX	XXXX	XXXX
Carmichael River North Levee	1000	XXXX	XXXX	XXXX
Eight Mile Creek Levee	1000	XXXX	XXXX	XXXX

13.20 Groundwater

13.20.1 Legislative Framework

There are two key pieces of legislation that govern ground water resources in Queensland.

The EP Act establishes the frameworks for managing water quality such that environmental values in relation to water quality are protected. This includes:

- The Environmental Protection (Water) Policy 2008 which:
- Identifies environmental values and management goals for Queensland waters (surface water and groundwater)
  - Establishes water quality goals and guidelines for waters
  - Provides guidance on making consistent, equitable and informed decisions about waters
  - Includes requirements for monitoring of ambient water quality.
- Requirements for assessment and approval of activities (environmentally relevant activities) that might result in impacts on groundwater resources.
- Provisions in relation to compliance with approval conditions in relation to impacts of activities on ground water resources.

The *Water Act 2000* regulates the sustainable use of water resources, including allocation of water resources for environmental benefits as well as activities that impact on the integrity of watercourses. Water resource plans (WRPs) define the availability of water for each basin in Queensland, including the Great Artesian Basin (GAB), and frameworks and mechanisms for sustainably managing water supply and demand. Resource operations plans then set out rules in relation to the allocation of water resources and other decisions made under the WRP. The Carmichael Coal Mine is within the area covered by the *Water Resource (Burdekin Basin) Plan 2007* and at the edge of the area covered by the *Water Resource)Great Artesian Basin) Plan 2006*.

Water supply for the Carmichael Coal mine from outside the mining lease and is covered in the EMP for off-site infrastructure. Within the mining lease a water licence is required in relation to the extraction of groundwater through mine dewatering and development approvals are required for installation of groundwater bores.

13.20.2 Environmental Values

A summary of the hydrogeological units present in the Carmichael Coal Mine area is provided in Volume 2 Section 6 Water Resources.

Groundwater from the Moolayembar Formation and Clematis Sandstone is suitable for stock, domestic and irrigation use. Salinity and other constraints affect suitability for use of groundwater from other aquifers, however some extraction from bores in these units for stock and domestic use is known to occur. Groundwater quality is generally suitable for industrial use.

Groundwater flow appears to be typically towards the south-east across the northern and central parts of EPC 1690 in the Dunda Beds, Rewan Group, Permian-age sandstones and siltstones, the AB seam and the D seam. Across southern areas of EPC 1690, interpretation of the data suggests groundwater flow is typically towards the north west in the Permian-age sandstones and siltstones and the AB and D seams.

There is potential for groundwater to discharge to the Carmichael river, particularly towards the western margin of the Study Area. Data suggests that in the western part of the mine, there is an upward gradient from the Dunda Beds to the overlying alluvium and groundwater levels in the alluvium are typically above the bed of the adjacent Carmichael River.

To the east, it appears that there are upward gradients from the Tertiary deposits to the overlying alluvium but that groundwater levels in the alluvium at and shallow Tertiary deposits are below the bed of the adjacent Carmichael River. This suggests the potential for leakage from the river to groundwater in these areas.

Based on the groundwater level data alone it appears that the Carmichael River may switch from gaining flow from groundwater to losing flow to groundwater between the western and eastern boundaries of the site.

There are several groundwater dependent ecosystems in the area:

- The Doongmabulla Spring complex is located approximately 10 km west of the study area on the eastern margin of the GAB. This complex features around 11-14 springs
- Two springs on the Mellaluka property, about 10 km to the south of the mine area. Geological data is limited in this area and it is not certain which aquifer discharges to these springs
- Riparian vegetation, particularly mature trees along the Carmichael River and Belyando River appears to be dependent on alluvial groundwater.
- Groundwater contributes around 15,300 m3/day of flow to the Carmichael River.

13.20.3 Potential Impacts

13.20.3.1 Construction

Table 13-54 Potential Environmental Impacts – Construction

Activity	Potential Environmental Impact
Dewatering of excavations	◗ Drawdown of groundwater may occur, however most excavations are relatively shallow with respect to the groundwater levels, relatively small in volume and requiring dewatering only over a short period of time. Hence, impacts are not expected. ◗ Disposal of groundwater from dewatering has the potential to cause surface water degradation particularly if salinity is high
Contamination from spills or leaks of environmentally hazardous substances	◗ Large spills of environmentally hazardous materials, or leaks that are allowed to continue over long periods of time may cause contamination of groundwater. Measures to prevent soil contamination set out in Section 13.27.5 will also address risk to groundwater. ◗ Improper irrigation of treated wastewater may cause nutrients to leach to groundwater. Measures for management of irrigation of treated sewage are set out in Section 13.22.5 will address this impact.

13.20.3.2 Operations

Table 13-55 Potential Environmental Impacts – Operation

Activity	Potential Environmental Impact
Mine dewatering	◗ Mine dewatering is predicted to cause groundwater drawdown ◗ Drawdown impacts on Doongmabulla Springs are predicted to be negligible (0.05 to 0.12 m). Preliminary drawdown predictions for Mellaluka Springs indicate drawdown of of 0.7-0.8m however further work is required

Activity	Potential Environmental Impact
	◗ Drawdown of up to 30m may occur in the vicinity of the Carmichael River ◗ Groundwater flows to the Carmichael River may be reduced by up to 1,000 m3/day which equates to about 7 % of groundwater inputs to the River
Longwall mining and subsidence	◗ Subsidence is predicted to cause fracturing in overlying strata with predictions of a free draining fracture zone with a maximum height of approximately 150 meters forming above each of the mined seams. This will increase vertical hydraulic conductivity between aquifers.
Contamination from spills or leaks of environmentally hazardous substances	◗ Large spills of environmentally hazardous materials, or leaks that are allowed to continue over long periods of time may cause contamination of groundwater. Measures to prevent soil contamination set out in Section 13.27.5 will also address risk to groundwater. ◗ Improper irrigation of treated wastewater may cause nutrients to leach to groundwater. Measures for management of irrigation of treated sewage are set out in Section 13.22.5 will address this impact.

13.20.4 Performance Outcome

- Groundwater users are not adversely impacted in terms of availability of water for stock and domestic use
- Impacts on groundwater dependent ecosystems do not cause loss of biodiversity values.

13.20.5 Proposed Controls

13.20.5.1 Design and pre-construction

Table 13-56 Groundwater – Design and Preconstruction Controls

Control	Responsibility	Timing	Evidence
Update groundwater model to include additional information on groundwater and geology obtained from monitoring programs	Environmental Manager	6 months prior to commencement of mining	Revised model
Re-run groundwater model to test effects on long term drawdown of partial backfill of all pits and determine whether backfilling of pits is beneficial	Environmental Manager	Prior to finalisation of Mine Plan	Revised model
Use monitoring data to set groundwater quality trigger levels	Environmental Manager	Prior to commencement of mining	Trigger levels in environmental authority
Liaise with adjacent landholders and develop bore monitoring programs to detect changes in bores used for water supply	Environmental manager	12 months prior to commencement of mining	Updated groundwater monitoring plan.
Enter into “make good” agreements with surrounding landholders in relation to groundwater impacts.	Stakeholder Manager	Prior to commencement of mining	Agreements in place

13.20.5.2 Construction

Table 13-57 Groundwater - Construction Controls

Control	Responsibility	Timing	Evidence
Identify presence and quality of groundwater in any areas where excavation is to occur and determine approach to managing groundwater from excavation such that degradation of surface water quality or land does not occur. Document management approach and monitoring requirements in the work permit application	Construction Manager	Prior to any excavation more than 2m below ground level	Work permit details
Check that work permit applications include appropriate measures for management of groundwater from excavations	Environmental Manager	Prior to issuing permit	Work permit

13.20.5.3 Operations

Table 13-58 Groundwater - Operational Controls

Control	Responsibility	Timing	Evidence
Update groundwater model to include additional information on groundwater and geology obtained from monitoring programs	Environmental Manager	Everytwo2 years for first ten years and then every five years	Revised model
Re-run groundwater model to test drawdown effects on sensitive receptors, review management, monitoring and mitigation measures and develop additional measures as required	Environmental Manager	Each time model is updated	Updated monitoring, management and mitigation measures

13.20.6 Monitoring and Corrective Action

Table 13-59 Groundwater Monitoring and Corrective Action

Monitoring action	Responsibility	Frequency	Performance Requirement	Corrective Action
Monitor groundwater flows into Carmichael River and surface flows	Environmental Manager	Annually	No more than 10% reduction in groundwater inflows	Direct diversions to the Carmichael River or release high quality water to the River
Conduct groundwater quality monitoring across monitoring network for: • pH, DO, turbidity, EC, temperature (field and lab) • total organic carbon • Major ions • Fluoride and sulfide • Nutrients • Dissolved metals • Hydrocarbons (TPH and BTEX)	Environmental Manager	Quarterly for first 10 years and then annually	Trigger levels set in environmental authority are not exceeded	• Repeat monitoring immediately on receiving non-compliant results • If repeat results indicate persistent elevation, raise an incident report and commence incident investigation. • Undertake corrective actions as identified in the incident investigation
Conduct groundwater level monitoring across monitoring	Environmental Manager	Continuous	Drawdown at Doongmabulla Springs does not exceed	• Implementation of adaptive monitoring

Monitoring action	Responsibility	Frequency	Performance Requirement	Corrective Action
network			0.1m	program
			Drawdown at Mellaluka springs does not exceed trigger level to be determined	• Mine Planning and Rehabilitation mitigation measures implemented
			Drawdown at stock and domestic bores does not affect yield	• Implement make good agreements with landholders
As Mining Activity progresses, the monitoring network will be updated for inclusion of new bores or exclusion of bores in mined areas.	Environmental Manager	Continuous	Ongoing monitoring	• Maintain updated monitoring program

Table 13-60 Groundwater Monitoring Network Summary

Groundwater Monitoring Sites	Monitored Unit	Monitoring Purpose
C006P1	Interburden	Levels and quality, vertical gradients between strata
C006P3r	D Seam	
C007P2	AB Seam	Levels and quality, vertical gradients between strata
C007P3	D Seam	

Groundwater Monitoring Sites	Monitored Unit	Monitoring Purpose
C008P1 C008P2	Permian Overburden AB Seam	Levels and quality, vertical gradients between strata
C011P1 C011P3	Interburden D Seam	Levels and quality, vertical gradients between strata
C012P1 C012P2	Permian Overburden Tertiary/Permian	Levels and quality, vertical gradients between strata
C014P2	AB Seam	Levels and quality (no groundwater encountered in Tertiary-age strata)
C016P2	AB Seam	Levels and quality
C018P1 C018P2 C018P3	Permian Overburden AB Seam D Seam	Levels and quality, vertical gradients between strata
C020P2	AB Seam	Levels and quality
C022P1	Dunda Beds	Levels and quality, geological unit within the Great Artesian Basin
C024P3	D Seam	Levels and quality
C025P1 C025P2	Tertiary Tertiary	Levels and quality, potential connectivity between groundwater and the Carmichael River, vertical gradients
C027P1 C027P2	Alluvium Dunda Beds	Levels and quality, potential connectivity between groundwater and the Carmichael River, vertical gradients

Groundwater Monitoring Sites	Monitored Unit	Monitoring Purpose
C029P1	Alluvium	Levels and quality, potential connectivity between groundwater and the Carmichael River, vertical gradients
C029P2	Tertiary	
C032P2	AB Seam	Levels and quality
C034P1	Interburden	Levels and quality, vertical gradients between strata
C034P3	D Seam	
C035P1	Rewan Group	Levels and quality, vertical gradients between strata
C035P2	AB Seam	
C9553P1R	Dunda Beds	Levels, vertical gradients between strata
C553P_V01	D1 Seam	
C553P_V02	AB1 Seam	
C553P_V03	Permian Overburden	
C555P1	Rewan Group	Levels, vertical gradients between strata
C555P_V01	D Seam	
C555P_V02	AB1 Seam	
C555P_V03	Rewan Group	
C556P1	Rewan Group	Levels, vertical gradients between strata
C9556P_V01	D2 Seam	
C9556P_V02	AB1 Seam	

Groundwater Monitoring Sites	Monitored Unit	Monitoring Purpose
C9556P_V03	Rewan Group	
C558P1	Permian Overburden	Levels, vertical gradients between strata
C558P_V01	D1 Seam	
C558P_V02	Interburden	
C558P_V03	AB1 Seam	
C056C_V01	D1 Seam	Levels, vertical gradients between strata
C056C_V02	AB1 Seam	
C056C_V03	Rewan Group	
HD01	Dunda Beds	Levels (west of EPC 1690)
HD02	Clematis Sandstone	Levels (between EPC 1690 and Doongmabulla Springs)
HD03A	Dunda Beds	Levels, vertical gradients between strata (between EPC 1690 and Doongmabulla Springs)
HD03B	Alluvium	

13.20.6 Proposed Environmental Authority Conditions

(D1) A groundwater monitoring program must be designed and implemented as described in Table D1 and Table D2.

Table D1 Groundwater Monitoring Frequency and Parameters

Monitoring Sites	Parameter	Frequency
C006P1, C006P3r, C007P2, C007P3, C008P1, C008P2, C011P1, C011P3, C012P1, C012P2, C014P2, C016P2, C018P1, C018P2, C018P3 C020P2 C022P1 C024P3 C025P1, C025P2 C027P1, C027P2 C034P1, C034P3 C035P1, C035P2	Water level	weekly – electronic data loggers
	pH, EC, TDS (lab), cations, anions, sulphate and fluoride, selected dissolved metals (Al, As, B, Cd, Cr, Co, Cu, Fe, Pb, Mn, Hg, Ni, Se, Zn), nutrients	Quarterly for initial 10 years and then annually
C9553P1R, C553P_V01, C553P_V02, C553P_V03 C555P1, C555P_V01, C555P_V02, C555P_V03, C556P1, C9556P_V01, C9556P_V02, C9556P_V03 C558P1, C558P_V01, C558P_V02, C558P_V03 C056C_V01, C056C_V02, C056C_V03 HD01 HD02 HD03A, HD03B	Water level only	weekly – electronic data loggers

Table D2 Groundwater Monitoring Network Locations

Monitoring Sites	Easting (AGD84)	Northing (AGD84)	Monitored Unit	Monitoring Type
C006P1	435726.146	7560833.182	Interburden	Levels and quality, vertical gradients between strata
C006P3r	435733.591	7560825.82	D Seam	
C007P2	434726.28	7559864.482	AB Seam	Levels and quality, vertical gradients between strata
C007P3	434727.969	7559861.908	D Seam	

Monitoring Sites	Easting (AGD84)	Northing (AGD84)	Monitored Unit	Monitoring Type
C008P1	433710.221	7558830.229	Permian Overburden	Levels and quality, vertical gradients between strata
C008P2	433707.789	7558826.807	AB Seam	
C011P1	428842.528	7569952.912	Interburden	Levels and quality, vertical gradients between strata
C011P3	428845.625	7569954.926	D Seam	
C012P1	430887.597	7569874.426	Permian Overburden	Levels and quality, vertical gradients between strata
C012P2	430887.426	7569876.797	Tertiary/Permian	
C014P2	430730.902	7563976.225	AB Seam	Levels and quality (no groundwater encountered in Tertiary-age strata)
C016P2	422017.42	7574974.28	AB Seam	Levels and quality
C018P1	423981.852	7574849.963	Permian Overburden	Levels and quality, vertical gradients between strata
C018P2	423988.081	7574849.148	AB Seam	
C018P3	423977.524	7574853.22	D Seam	
C020P2	427845.604	7566931.847	AB Seam	Levels and quality
C022P1	426812.614	7565961.716	Dunda Beds	Levels and quality, geological unit within the Great Artesian Basin
C024P3	428909.131	7571761.206	D Seam	Levels and quality
C025P1	438015.576	7555845.846	Tertiary	Levels and quality, potential connectivity between

Monitoring Sites	Easting (AGD84)	Northing (AGD84)	Monitored Unit	Monitoring Type
C025P2	438010.253	7555844.706	Tertiary	groundwater and the Carmichael River, vertical gradients
C027P1	433643.076	7554818.391	Alluvium	Levels and quality, potential connectivity between groundwater and the Carmichael River, vertical gradients
C027P2	433648.209	7554818.544	Dunda Beds	
C029P1	437691.058	7555082.374	Alluvium	Levels and quality, potential connectivity between groundwater and the Carmichael River, vertical gradients
C029P2	437687.554	7555080.918	Tertiary	
C032P2	439404.358	7544896.018	AB Seam	Levels and quality
C034P1	442385.586	7547815.692	Interburden	Levels and quality, vertical gradients between strata
C034P3	442388.717	7547813.986	D Seam	
C035P1	441403.586	7546823.808	Rewan Group	Levels and quality, vertical gradients between strata
C035P2	441401.683	7546827.747	AB Seam	
C9553P1R			Dunda Beds	Levels, vertical gradients between strata
C553P_V01			D1 Seam	
C553P_V02			AB1 Seam	
C553P_V03	421010.111	7573974.87	Permian Overburden	
C555P1			Rewan Group	Levels, vertical gradients between strata
C555P_V01			D Seam	
C555P_V02	432449.639	7557880.783	AB1 Seam	

Monitoring Sites	Easting (AGD84)	Northing (AGD84)	Monitored Unit	Monitoring Type
C555P_V03			Rewan Group	
C556P1			Rewan Group	Levels, vertical gradients between strata
C9556P_V01			D2 Seam	
C9556P_V02			AB1 Seam	
C9556P_V03	436524.082	7549881.547	Rewan Group	
C558P1			Permian Overburden	Levels, vertical gradients between strata
C558P_V01			D1 Seam	
C558P_V02			Interburden	
C558P_V03	430311.546	7566903.059	AB1 Seam	
C056C_V01			D1 Seam	Levels, vertical gradients between strata
C056C_V02			AB1 Seam	
C056C_V03	424920	7569970	Rewan Group	
HD01	426146.035	7561467.856	Dunda Beds	Levels (west of EPC 1690)
HD02	423823	7557008	Clematis Sandstone	Levels (between EPC 1690 and Doongmabulla Springs)
HD03A	427560	7556126	Dunda Beds	Levels, vertical gradients between strata (between EPC 1690 and Doongmabulla Springs)
HD03B	427559	7556122	Alluvium	

(D2) The holder of the environmental authority must, when requested by the administering authority, submit within 30 days an assessment report on the results of the groundwater monitoring program. The assessment must address whether the environmental values are being protected with reference to water quality parameters in Table D1, and any other monitoring data obtained, and state the basis on which the conclusions are drawn. If necessary, corrective and mitigation measures taken should be described.

(D3) Should hydrochemical monitoring data results greater than the trigger levels specified for the relevant aquifer in Table D3 be recorded, then the following will be conducted:

a) The relevant monitoring point(s) will be resampled and the samples analysed for major cations and anions, and selected dissolved metals, including aluminium, arsenic, antimony, boron, cadmium, chromium, cobalt, copper, iron, lead, mercury, manganese, molybdenum, nickel, selenium, silver, uranium and zinc.

b) If elevated concentrations (above trigger) are recorded on two consecutive sampling events then an investigation into cause, optimum response, and the potential for environmental harm must be conducted.

c) If elevated concentrations (above trigger) are recorded on two consecutive sampling events then the administering authority will be notified within one month of receiving the analysis results.

Table D3 Groundwater Contaminant Limits and Trigger Levels

Parameter	Units	Trigger Levels	Contaminant limits
Dissolved metals Al Antimony (Sb) As Fe Molybdenum (Mo) Se Silver (Ag)	µg/L	80th percentile of background data	99th percentile of background data
Total Dissolved Solids	mg/L		
Electrical Conductivity	µS/cm		
Major anions and cations Sulphate Calcium Magnesium Sodium	mg/L		

Parameter	Units	Trigger Levels	Contaminant limits
Potassium			
Chloride			
Carbonate			
Bicarbonate			
Total Petroleum Hydrocarbons	ppb		
pH	unit	Note: ± 1 pH unit from mean and highest / lowest readings	< 6.5; > 8.5
Groundwater level	For interpretational purpose only		

Baseline value ±1.0 for pH, means the corresponding variation allowed is 1.0 pH unit above and below average and maximum / minimum pH values.

Parameters and sampling frequency will be revised at the end of background sampling, based on results compiled at each monitoring point and proposed land use.

The administering authority and the holder will agree to suitable trigger levels and contaminant limits (per aquifer and season) once sufficient hydrochemical data has been compiled.

(D4) Groundwater contaminant trigger levels for Table D3 must be finalised based on the Groundwater Monitoring Program approved under condition (D1), and submitted to the administering authority 28 days prior to commencing coal extraction.

(D5) The method of water sampling required by the environmental authority must comply with that set out in the current edition of the DERM Water Quality Sampling Manual, or subsequent updated versions. The following information must also be recorded in relation to all groundwater water sampling:

a) the date on which the sample was taken,

b) the time at which the sample was taken,

c) the monitoring point at which the sample was taken, and

d) the results of all monitoring.

(D6) The monitored data must be reported to the administering authority, and must satisfy the following criteria:

a) data collected under the monitoring program will be compiled in an annual monitoring report in a format approved by the administering authority;

b) the proponent shall undertake an assessment of the impacts of mining on groundwater after the first 12 months of dewatering commencing and thereafter every subsequent calendar year;

c) the annual monitoring report will be available by the EA anniversary each calendar year; and

d) the annual monitoring report will include an assessment of impacts, any mitigation strategies as wells as any recommendations for changes to the approved monitoring program.

(D7) If there is a requirement to submit a similar groundwater report as part of any term issued under a water licence under the Water Act then the proponent and the relevant authorities may agree for the reports to be combined.

13.21 Mine Waste Management

13.21.1 Legislative Framework

Mine waste, including overburden, interburden, rejects and fines is managed under the EP Act. As mine waste is typically disposed of within the mining lease, waste management requirements are included in the environmental authority (mining lease).

13.21.2 Environmental Values and Characteristics

Mine waste consists of naturally occurring materials, the properties of which can be altered by the mining activity.

If not properly managed, mine waste can cause impacts to surface and groundwater quality and hence these environmental values are also relevant in relation to mine waste. As mine waste disposal usually results in a change in landform, scenic amenity is another environmental value associated with mine waste management.

Based on the available results the majority of the overburden and interburden materials (not immediately adjacent to the coal seams) and roof and floor wastes are not likely to be a source of acid immediately after mining. Nor would most of these materials be expected to an immediate source of salinity; however, some portion could be a source of salinity. The clay materials of the overburden and interburden could have a markedly higher potential to release salts and metals to contact water even though the pH may remain alkaline. Typically however, the concentrations of metals in water contacting the waste would be expected to be low while waters remain circumneutral.

A portion of the carbonaceous mudstone, claystone and sandstone roof and floor and coal materials could be expected to be potentially acid forming in the longer term. Some clay, claystone, mudstone and sandstone components of the overburden and interburden may be acid forming in the long term and there may be a requirement to manage these materials prevent or limit the longer-term development of AMD.

The approximate maximum volume of Carbonaceous Group material within fresh interburden required for removal as determined within the limitations of this study was calculated as 1 billion bcm, or approximately 5.5% of total waste. The approximate maximum volume of the C seam in pits and therefore required to be removed is 0.8 billion bcm, which represents approximately 3.5% of the total mine waste. Therefore, based on the limitations of the mine waste geochemistry assessment, a total of 1.8 billion bcm, or around 8 to 9% of the total volume of mine waste may require the application of dedicated AMD management strategies.

The clays, weathered mudstone, claystone, carbonaceous mudstone and siltstone generally may exhibit dispersive behaviour. Slightly weathered siltstone and fresh mudstones may show a very slight potential for dispersivity. The weathered sandstone did not show any indication of dispersive behaviour.

Weathered rock (all lithological units), fresh siltstone and fresh sandstone showed potential for deterioration and breakdown after exposure to water. The fresh siltstone showed a moderate rate of deterioration, and the fresh sandstone showed slow deterioration. This may indicate that although the fresh rock units are not dispersive, they are not durable, and with time may degrade to sand, silt or clay. The degraded material may be more prone to physical erosion than the original fresh rock

13.21.3 Potential Impacts

If not properly managed, mine waste can cause impacts to surface and groundwater quality. As mine waste disposal usually results in a change in landform, scenic amenity is another environmental value

All coarse rejects from the CHPP will be disposed in the pit voids, and incorporated within the backfill. An open cut pit (Pit J) will be kept open during mining to serve as a dedicated below-ground tailings disposal area. When this is filled, it will be replaced by the final void from another pit adjacent to the mine infrastructure (Pit G). A short-term tailings dam will be constructed adjacent to the central mine infrastructure until the below-ground long term disposal areas are available.

13.21.4 Construction

Table 13-61 Potential Environmental Impacts – Construction

Activity	Potential Environmental Impact
Excavation and disposal of PAF materials	◗ Acidification of water that comes into contact with the material, with associated impacts on surface water runoff and groundwater. ◗ Reduction in pH may increase solubility of metals, leading to metal concentrations in surface water and groundwater becoming elevated above background concentrations and degradation of environmental values of these waters ◗ During mining, and potentially post mining, groundwater drawdown will prevent migration of acidified groundwater (Section 13.20). Runoff from spoil disposal areas will be captured in sediment basins (see Section 13.19)
Excavation and disposal of dispersive materials	◗ Dispersive materials will be susceptible to erosion when disposed of above ground waste disposal areas. ◗ This in turn may lead to high levels of suspended solids in runoff water ◗ If dispersive materials are placed at or near the final landform surface, the dispersivity may compromise the success of rehabilitation, particularly in relation to creation of a stable landform and restoration of vegetation cover. ◗ Runoff from spoil areas will be captured in sediment basins, which will remain in place until rehabilitation is complete (see Section13.19 and Section 13.34)
Excavation and disposal of	◗ Salt from saline waste materials may become dissolved in surface runoff or groundwater that comes in contact with the saline or potentially saline

Activity	Potential Environmental Impact
potentially saline materials	wastes ◗ This in turn may affect environmental values associated with surface water and groundwater resources ◗ During mining, and potentially post mining, groundwater drawdown will prevent migration of acidified groundwater (Section 13.20). Runoff from spoil disposal areas will be captured in sediment basins (see Section 13.19)
Excavation and disposal of all mine wastes	◗ Placement of mine waste in above ground disposal areas will permanently alter surface topography and landform ◗ Ex-pit mine waste disposal areas will be visible from the surrounding landscape, however there are limited sensitive receptors.
Generation of tailings	◗ Tailings may be potentially acid forming and have similar impacts to PAF materials ◗ In addition, tailings generally have low structural integrity and will need to be contained to prevent spread across the landscape.

13.21.5 Performance Outcome

Mine waste is managed to avoid impacts on environmental values of surface water and groundwater and to maximise rehabilitation success.

13.21.6 Proposed Controls

13.21.7.1 Design and pre-construction

Table 13-62 Mine Waste – Design and Preconstruction Controls

Control	Responsibility	Timing	Evidence
Conduct geochemical characterisation across the proposed mine area. Analyse results and use results to identify likely locations and volumes of PAF, potentially saline or dispersive waste materials.	Mine manager	Prior to commencement of mining	Test results and assessment report
Confirm preferred disposal and encapsulation strategies for PAF, potentially saline or dispersive waste. Incorporate into the mine plan and plan of operations.	Mine manager	Prior to commencement of mining	Mine waste disposal strategy report
Update mine plan to ensure that PAF, potentially saline or dispersive waste can be placed directly into a suitable disposal location whereby adverse properties can be managed and impacts avoided.	Mine manager	Prior to commencement of mining	Updated mine plan
Establish an ongoing testing program for mine waste characterisation to be carried out as mining progresses such that the characteristics of mine waste with respect to potential for acid formation, salinity and dispersivity are known prior to excavation. The testing program should include: ◗ Required testing density, based on potential risk associated with different materials ◗ Field identification and classification of waste types for waste	Mine manager	Prior to commencement of mining	Program in place

Control	Responsibility	Timing	Evidence
management operations ◗ Back up laboratory testing as required to validate field testing and better understand samples where field tests indicate potential problems ◗ Criteria against which monitoring results can be compared to identify the need for special management techniques			
Establish a mine waste tracking program that: ◗ Identifies in advance the placement location for mine wastes based on characteristics and links to the geological model for the coal mine ◗ Records where particular mine wastes have been placed ◗ Correlates mine waste placement with surface water and groundwater monitoring	Mine manager	Prior to commencement of mining	Program in place

13.21.7.2 Construction

There are no specific management controls required during construction

13.21.7.3 Operations

Table 13-63 Mine Waste Operational Controls

Control	Responsibility	Timing	Evidence
Implement testing program ahead of each stage of mining activities.	Mine manager	At least 6 months ahead of each new	Test results

Control	Responsibility	Timing	Evidence
		stage	
Implement mine waste tracking program.	Mine manager	Ongoing	Register of mine waste placement
Dispose of problem mine wastes in accordance with mine plan	Mine manager	Ongoing	Register of mine waste placement
Review groundwater and surface water monitoring programs to check that adequate monitoring is taking place in the vicinity of areas where problem wastes have been disposed to detect any acidification or increased salinity.	Environmental Manager	Every five years	Updated monitoring programs

13.21.7 Monitoring and Corrective Action

Table 13-64 Noise and Vibration monitoring and Corrective Action

Monitoring action	Responsibility	Frequency	Performance Requirement	Corrective Action
Conduct in situ testing of mine waste prior to excavation.	Mine manager	Ahead of each stage	Problem wastes are identified	Ensure that problem wastes can be placed in waste disposal areas such that environmental harm is not caused.
Audit mine waste tracking program to check that correct placement is	Environmental Manager	Every two years	All problem wastes are placed as per the mine plan	Raise an incident report and investigate potential for environmental impacts to

Monitoring action	Responsibility	Frequency	Performance Requirement	Corrective Action
occurring				arise. Potential responses might include: ◗ Increased intensity of groundwater/surface water monitoring ◗ In situ amelioration ◗ Removal of wastes to another location.

Note also that monitoring activities in relation to surface water (Section 13.19) and groundwater (Section 13.20) are relevant to monitoring of the effectiveness of mine waste management.

13.21.8 Proposed Environmental Authority Conditions

Tailings Disposal

The management of tailings disposal must be in accordance with the following:

- All tailings material must be progressively characterised during disposal for net acid producing potential and the metals and metalloids listed in Table 13-44 (Surface Waters Trigger Levels).
- Tailings characterisation must be undertaken at a minimum rate of one (1) per month of tailings material discharged to the tailings storage facility.
- Records must be kept of the tailings disposal to indicate locations and characteristics of tailings stored within the tailings storage facility.

Waste Rock Disposal

- The environmental authority holder must develop and implement a waste rock management plan as part of the mine plan.
- Waste rock disposal must not occur on the licensed place unless the environmental authority holder has submitted to the administering authority the waste rock management approach.

The Waste Rock Management Plan must include, at least:

- Characterisation of the waste rock to predict the quality of runoff and seepage generated, including salinity, acidity, alkalinity, dissolved metals, metalloids and non-metallic inorganic substances;
- A program of progressive sampling program to validate pre-mine waste rock characterisation.
- Records must be maintained of all waste rock characterisation and disposal including contingency planning for the management of acid rock / neutral mine drainage / saline mine drainage;
- A materials balance and disposal plan demonstrating how potentially acid forming and acid forming waste rock will be selectively placed and/or encapsulated to minimise the generation of acid mine drainage;
- A materials balance and disposal plan demonstrating how waste rock that has a potential to generate acid and/or saline mine drainage will be selectively placed and managed to minimise the generation of acid and/or saline mine drainage;
- A sampling program to verify encapsulation and/or placement of potentially acid forming / acid forming waste rock / waste rock that has a potential to generate neutral mine drainage.

Acid Rock Drainage Management

Subject to the release limits defined in Schedule – XX, all reasonable and practicable measures must be implemented to prevent hazardous leachate being directly or indirectly released or likely to be released as a result of the activity to any groundwater or watercourse

13.22 General and Hazardous Waste Management

13.22.1 Legislative Framework

The key legislation in relation to waste management is the EP Act which identifies effective waste management strategies as part of an integrated management approach to environment protection and ecologically sustainable development and sets up requirements for minimisation, handling, transport, storage and disposal of wastes. Under the EP Act and EP Regulation, activities associated with waste management, including transport, treatment, storage and disposal of wastes are environmentally relevant activities and an authorisation is required to carry out these activities. Schedule 7 of the EP Regulation also defines regulated waste, being wastes that are particularly hazardous to the environment if not managed appropriately.

The *Environmental Protection (Waste Management) Regulation 2000* establishes procedures for tracking of certain regulated wastes. Trackable wastes are defined in Schedule 1 of this regulation and a docket system is in place to track these wastes from the point of origin to disposal.

Waste Reduction and Recycling Act 2011 (WRR Act) and *Waste Reduction and Recycling Regulation 2011* strengthens waste management and resource recovery practices in Queensland. The WRR Act provides a framework for statewide waste management strategy and establishment of levys and other mechanisms to promote waste minimisation. The strategy identifies waste tyres from commercial and industrial activities as a high priority for waste minimisation and management.

The following Adani HSE System compliance guidelines also apply to waste management:

- HSE-CG-063 – management of wastes
- HSE-CG-064 – waste minimisation
- HSE-CG-065 – waste recycling and reuse
- HSE-CG-066 – waste treatment
- HSE-CG-121 – waste disposal.

13.22.2 Environmental Values

Wastes represent lost or degraded material and energy resources.

Improper waste management can impact on a range of environmental values including land, air quality, surface water and groundwater. Improper waste management can also cause a range of public health hazards.

13.22.3 Potential Impacts

Types of wastes likely to be produced during construction and operation of the Carmichael Coal Mine are listed in Table 13-65, together with potential environmental or public health impacts that may arise if wastes are not properly managed. Mine wastes, including overburden, interburden, fines and rejects are discussed in Section 13.21. Mine affected water is discussed in Section 13.19, emissions to air are discussed in Section 13.16 and greenhouse gas emissions (including vehicle exhausts) are discussed in Section 13.17.

Table 13-65 - Potential Environmental Impacts – Waste Generation

Waste type	Potential Environmental Impact (with no management)
Vegetation waste	◗ Fire hazard ◗ Emissions of greenhouse gases as vegetation rots ◗ Possible loss of nutrients in natural nutrient cycles ◗ Spread of weeds ◗ Visual impact ◗ May harbour vermin (may also harbour native animals)
Packaging waste	◗ Lost resource ◗ Visual impact ◗ Source of litter ◗ Plastics may entrap native animals
Waste concrete and concrete wash out waste	◗ Localised increases in pH ◗ Lost resource ◗ Visual impact
Scrap metal	◗ Loss of resource ◗ Visual impact ◗ Localised soil contamination with potential to leach to surface and groundwater ◗ Human health risk (tetanus)
Other building and demolition wastes	◗ Loss of resource ◗ Visual impact
Waste oil and oil contaminated wastes	◗ Contamination of soils, surface water and groundwater ◗ Toxicity to plants and animals ◗ Degradation of water resources ◗ Loss of resource
Waste solvents and paints	◗ Contamination of soils, surface water and groundwater ◗ Toxicity to plants and animals ◗ Degradation of water resources ◗ Loss of resource
Office wastes	◗ Litter ◗ Loss of resource
Food wastes	◗ May attract vermin ◗ Odour ◗ Disease, particularly through bacterial infection

Waste type	Potential Environmental Impact (with no management)
Other domestic wastes	◗ Loss of resource ◗ Litter ◗ Plastics may entrap animals
Wastewater (toilets, showers, crib rooms) Sewage and water treatment plant sludge	◗ Contamination of land, surface and groundwater ◗ Degradation of water resources ◗ Inhibition of native plant growth ◗ Increased nutrient levels in aquatic ecosystems, causing eutrophication and algal outbreaks ◗ Spread of disease ◗ Odour.
Tyres	◗ Fire hazard ◗ Toxic smoke if fire occurs ◗ Visual impact ◗ Loss of resource ◗ Collect water which may harbour mosquitoes and other biting insects
Batteries	◗ Loss of resource ◗ Release of acidic and/or metallic contaminants to land, surface water and groundwater ◗ Toxicity to plants and animals ◗ Degradation of water resources ◗ Inhibition of native plant growth

13.22.4 Performance Outcome

Minimise generation of waste in accordance with the waste management hierarchy:

- AVOID unnecessary resource consumption;
- REDUCE waste generation and disposal;
- RE-USE waste resources without further manufacturing;
- RECYCLE waste resources to make the same or different products;
- RECOVER waste resources, including the recovery of energy;
- TREAT waste before disposal, including reducing the hazardous nature of waste;
- DISPOSE of waste only if there is no viable alternative.

Avoid adverse impacts of waste on land contamination, surface and groundwater quality and visual amenity.

13.22.5 Proposed Controls

13.22.5.1 Design Procurement and pre-construction

Table 13-66– General and Hazardous Waste Management – Design, Procurement and Preconstruction Controls

Control	Responsibility	Timing	Evidence
Identify opportunities for waste minimisation and recycling in design of all components	Design manager	During design phase	Design checklist
Include requirements for minimisation of packaging waste in contract specifications for equipment, plant, consumables and other items.	Procurement manager	Prior to commencement of construction	Contracts and specifications
Ensure waste contracts are in place for all wastes that require removal from the mine for reuse, recycling, treatment and/or disposal. Utilise contractors that can offer reuse and recycling services in preference to those that cannot and ensure that all contractors hold appropriate authorisations to transport, receive, store, reprocess, treat and/or dispose of wastes expected to be generated.	Procurement manager	Prior to commencement of construction	Requests for tenders, tenders received Contracts in place
Identify obligations for national pollutant inventory (NPI) reporting and ensure that mechanisms are in place to collect required data.	Environmental Manager	Prior to commencement of construction	Monitoring records
Select appropriate wastewater treatment system to achieve treatment levels that protect environmental values and allow maximum reuse of treated	Design manager	Prior to commencement of	Design checklist

Control	Responsibility	Timing	Evidence
wastewater without creating health and safety issues		construction	
If treated wastewater is to be disposed of through irrigation, develop an effluent irrigation management plan based on soil testing and results of MEDLI modelling	Design manager	Prior to commencement of construction	Effluent irrigation management plan
Determine storage requirements for untreated and treated wastewater in the event of unforseen events such as malfunction of the wastewater treatment plant or wet weather	Design manager	Prior to commencement of construction	Design checklist

13.22.5.2 Waste Management Inventory

Table 13-67 – General and Hazardous Waste Inventory and Management

Waste type	Waste storage and handling requirements	Indicative waste management methods
Vegetation waste	◗ Store so as to minimise fire hazard ◗ Separate logs and hollow trees ◗ Avoid mixing native vegetation with introduced vegetation where possible ◗ Store away from trafficked areas	◗ Place logs and hollow trees in rehabilitated areas or areas of retained habitat ◗ Mulch or otherwise treat native vegetation for reuse in revegetation areas (trials to be undertaken to determine best methods for reuse)
Packaging waste	◗ Segregate plastic, wood and cardboard ◗ Flatten cardboard and store in low fire risk areas ◗ Contain plastics so that these do not blow away	◗ Return packaging to source wherever possible ◗ Mulch cardboard and wood for reuse in revegetation (subject to trials) ◗ Plastics and cardboard removed from site for recycling

Waste type	Waste storage and handling requirements	Indicative waste management methods
		where viable ◗ Burial of packaging wastes in on-site landfill or engineered cell in open cut void
Waste concrete and concrete wash out waste	◗ Concrete wash out in designated areas away from watercourses.	◗ Crush waste concrete for reuse in road building if required ◗ Dispose of in on-site landfill or engineered cell in open cut void
Scrap metal	◗ Segregate from other wastes	◗ Off-site recycling if feasible ◗ Dispose of in on-site landfill or engineered cell in open cut void
Other building and demolition wastes	◗ Segregate from other wastes	◗ Dispose of in on-site landfill or engineered cell in open cut void
Waste oil and oil contaminated wastes	◗ Store in sealed containers in a designated bunded area, away from sources of fire and watercourses	◗ Consider use of biological methods to treat oily waste and waste oils ◗ Combine with oily wastes from off-site infrastructure ◗ Removal by authorised oil recovery contractor if viable ◗ Disposal in on-site landfill
Waste solvents and paints	◗ Store in sealed containers in a designated bunded area, away from sources of fire and watercourses	◗ Removal by authorised solvent recovery contractor if viable ◗ Consider distillation of solvents to recover usable solvents

Waste type	Waste storage and handling requirements	Indicative waste management methods
		◗ Harden waste paints ◗ Removal for disposal in authorised landfill facility if other options are not feasible
Office wastes	◗ Print paper on both sides ◗ Segregate paper, cartridges, computer wastes ◗ Store paper in a closed container to avoid litter	◗ If feasible, remove wastes for recycling ◗ If not feasible, bury in on-site landfill
Food wastes	◗ Store in sealed containers and remove to worker accommodation village for management	◗ NA – will be managed with wastes from off-site infrastructure
Other domestic wastes	◗ Remove to worker accommodation village for management	◗ NA – will be managed with wastes from off-site infrastructure
Wastewater (toilets, showers, crib rooms)	◗ Storage capacity for untreated wastewater for at least three days ◗ Treat in one or more package wastewater treatment plants to Class A or A+ ◗ Storage capacity for treated wastewater for up to 10 days	◗ Irrigate on pasture or revegetation areas (subject to soil investigations and MEDLI modelling) ◗ Mix with MAW for reuse
Sewage and water treatment plant sludge	◗ Store in fully contained receptacles	◗ Use in revegetation areas – subject to trials ◗ Place in on-site landfill or removal by authorised contractor for disposal
Tyres	◗ Puncture tyre walls so they cannot contain water	◗ Reuse in engineering works, for example low level retaining walls if possible

Waste type	Waste storage and handling requirements	Indicative waste management methods
	◗ Minimise duration of storage in stockpiles ◗ Stockpiles not to exceed 3m in height and 200m^2 in area and to be away from fire hazard areas	◗ Removal by tyre recycling or reconditioning service if feasible ◗ Disposal in underground workings or spoil disposal areas following requirements of DEHP Operational Policy Disposal and storage or scrap tyres at mine sites (or current relevant guidelines)
Batteries	◗ Store in contained areas	◗ Removal by authorised contractor for material recovery or disposal at an authorised disposal facility.

13.22.5.3 Other Controls

Table 13-68 – General and Hazardous Waste Management - Controls

Control	Responsibility	Timing	Evidence
Maintain a waste register, including the following information: ◗ Waste type and waste code ◗ Waste source ◗ Potential contaminants and other environmental hazards ◗ Quantity generated ◗ Storage locations and requirements ◗ Whether the waste is regulated and trackable ◗ Waste avoidance or reduction measures in place	Procurement manager	Continual	Waste register

Control	Responsibility	Timing	Evidence
◗ Management method (reuse, recycling, on-site disposal, off-site disposal) ◗ Quantities removed for reuse/recycling/disposal ◗ Relevant waste contractor. A combined waste register may be maintained for the mine and off-site infrastructure			
For trackable wastes, waste register will include: ◗ Consignment number for the load; ◗ transport provider's details (including licence number); ◗ Date and time trackable waste removed from Adani Mining's premises; ◗ Quantity removed; ◗ Receiver's details (including licence number).	Procurement manager	Continual	Waste register
If on-site tyre disposal is required, include placement of tyres in mine plan for backfilling of voids or underground stopes	Mine manager	Continual	Mine plan

13.22.6 Monitoring and Corrective Action

Table 13-69 – General and Hazardous Waste Management Monitoring and Corrective Action

Monitoring action	Responsibility	Frequency	Performance Requirement	Corrective Action
Review waste register for waste avoidance, reuse,	Environmental Manager	Annually for first five years and then every second year	Waste avoidance and minimisation opportunities	Review on-site procedures and incorporate waste

Monitoring action	Responsibility	Frequency	Performance Requirement	Corrective Action
recycling or other minimisation opportunities. Identify trends in waste generation and check that appropriate storage, handling and management measures are in place for each waste type			are maximised	avoidance and minimisation measures Amend waste contracts to maximise reuse and recycling in preference to disposal
Monitor wastes as required under the NPI scheme	Environmental Manager	Annual	NPI report is submitted	NA
Implement monitoring requirements as set out in effluent irrigation management plan	Environmental Manager	As per effluent irrigation management plan	As per effluent irrigation management plan	Adjust treatment methods Adjust irrigation regime
Review waste contracts	Procurement manager	Annual	Waste contractors are properly authorised to transport, treat and dispose of waste Waste contracts maximise reuse and recycling of waste over disposal where practical	Utilise only contractors with proper authorisations for waste management services Amend waste contracts to maximise reuse and recycling in preference to disposal
Track cost savings achieved by waste reduction and	Procurement Manager	Annually	NA	NA

Monitoring action	Responsibility	Frequency	Performance Requirement	Corrective Action
include in HSE budget as a cost recovery				

13.22.7 Proposed Environmental Authority Conditions

Waste Management

E1 For the purpose of conditions EXX to EXX, effluent, waste rock, spoil, overburden, rejects and tailings generated on Mining Lease XX and Mining Lease XX are not defined as 'waste'.

E2 The holder of this Environmental Authority must develop, implement and maintain a waste management program in accordance with the *Environmental Protection Act 1994* and subordinate legislation for this site. The waste management program must include:

(a) waste management control strategies covering:

i. the types and amounts of wastes generated by the mining activities;

ii. segregation of the wastes;

iii. storage of the wastes;

iv. transport of the wastes

v. monitoring and reporting matters concerning the waste

(b) the hazardous characteristics of the wastes generated including disposal procedures for hazardous wastes;

(c) a program for reusing, recycling or disposing of all wastes;

(d) how the waste will be dealt with in accordance with the waste management hierarchy, including a description of the types and amounts of waste that will be dealt with under each of the waste management practices in the waste management hierarchy (i.e. avoidance, reuse, recycling, energy recovery, disposal);

(e) procedures for identifying and implementing opportunities to minimise the amount of waste generated, promote efficiency in the use of resources and improve the waste management practices employed

(f) procedures for dealing with accidents, spills and other incidents

(g) details of any accredited management system employed, or planned to be employed, to deal with waste;

(h) how often the performance of the waste management program will be assessed

(i) the indicators or other criteria on which the performance of the waste management program will be assessed; and

(j) staff training and induction to the waste management program.

E4 Unless otherwise permitted by the condition of this Environmental Authority or with prior approval from the administering authority and in accordance with a relevant standard operating procedure, waste must not be burnt.

E6 The holder of this Environmental Authority may burn vegetation cleared in the course of carrying out extraction activities provided the activity does not cause environmental harm at any sensitive place or commercial place.

E7 Regulated waste, other than that authorised to be disposed of onsite under this authority, must only be removed and transported from the site by a person who holds a current authority to transport such wastes to a facility that is lawfully able to accept the waste under the *Environmental Protection Act 1994*.

E8 The following regulated waste may be temporarily stored on Mining Lease XX before being directed to a facility that can lawfully accept such waste:

- batteries;
- hydrocarbons;
- oils;
- oil interceptor sludges;
- oil water emulsions and mixtures; and
- chemicals listed under the *Environmental Protection Act 1994* and subordinate legislation.

E9 Each container of regulated waste stored awaiting movement off site must be marked to identify the contents.

E10 Scrap tyres stored awaiting disposal or transport for take-back and recycling, or waste-to-energy options must be stored or stockpiled in volumes less than 3m in height and 200m^2 and at least 10m from any other tyre storage area.

E11 All combustible materials, including grass and vegetation, must be removed within a 10m radius of any waste storage area.

NOTE: Waste storage area include areas for the storage of general wastes, scrap tyres or other regulated wastes.

E12 Subject to demonstrating to the administering authority that no other use higher in the waste management hierarchy can be practicably implemented, waste tyres generated from mining activities may be disposed of on site in underground stopes

13.23 Terrestrial Ecology

13.23.1 Legislative Framework

Terrestrial ecosystem values are protected by Federal and State legislation.

The Commonwealth EPBC Act provides protection for matters of national environmental significance including listed threatened species, listed migratory species and threatened ecological communities. The mining activity must proceed in accordance with conditions of approval under this Act. Offsets are required where significant impacts on matters of national environmental significance are unavoidable.

In Queensland, the NC Act also provides a framework for protecting all native plants and animals including threatened species, breeding places and habitat.

Under the EP Act, mining projects are also subject to the Queensland Biodiversity Offsets Policy (DERM, October 2011) in relation to impacts on state significant biodiversity values.

Queensland Land Protection (Pest and Stock Route Management) Act 2002 identifies declared pest plant and animal species, and provides for their control. The LP Act imposes a legal responsibility on all landowners to control declared species on their land (subject to certain conditions).

13.23.2 Environmental Values

13.23.2.1 Vegetation Communities and Fauna Habitats

Remnant vegetation occurs over approximately 60 per cent of the Project Area (approximately 28,752 ha of the 48,042 ha). Where remnant vegetation occurs, an assortment of habitat resources is available for fauna, in contrast with surrounding areas that have been previously cleared.

Seven broad vegetation communities were identified in the Project Area based on the particular vegetation communities and land forms present. A total of 36 field verified regional ecosystems (REs) were identified within the Project Area, 22 from the Desert Uplands and 14 from the Brigalow Belt bioregions.

The remnant vegetation in northern, western and southern parts of the Project Area forms part of larger tracts of remnant vegetation to the north-east, north, west, south and south-east of the Project Area. A large area of cleared land dominates much of the central part of the Project Area mainly between the Carmichael River and the Moray-Carmichael Road. Habitat values for native fauna are limited in this cleared area, due to the lack of microhabitats and the prevalence of buffel grass (*Cenchrus ciliaris*). Other fragments of cleared land occur near the eastern boundary of the Project Area to the north of the Moray-Carmichael Road, and to the south of the Carmichael River. Fauna habitat values are similarly limited in these fragments. The value of these cleared areas is further limited at the eastern-most part of the Project Area where much of the surrounding landscape is cleared.

Connectivity between remnant vegetation associated with the Belyando River and the south-east part of the Project Area (i.e. the eastern part of the Bygana West Nature Refuge) is maintained through a tract of partially fragmented (though wholly connected) mapped remnant vegetation. Vegetation within the Project Area forms part of potential corridors associated with the Belyando River, Carmichael River and Bygana West Nature Refuge.

The Project Area contains a range of fauna habitat types that share broadly similar habitat values (based on habitat structure), but vary in their value for wildlife based on the specific forage and shelter resources they provide. Ironbark-box woodland was the most widespread fauna habitat type at the Project Area. In general, across the Project Area, disturbance to fauna habitats from cattle, weeds and feral animals was observed to be low. These disturbances were mainly observed in cleared areas, where ecological value is regarded as low, between the Carmichael River and the Moray-Carmichael Road, and in eastern parts of the Project Area.

The Queensland Department of Environment and Heritage Protection (DEHP) Biodiversity Planning Assessment (BPA) mapping indicated that some remnant vegetation within and surrounding the Project Area is of ecosystem value at a regional level, while much of this remnant vegetation is ranked as having very high or high ecosystem diversity and (ecosystem) context and connection.

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) listed threatened ecological community (TEC), Brigalow (*Acacia harpophylla* dominant and co-dominant), was identified as present at the Project Area during field surveys. The presence of this

TEC was recorded from the occurrence of REs 11.3.1, 11.4.8 and 11.4.9 within the Project Area. Approximately 267 ha of these REs are present, predominantly south of the Carmichael River in the east of the Project Area.

Approximately 1,060 ha of Category B Environmentally Sensitive Areas (ESAs) (endangered Biodiversity Status REs), recorded from the occurrence of seven RE types (10.4.3, 10.9.3, 11.3.1, 11.4.5, 11.4.6, 11.4.8 and 11.4.9), were identified from the Project Area (based on field-verified RE mapping).

No State mapped essential habitat occurs in the Project Area, although a number of patches (for a variety of species) occur in the landscape around the Project Area.

13.23.2.2 Flora Species

Native flora species were prevalent across much of the Project Area, in association with areas of remnant vegetation. Field studies identified 373 native flora taxa and 27 introduced taxa in the Project Area. Of the 27 introduced species, five are declared Weeds of National Significance (WONS) and declared weeds under the Queensland *Land Protection (Pest and Stock Route) Management* Act 2002 (LP Act).

One threatened flora species, listed under both the EPBC Act and the NC Act, was recorded within the Project Area from field surveys – waxy cabbage palm (*Livistona lanuginosa*). This species is restricted to the Carmichael River channel. One EPBC Act listed threatened flora species and two flora species listed under the Queensland *Nature Conservation Act 1992* (NC Act) may occur at the Project Area (based on suitability of habitat, previous records from the regionand current known distribution).

13.23.2.3 Fauna Species

A total of 232 fauna species were recorded during field studies at the Project Area (213 species recorded during Spring 2010 and Autumn 2011 surveys; 173 species recorded during Spring 2011 survey). The vast majority of fauna species recorded from the Project Area were common, widely distributed species. A limited number of introduced fauna species were recorded. Other than the cane toad (*Rhinella marina*), introduced animals were recorded to occur at relatively low densities.

Two threatened birds and one mammal listed under the EPBC Act were recorded – the endangered black-throated finch (southern), the vulnerable squatter pigeon (southern) (*Geophaps scripta scripta*) and the vulnerable koala (*Phascolarctos cinereus*). Both bird species appeared to be locally common where suitable habitat was present at the Project Area. Potential habitat occurring within and beyond the Project Area for these species was identified. Two additional EPBC Act listed threatened fauna species, yakka skink (*Egernia rugosa*) and ornamental snake (*Denisonia maculata*), were not recorded from field studies, however are considered likely to occur at the Project Area (based on suitability of habitat, previous records from the region and current known distribution).

Three common EPBC Act listed migratory bird species, eastern great egret (*Ardea alba*), rainbow bee-eater (*Merops ornatus*), and satin flycatcher (*Myiagra cyanoleuca*) were recorded at the Project Area. In addition to these, 15 EPBC Act listed migratory bird species not recorded during field studies have the potential to occur at the Project Area. However, habitats at the Project Area are not considered likely to support important assemblages of migratory species.

Three threatened fauna species listed under the NC Act were recorded (in addition to the two birds also listed under the EPBC Act (black-throated finch (southern) and squatter pigeon (southern)) – the

near threatened black-necked stork (*Ephippiorhynchus asiaticus*), cotton pygmy-goose (*Nettapus coromandelianus*) and little pied bat (*Chalinolobus picatus*). Potential habitat occurring within the Project Area for these species was identified. An additional two threatened fauna species listed under the NC Act (in addition to the two species also listed under the EPBC Act) are considered likely to occur at the Project Area (based on suitability of habitat, previous records from region, current known distribution).

Five NC Act-listed special least concern fauna species were recorded at the Project Area (the three EPBC Act listed migratory birds mentioned above, echidna (*Tachyglossus aculeatus*), and koala).

One priority fauna species described in the Burdekin NRM 'Back on Track Actions for Biodiversity' report (DERM, 2010a) was recorded at the Project Area (black-throated finch (southern)). A further four priority fauna species, yakka skink, ornamental snake, red goshawk (*Erythrotriorchis radiatus*) and Australian painted snipe (*Rostratula australis*), have the potential to occur at the Project Area.

13.23.2.4 Protected Areas

One protected area occurs within the Project Area. Bygana West Nature Refuge, at the southern part of the Project Area, is dominated by ironbark-box woodland, although smaller patches of three other fauna habitat types were recorded within its boundary. The land use of the nature refuge is cattle grazing. Two threatened species were recorded along its southern boundary - black-throated finch (southern) and squatter pigeon (southern). Both (sub) species are likely to utilise habitats within the Nature Refuge.

13.23.3 Potential Impacts

Table 13-70 - Potential Environmental Impacts -Terrestrial Ecology

Activity	Potential Environmental Impact
Vegetation clearing	◗ Loss of native plants and vegetation communities. This includes loss of some threatened ecological communities (brigalow) and endangered and of concern regional ecosystems ◗ Loss of habitat for native animals, including some threatened species ◗ Injury or mortality to native animals ◗ Clearing of the Bygana West nature refuge ◗ Fragmentation of habitat, particularly in relation to east-west connectivity ◗ Degradation of adjacent habitat due to dust deposition, changes in overland flow regimes, exposure of edges to sunlight and increased predation and ◗ Proliferation of weeds and pests
Works in and adjacent to watercourses	◗ Loss of or degradation of surface water resources utilised by native animals
Groundwater drawdown from mine dewatering	◗ Reduced groundwater outflows at spring fed ecosystems (see also Section 13.20) – Drawdown impacts on Doongmabulla Springs are predicted

Activity	Potential Environmental Impact
	to be negligible. Preliminary drawdown predictions for Mellaluka Springs indicate drawdown of of 0.7-0.8m however further work is required – Drawdown of up to 30m may occur in the vicinity of the Carmichael River
General site activities	◗ Introduction of new weeds and pests ◗ Spread of weeds and pests across the site ◗ Noise and light ◗ Changed fire regime
Underground mining and subsidence	◗ See Section 13.31.3

13.23.4 Performance Outcome

No unapproved loss in biodiversity values over and above those impacts permitted through project approvals and implementation of Offset requirements.

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13.23.5 Proposed Controls

13.23.5.1 Design and pre-construction

Table 13-71 – Terrestrial Ecology – Design and Preconstruction Controls

Control	Responsibility	Timing	Evidence
Prepare offsets management plan	Environmental Manager	Prior to any vegetation clearing	Offsets management plan
Prepare species specific management plans for: ◗ Black throated finch ◗ Brigalow reptiles ◗ Squatter pigeon ◗ Koala	Environmental Manager	One year prior to commencement of mining	Species management plans in place
Design lighting systems to minimise light spill into areas of native vegetation	Design manager	During detailed design	Design checklist
Review clearing requirements for MIA and other infrastructure and identify opportunities to reduce clearing of native vegetation and utilise existing cleared areas wherever possible	Design manager	During detailed design	Design checklist
Identify facilities and resources in the region for assistance in the event that native animals are injured and develop procedures for response to native animal injuries that avoid unnecessary suffering of animals.	Environmental manager	Prior to any vegetation clearing	Injured animal procedures

13.23.5.2 Construction and Operations

Table 13-72 – Terrestrial Ecology Construction and Operational Controls

Control	Responsibility	Timing	Evidence
Implement species specific management plans	Environmental Manager	Ongoing	Survey and management records
Implement offset strategy and management plan	Environmental manager	Ongoing	Offset areas in place as per offset strategy
Conduct pre-clearing surveys. Surveys are to include: ◗ Searches for breeding places or habitat ◗ Searches of micro habitat for reptiles	Environmental manager	As specified in species specific management plans or otherwise, in wet season immediately prior to clearing	Survey results
Determine requirements to manually relocate species from areas to be cleared based on pre-clearing survey results and conduct relocations as required	Environmental manager	Prior to clearing	Records of translocations
Based on pre-clearing survey results, determine any particular requirements in relation to clearing and document in permit to disturb application. Requirements may include: ◗ Presence of a spotter catcher ◗ Clearing in a particular direction to allow animals to escape ◗ Felling of habitat trees separately to general clearing	Construction manager/area manager	Prior to clearing	Permit to disturb specifies optimal clearing approach

Control	Responsibility	Timing	Evidence
◗ Salvage of habitat features ◗ Mulching of vegetation.			
Clearly delineate areas for vegetation clearing and ensure that all personnel involved are aware of the clearing limits	Construction manager/area manager	Prior to clearing	Clearing limits delineated
Conduct pest control program for feral cats, pigs and cane toads	Environmental manager	Annually	Records of control program.
Vehicles and equipment are to be cleaned before being brought to site and inspected on entry to site. *Queensland Government Checklist for Cleandown Procedures* (2000) to be followed for clean down and inspection (http://www.daff.qld.gov.au/documents/Biosecurity_EnvironmentalPests/IPA-Cleandown-Procedures.pdf).	Construction manager/area manager	Whenever vehicles or equipment are brought to site	Weed hygiene declaration form
All soil and materials of plant origin to be certified as weed free by the supplier using the Queensland Government weed hygiene declaration form or similar (**http://www.daff.qld.gov.au/4790_7075.htm**).	Construction manager/area manager	Whenever soil or plant materials are brought to site	Weed hygiene declaration form
Drag any road kill to the side of the road immediately and arrange for collection and disposal	All personnel	Ongoing	Road kill removed from roads
Report injured animals to environmental manager/officers	All personnel	Ongoing	Incident records
Respond to injured animals as per procedures developed	Environmental Manager	As required	Incident record

13.23.6 Monitoring and Corrective Action

Table 13-73 – Terrestrial Ecology Monitoring and Corrective Action

Monitoring action	Responsibility	Frequency	Performance Requirement	Corrective Action
Conduct monitoring as per Species Management Plans	Environmental Manager	As per species management plans	As per species management plans	As per species management plans
Conduct monitoring of offset areas	Environmental Manager	As per offset strategy and management plan	As per offset strategy and management plan	As per offset strategy and management plan
Conduct inspections of disturbed areas for weed proliferation	Environmental Manager	Annually	Weed levels in disturbed areas are similar to pre-clearing	Conduct a weed control program
Check for pest plants and fauna within subsided areas where ponding occurs	Environmental Manager	Annually	Weed and pest animal levels are similar to pre-subsidence	Conduct a weed and pest control program
Monitor pest animal numbers at key water resource locations	Environmental manager	Quarterly	No increase in pest animal occurrence	Conduct a pest animal control program
Monitor road kill/injury statistics	Environmental manager	Annually	No particularly high occurrences of animal death/injury	Provide fauna crossing or other control to protect animals from harm.

13.23.7 Proposed Environmental Authority Conditions

There are no proposed environmental authority conditions in relation to terrestrial ecology.

13.24 Aquatic Ecology

13.24.1 Legislative Framework

Legislative requirements in relation to aquatic ecosystems include:

- The EPBC Act protects a range of animals and plants that occur in aquatic environments
- The EP Act and associated EPP (Water) recognise aquatic ecosystem health as a water quality value and set objectives for protection of aquatic ecosystems
- The *Water Act 2000* includes requirements in relation to protection of watercourses, including a requirement for a riverine protection permit in relation to works in the bed and banks of watercourses and a water licence for diversion of water courses. On a mining lease, a riverine protection permit is not required but the Guideline - *activities in a watercourse, lake or spring associated with a resource activity or mining operations* (WAM/2008/3435) are relevant
- The Fisheries Act 1994 protects fish and fish habitat. Approval requirements in relation to disturbance of fish habitat are assessable development under the SP Act and as such, do not apply on a mining lease. However, it is noted that matters regulated by the Fisheries Act include maintaining fish passage and creating a waterway barrier.

13.24.2 Environmental Values

The main riverine feature of the Study Area is the Carmichael River, which flows through the mining lease and joins the Belyando River almost 20 km downstream of the mining lease. The river is located high in the Burdekin River catchment and seasonality in rainfall restricts flows to the wetter months, November to March. Flow of the Carmichael River varies with the intensity of wet season conditions annually however baseflow is maintained from groundwater and spring discharges.

Many streams and drainage channels within the catchment dry entirely during the winter months (June/July) when rainfall is typically lower than the summer months around December and January. Larger rivers sustain only pools or low flows during the drier, winter periods.

Field assessments within the Study Area detected a low diversity of aquatic flora and fauna species in the surveyed habitats.

No conservation significant species or communities were observed within the Study Area or are expected to occur based on habitat requirements.

13.24.3 Potential Impacts

Table 13-74 - Potential Environmental Impacts – Aquatic Ecosystems

Activity	Potential Environmental Impact
Watercourse diversions and other works in watercourses	◗ Loss of aquatic habitat ◗ Changes in downstream flows ◗ Scouring and degradation of bed and banks ◗ Changes in geomorphological form in downstream areas due to scouring or sediment deposition
Change in topography	◗ Changes in flows to downstream environments
Earthworks and spoil disposal	◗ Release of sediment to watercourses (see also Section 13.26).
Groundwater drawdown	◗ See Section 13.20
Underground mining	◗ Ponding of ephemeral streams in subsidence troughs (see also Section 13.31)
Discharges of stormwater and mine affected water	◗ See Section 13.19

13.24.4 Performance Outcome

Downstream habitats are not degraded by sediment deposition, scouring or water quality degradation

Downstream flow changes remain within natural fluctuations

13.24.5 Proposed Controls

13.24.5.1 Design and pre-construction

Table 13-75 – Aquatic Ecology – Design and Preconstruction Controls

Control	Responsibility	Timing	Evidence
Review clearing requirements for MIA and other infrastructure and identify opportunities to reduce disturbance to watercourses, avoid removal of mature trees if possible and utilise existing disturbed cleared areas wherever possible	Design manager	During detailed design	Design checklist
Design watercourse diversions using guidelines in place at the time (DEHP watercourse diversion guidelines, ACARP, Bowen Basin River Diversions, Design and Rehabilitation Criteria, Australian Coal Association Research Program (2002)). Ensure that geomorphologically stable channels are created and diversions will be stable in perpetuity.	Design manager	During detailed design	Design checklist
Establish control and impact monitoring sites as follows: ◗ Doongmabulla Springs ◗ Upstream location on Carmichael River ◗ Upstream location on at least one other minor watercourse crossing the mining lease ◗ Midway and downstream location on Carmichael River ◗ Downstream location on at least one minor watercourse crossing the mining lease	Environmental Manager	12 months prior to commencement of construction	Aquatic ecology monitoring program

Control	Responsibility	Timing	Evidence
◗ Belyando River upstream of confluence with Carmichael River ◗ Belyando River at the Gregory Developmental Road.			
Plan works in watercourses to minimise the period of disturbance to the watercourse	Construction manager	Prior to construction	Schedule
Schedule works in watercourses to occur outside the wet season wherever possible.	Construction manager	Prior to construction	Schedule
As far as practicable, design pipeline crossings, culvert crossings and bed level crossings in accordance with: ◗ Code for self-assessable development Minor waterway barrier works – part 3 culverts (WWBW01) (DAFF 2011a); ◗ Code for self-assessable development Minor waterway barrier works – part 4 – bed level crossings (WWBW01) October (DAFF 2011b). ◗ Guideline - activities in a watercourse, lake or spring associated with mining operations (WAM/2008/3435) (DERM (2010a))	Design manager	During detailed design	Design checklist

13.24.5.2 Construction

Table 13-76 – Aquatic Ecology - Construction Controls

Control	Responsibility	Timing	Evidence
Avoid undertaking works in streams in times of flow wherever possible.	Construction manager	During construction	Schedule

Control	Responsibility	Timing	Evidence
Locate temporary lay down areas, parking areas and refuelling areas at least 100m from any defined watercourse.	Construction manager	During construction	Inspections
For buried pipeline crossings ensure that design requirements are met during construction and: ◗ Remove topsoil and vegetation and set aside for reinstatement ◗ Place pipelines such that the bed level of the stream will be restored once backfilling is complete ◗ Backfill trenches with material in a similar order to naturally occurring material ◗ Replace topsoil ◗ Stabilise with “soft” techniques such as jute matting or geotechnical fabric	Construction manager	During construction	Stable work areas
For culvert and low level crossings for access roads, ensure that design requirements are met during construction and: ◗ Remove topsoil and vegetation and set aside for reinstatement ◗ Place culverts or pipes such that the bed level remains even ◗ Use topsoil and vegetation in rehabilitation ◗ Stabilise completed surfaces with “soft” techniques such as jute matting or geotechnical fabric as far as practicable.	Construction manager	During construction	Stable work areas
For diversions, ensure diversion is constructed as per design. Minimise construction activities during flow events where practical and stabilise works as quickly as possible after construction.	Construction manager	During construction	Stable work areas

13.24.5.3 Operations

There are no particular operational controls in relation to aquatic ecology. Operational controls in relation to erosion and sediment control, subsidence management, surface water management and groundwater management are relevant to protecting downstream aquatic ecosystem values.

13.24.6 Monitoring and Corrective Action

Table 13-77 – Aquatic Ecosystems - Monitoring and Corrective Action

Monitoring action	Responsibility	Frequency	Performance Requirement	Corrective Action
Monitor aquatic ecology monitoring sites: ◗ in situ water quality (at time and location of each aquatic ecology monitoring event); ◗ fish species and abundance; and ◗ macroinvertebrate taxa and abundance. Undertake statistical analysis of results including SIGNAL, PET and multivariate analysis	Environmental Manager	At least two events prior to commencement of mining Annually for first 10 years of mining Biannually thereafter Monitoring to take place towards the end of the wet season	No statistically significant changes between control and impact sites, and between baseline and post impact results from each monitoring event.	If significant differences are observed , an incident should be logged and an incident investigation carried out to determine cause of changes and develop corrective actions.

13.24.7 Proposed Environmental Authority Conditions

There are no proposed conditions in relation to aquatic ecology. Conditions in relation to groundwater, water and soils will provide protection of aquatic ecology values.

13.25 Scenic Amenity

13.25.1 Legislative Framework

While the EP Act includes aesthetic dimensions in its definition of environment, there are no specific provisions in relation to scenic amenity.

Scenic amenity is often a consideration under regional and local planning provisions.

13.25.2 Environmental Values

The landscape in the vicinity of the Carmichael Coal Mine is flat to undulating modified bushland, with slightly sharper rises to the west. The dominant land use is grazing which takes place on a mosaic of pasture and remnant vegetation.

Views from homesteads surrounding the Carmichael Coal Mine cannot see the mine area. Viewers travelling along the Moray-Carmichael road will see the mine and associated infrastructure.

13.25.3 Potential Impacts

Table 13-78 - Potential Environmental Impacts

Activity	Potential Environmental Impact
Vegetation clearing	◗ Increased visual permeability ◗ Change in landscape from native vegetation to cleared land
Out of pit spoil dumps	◗ Change in topography, creating 100m high permanent feature which will initially be exposed rock/soil and will ultimately be vegetated
Open cut pits	◗ Change in topography creating permanent voids in the landscape
Mining infrastructure and facilities	◗ Increase in presence of built infrastructure in the landscape.
Lighting	◗ Appearance of a glow around mining activities and infrastructure at night

13.25.4 Performance Outcome

Minimal change to visual amenity from residential viewpoints.

13.25.5 Proposed Controls

13.25.5.1 Design, Procurement and Pre-construction

Table 13-79 – Visual Amenity – Design, Procurement and Preconstruction Controls

Control	Responsibility	Timing	Evidence
Design lighting systems to minimise light spillage and upward “glow”	Design manager	During detailed design	Design checklist

13.25.5.2 Construction and Operation

Table 13-80 – Visual Amenity – Construction and Operational Controls

Control	Responsibility	Timing	Evidence
Progressive rehabilitation of the mine as set out in Section 13.34.	NA		

13.25.6 Monitoring and Corrective Action

There are no monitoring requirements in relation to visual amenity.

13.25.7 Proposed Environmental Authority Conditions

There are no proposed environmental authority conditions in relation to visual amenity.

13.26 Erosion and Sediment Control

13.26.1 Legislative Framework

While there are no formal legislative requirements in relation to erosion and sediment control, the EP Act specifically makes it an offence to deposit contaminants into surface waters, and to place contaminants in such a way as the contaminant may be reasonably expected to enter surface waters.

For activities within the mining lease, the environmental authority contains general conditions regarding prevention of environmental harm.

13.26.2 Environmental Values

Environmental values relevant to erosion and sediment control include soil resources, particularly topsoil resources which are a scarce resource. Erosion and sediment mobilisation also has potential to impact on a surface water quality and aquatic ecosystem values as described in Section 13.26.3.

13.26.3 Potential Impacts

Vegetation clearing, earthworks and stockpiling of topsoil and overburden during both construction and operation will result in exposure of soils to erosive forces from either overland flows of water or wind action.

The initial impact of erosion is loss of topsoil resources, which may compromise rehabilitation success.

Sediment mobilised by overland flow will be carried to drainage lines and watercourses. Impacts include:

- Increased turbidity, affecting light penetration and photosynthesis processes in aquatic environments
- Direct smothering of aquatic ecosystems by deposition of sediment
- Where large quantities of sediment are transported to watercourses, geomorphological changes may occur. For example, sediment deposition may obstruct flow causing exacerbation of flooding and alteration of channel pathways.
- The quality of water available to downstream users may be degraded, particularly in relation to appearance and palatability. Pumps and pipes used to extract water from watercourses may become blocked by sediment build up.

Not that impacts relating to wind erosion (dust generation) are covered in Section 13.16.

Works in watercourses will also result in erosion of the bed and banks if undertaken in flow conditions or if disturbed areas are not stabilised before flows occur. Management of the impacts of works in watercourses is covered in Section 13.24.

13.26.4 Performance Outcome

Sediment releases from the mining activity will not cause degradation of aquatic ecosystem and water supply values downstream. Generally, this will be indicated by less than 10% increase in turbidity levels from upstream to downstream of activity areas.

Topsoil resources will not be lost through erosion. This will be measured by visual observation of disturbed areas.

13.26.5 Proposed Controls

13.26.5.1 Design, Procurement and pre-construction

Table 13-81 – Erosion and Sediment Control – Design, Procurement and Preconstruction Controls

Control	Responsibility	Timing	Evidence
Design stormwater systems for infrastructure areas to include sediment retention basins capable of retaining a 1 in 20 year ARI event (or other event as determined through risk assessment in design phase)	Design Manager	Prior to commencement of construction	Design checklist Stormwater system designs
Locate infrastructure and facilities away from drainage lines and steep slopes wherever practicable.	Design Manager	Prior to commencement of construction	Design checklist
Schedule construction works as far as practical such that: ◗ Works in streams do not need to take place in times of flow ◗ Major vegetation clearing and earthworks activities do not take place in the wet conditions ◗ Permanent stormwater systems are installed as early as possible in the construction phase	Construction Manager	Prior to commencement of construction	Construction Schedule
Design haul roads and other access tracks with drainage systems to minimise concentration of flow and erosion risk	Design Manager	Prior to constructing haul roads	Design checklist
Design sediment ponds to capture runoff from overburden stockpiles. Runoff to be captured in up to the 1 in 20 AEP event, or other event based on design	Design Manager	Prior to creation of stockpiles	Design checklist

Control	Responsibility	Timing	Evidence
risk assessment.			

13.26.5.2 Construction

Table 13-82 – Erosion and Sediment Control - Construction Controls

Control	Responsibility	Timing	Evidence
Develop and implement a customised erosion and sediment control plan for each work area, including linear infrastructure. General principles for erosion and sediment control will be drawn from industry guidelines in place at the time of construction (current preferred guidelines are the International Erosion Control Association (Australasia) Best Practice Erosion and Sediment Control (2007)). Erosion and sediment control to be developed based on erosion risk assessment and to include: ◗ Divert surface flows around disturbed areas. This will include permanent diversion of minor watercourses that currently pass through the proposed open cut and overburden dump areas ◗ Minimise exposure of soils to erosive forces. This is largely achieved by clearing vegetation progressively with minimal time lag between clearing and construction or mining works, and stabilising and/or rehabilitating cleared areas and stockpiles as quickly as possible ◗ Detain sediment laden runoff using sediment fences, check dams and sediment dams to allow sediment to settle out	Construction Manager	Prior to any ground disturbance from September to March of each year.	Erosion controls in place

Control	Responsibility	Timing	Evidence
◗ For permanent or long term facilities, install permanent stormwater control works as quickly as possible.			
Strip topsoil as per topsoil management plan (Section 13.28)	Construction manager	When commencing construction	Topsoil register
For areas no longer required after construction, and for buried infrastructure alignments, reinstate areas by: ◗ Reforming of surfaces to reinstate drainage patterns and prevent scouring or ponding ◗ Replacement of topsoil and revegetation with selected native plant species (Section 13.34.6). Trees and large shrubs are not to be placed over buried infrastructure. Erosion and sediment controls to remain in place until completion criteria are obtained (see Section 13.34.5).	Construction manager	As soon as possible after completion of construction	Rehabilitation register
Refer Section 13.24.5 for controls in relation to watercourse crossings			

13.26.5.3 Operations

There are no specific operational controls for erosion and sediment control. Controls for erosion in runoff from spoil dumps are through provision of sediment ponds and progressive rehabilitation. If ground disturbing activities are required, the controls for the construction phase should be followed.

13.26.6 Monitoring and Corrective Action

Table 13-83 – Erosion and Sediment Control - Monitoring and Corrective Action

Monitoring action	Responsibility	Frequency	Performance Requirement	Corrective Action
Inspect erosion and sediment control devices	Environmental Manager	Weekly (Checklist)	See weekly checklist	Undertake repairs or replace devices Empty sediment from sediment traps Repair scouring or other eroded areas
Check capacity of sediment retention basins for overburden stockpiles and stormwater systems	Area Manager	At the end of each wet season	Design capacity is retained	Excavate deposited sediment and dispose of to in-pit disposal area
Inspect stormwater systems, including diversion drains and outlets	Environmental Manager	Monthly during wet season	No visible signs of scouring, concentration of flow or bypass flows	Repair scouring Maintain, repair or upgrade stormwater system to prevent scouring, concentration of flows over high risk areas or bypass flows

13.26.7 Proposed Environmental Authority Conditions

There are no proposed environmental authority conditions in relation to erosion and sediment control.

13.27 Contaminated Land

13.27.1 Legislative Framework

The legislative requirements covering contaminated land in Queensland are primarily contained in the *Environmental Protection Act 1994* (EP Act) and subordinate legislation. The EP Act is administered by DEHP.

Prior to commencement of mining, none of the affected land parcels were listed on the environmental management register (EMR) or contaminated land register (CLR). As the proposed mining activity includes notifiable activities, all land parcels on which the mining activity takes place will be listed on the EMR.

The EP Act contains a number of provisions in relation to the investigation, management and remediation of contaminated land. If notices are received from DEHP in regard to contaminated land, these notices must be complied with.

In Queensland, acceptable and unacceptable contaminant levels are set in:

- National Environment Protection (Assessment of Site Contamination) Measure 1999
- Draft Guidelines for the Assessment and Management of Contaminated Land in Queensland 1998

It is an offence under the EP Act to remove soils from a site listed on the CLR or EMR without a permit.

13.27.2 Environmental Values

Contamination of soil affects the viability of the soil resource. Disturbance of contaminated soil, or contamination of soil also has potential to impact on a surface water quality, groundwater resources and aquatic ecosystem values as described in Section 13.27.3.

13.27.3 Potential Impacts

The potential impacts of land contamination may arise in two ways. First, construction and operation activities may increase human exposure to pre-existing contaminants, or mobilise contaminants to surface water or groundwater. Second, construction and operation activities may release contaminants into soils, causing soil contamination.

Soil contamination then has a number of flow on effects, including:

- Acute or chronic toxicity effects on humans and animals who come into contact with the soil, including where contaminated soil becomes wind blown. Contaminated soil guidelines generally focus on whether or not levels of particular contaminants might be high enough to cause toxic effects.
- Inhibition of plant growth, and death of existing plants in contaminated areas.

- Mobilisation of contaminants by overland flows to surface watercourses. This in turn may lead to acute or chronic toxicity effects to aquatic organisms and to contamination of water supplies.
- Contaminants in watercourses may be deposited in sediment on the bed of the watercourse, resulting in sediment contamination. Subsequent flow events may re-mobilise sediments into the water columns, and contaminated sediments may also inhibit aquatic plant growth.
- Mobilisation of contaminants to groundwater, which in turn may lead to contamination of groundwater supplies. In high permeability aquifers, contaminant plumes may be conveyed over considerable distances. In alluvial aquifers such as that occurring along the Carmichael River, and where aquifers discharge as springs, contaminants may also be released into surface waterways.

13.27.4 Performance Outcome

Land contamination does not cause inhibition of plant growth, degradation of water resources or toxic effects to humans or other animals. Relevant contaminated land guidelines in place at the time will be used to indicate whether contaminant levels are acceptable (current guidelines are listed in Section 13.27.1.

13.27.5 Proposed Controls

13.27.5.1 Design, Procurement and Pre-construction

Table 13-84 – Contaminated Land– Design, Procurement and Preconstruction Controls

Control	Responsibility	Timing	Evidence
Notify DEHP of the location of all notifiable activities	Environmental Manager	On issue of environmental authority	Correspondence
Design all fuel storages to meet the requirements of AS1940: storage and handling of flammable and combustible liquids.	Design manager	Prior to construction	Design checklist
All fuel storage to be above ground	Design manager	Prior to construction	Design checklist
For all workshop areas, provide: ◗ Secure storage for oils and waste oils with roof and containment bunding equal to 110% of the largest container ◗ An impervious floor (concrete or similar) in all areas where vehicle maintenance will routinely be carried out ◗ Preferable roofed areas for vehicle maintenance ◗ Containment bunding, including rollover bunds or drains such that spills and rainwater are contained within the designated area ◗ Drainage of maintenance areas to sumps with oil/water separation ◗ Return of treated stormwater and wastewater from maintenance areas to	Design manager	Prior to construction	Design checklist

Control	Responsibility	Timing	Evidence
mine affected water storages			
For refuelling areas, provide: ◗ An impervious floor (concrete or similar) ◗ Containment bunding, including rollover bunds such that spills and rainwater are contained within the designated area ◗ Drainage of refuelling areas to sumps with oil/water separation ◗ Return of treated stormwater and wastewater from refuelling areas to mine affected water storages	Design manager	Prior to construction	Design checklist
Design vehicle washdown areas so that all runoff water is captured and passed through oil water separators and sediment catchment devices	Design manager	Prior to construction	Design checklist
Include a provision in contracts that makes all contractors responsible for and liable for costs of clean up of any contamination arising from activities undertaken by the contractor	Procurement manager	Prior to issuing any contract	Contract

13.27.5.2 Construction and Operation

Table 13-85 Contaminated Land - Construction and Operation Controls

Control	Responsibility	Timing	Evidence
Manage oily waste and hydrocarbon contaminated waste, including waste from sumps and bunds, in accordance with requirements in the waste management sub plan.			

Control	Responsibility	Timing	Evidence
Water from vehicle wash areas to be recirculated for use	Area manager	Ongoing	Site checklist
Diesel storage tanks and bunds are regularly inspected and maintained	Area manager	As per AS 1940 and/or manufacturer's instructions	Maintenance records
Transport of diesel and other dangerous goods to be in accordance with Australian Code for Transport of Dangerous Goods by Road and Rail	Warehouse manager	Ongoing	Transport records
Mobile refuelling activities to be carried out as follows: ◗ Mobile tankers to have automatic shut off valves ◗ At least one person present must have dangerous goods storage and handling and spill prevention and response training ◗ Refuelling to be undertaken in a safe location, away from vehicle movement pathways ◗ Refuelling not to take place within 100m of a watercourse ◗ Spill kit capable of cleaning up spills of at least 100L to be available ◗ Refuelling activity to be under visual observation at all times	Area managers	Ongoing	Observations of mobile refuelling activities
Fixed refuelling activities to be supervised at all times	Area managers	Ongoing	Observations of mobile refuelling activities
Workshop, refuelling and other areas are not to be cleaned by hosing of water	Area managers	Ongoing	Weekly checklist
Spill kits to be in place at workshops, refuelling areas and other areas where	Warehouse manager	Ongoing	Weekly checklists

Control	Responsibility	Timing	Evidence
fuels and oils are handled or stored			
◗ In the event of a small to medium spill (up to 100L): ◗ Don appropriate PPE (for diesel and oil spills, this shall include long sleeved shirts and trousers made of cotton, plastic or rubber gloves, boots) ◗ If safe to do so, shut off source of spill ◗ If safe to do so, use spill kit materials to contain the spill and place absorbents over the spilt material ◗ If spill kit is not available, use available materials to contain the spill from flowing across the ground ◗ Contact the environmental manager/HSE Manager and supervisor for further assistance ◗ Place all contaminated material in plastic bags and clearly label as hydrocarbon contaminated material ◗ Environmental manager/officer to advise if soils are to be bioremediated or disposed of ◗ Place all hydrocarbon contaminated material awaiting disposal in designated waste storage area and clearly label ◗ Environmental manager/officer to arrange for disposal permits if required ◗ Complete incident investigation and report as per Adani HSE system requirements	All staff	Ongoing	Incident register and reports

Control	Responsibility	Timing	Evidence
◗ In the event of a large spill: ◗ Don appropriate PPE (for diesel and oil spills, this shall include long sleeved shirts and trousers made of cotton, plastic or rubber gloves, boots) ◗ If safe to do so, shut off source of spill ◗ If safe to do so, use available spill kit or other material to contain material to stop overland flow. For very large spills, if earthmoving equipment is available this may be used to raise a bund downslope of the spill area. ◗ Remove all potential ignition sources and prevent traffic from entering the area ◗ Contact the environmental officer and/or supervisor for further assistance. ◗ Environmental manager to determine further clean up requirements and methods ◗ Environmental officer to discuss with environmental manager whether notification under EP Act is required (See Section 13.32.2) ◗ Place all hydrocarbon contaminated material awaiting disposal in designated waste storage area and clearly label ◗ Environmental officer to arrange for disposal permits if required ◗ Complete incident investigation and report as per Adani HSE system requirements	All staff	Ongoing	Incident register and reports
Conduct risk assessment for incidents of contamination and determine appropriate mitigation and management strategies.	Environmental manager	As required	Contaminated land register, incident

Control	Responsibility	Timing	Evidence
Hierarchy of management approaches, from most to least preferred: ◗ on-site treatment of the chemical substances to reduce risk to an acceptable level ◗ off-site treatment of excavated soil to reduce risk to an acceptable level, after which the treated soil is returned to the site ◗ containment of soil on site with a properly designed barrier ◗ disposal of affected soil to an approved landfill. Document in contaminated land register and incident report.			reports
Undertake further testing as required to delineate extent of contamination and/or validate that adequate clean up has occurred. Enter results in contaminated land register and incident report.	Environmental manager	As required	Contaminated land register, incident reports
If it appears likely that groundwater contamination may have occurred, initiate groundwater testing	Environmental manager	As required	Contaminated land register, incident reports
Enter locations of all spills of diesel, oil or other hazardous substances into a contaminated land register. Include details of the type and quantity of contaminant, and testing and remediation actions undertaken. Provide a reference to the incident investigation report	Environmental Manager	As required	Contaminated land register

13.27.6 Monitoring and Corrective Action

Table 13-86 – Contaminated Land – Monitoring and Corrective Action

Monitoring action	Responsibility	Frequency	Performance Requirement	Corrective Action
Soil and groundwater testing as required to follow up a particular incident of contamination	Environmental manager	As required	Soil and groundwater contamination levels are within current guidelines	Further remediation as required until guideline levels are met
See also weekly checklist	Environmental manager	Weekly After rain events	As per checklist	As required to achieve performance requirements in checklists

13.27.7 Proposed Environmental Authority Conditions

Preventing Contaminant Release to Land

F4 Contaminants must not be released to land in manner which constitutes nuisance, material or serious environmental harm.

F5 The Environmental Authority holder must take all practicable actions necessary to secure loads prior to transporting materials off site to minimise emissions or spillage of any material from vehicles or other transport infrastructure.

Chemicals and Flammable or Combustible Liquids

F6 All flammable and combustible liquids must be contained within an on-site containment system and controlled in a manner that prevents environmental harm and maintained in accordance with the current edition of *AS 1940 – Storage and Handling of Flammable and Combustible Liquids*.

F7 Spillage of all flammable and combustible liquids must be controlled in a manner that prevents environmental harm.

F8 All chemicals must be contained within an on-site containment system and controlled in a manner that prevents environmental harm and maintained in accordance with the current version of the relevant Australian Standard.

F9 All explosives, corrosive substances, toxic substances, gases and dangerous goods must be stored and handled in accordance with the relevant Australian Standard.

F10 All chemicals and flammable or combustible liquids stored on site that have the potential to cause environmental harm must be stored in or serviced by an effective containment system that is impervious to the materials stored and managed to prevent the release of liquids to waters or land. Where no relevant Australian Standard is available, the following must be applied:

- storage tanks must be bunded so that the capacity and construction of the bund is sufficient to contain at least 110% of a single storage tank or 100% of the largest storage tank plus 10% of the second largest storage tank in multiple storage areas; and
- drum storages must be bunded so that the capacity and construction of the bund is sufficient to contain at least 25% of the maximum design storage volume within the bund.

Spill Kit

F12 An appropriate spill kit, personal protective equipment and relevant operator instructions/emergency procedure guides for the management of wastes, chemicals and flammable and combustible liquids associated with the activity must be kept at the site.

F13 Anyone operating with wastes, chemicals or flammable and combustible liquids under this approval must be trained in the use of the spill kit.

13.28 Soil Resources

13.28.1 Legislative Framework

The requirement to manage topsoil arises from:

- Legislative requirements in relation to rehabilitation (see also Section 13.34)
- State government policy SPP1/92 regarding maintenance of good quality agricultural land resources.

Note that there is no strategic cropping land within the mine area.

Under the *Forestry Act 1959*, the State must be given the opportunity to assess and harvest any timber or quarry resources on State land.

13.28.2 Environmental Values

Environmental values of soils relate to the ability of soils to support native vegetation and agricultural land use. Approximately 60% of the mine site supported remnant native vegetation prior to mining, with condition of much of this area affected by the pre mining land use of grazing. Grazing occurred on a mixture of introduced and native pastures.

Soil types present are shown in Table 13-87. Table 13-87 also shows preliminary topsoil stripping depths. A key limitation for most of the soils is the variable depth to underlying hard sandstone or manganese pan. For Tm1, Tm4, Eb1 and Eb3 soils, depth to saline or sodic subsoil will also limit depth of stripping while depth to strongly alkaline soil will limit the depth of useable material from soil Cr3. Further soil testing should be carried out prior to stripping to confirm stripping depths and other soil properties.

Table 13-87 – Soil types (EPC 1690)

Soil Description	Australian soil classification	Area (Ha)	Stripping depth	Limitations to stripping
Gc1 – very shallow (0.25m), gravelly, acid to neutral, brown loamy to clay loam	Leptic rudosol	849	Not recommended for reuse	Shallow, rocky soil
Gc 2 Shallow to moderately deep (0.25–1.0 m), gravelly, acid to neutral, bleached loam to clay loam	Bleached-Leptic Tenosol	353	0.4m	Variable underlying rock
Lb 1 Moderately deep (0.5–1.0 m) acid to neutral soil with moderately thick loamy surface grading to red, massive fine sandy clay subsoil	Red Kandosol	423	0.4m	Variable underlying rock
Lb 2 Moderately deep (0.5–1.0 m) acid to neutral soil with medium to thick loamy surface grading to yellow-brown massive	Yellow or brown Kandosol	7,521	0.4m	Variable underlying

Soil Description	Australian soil classification	Area (Ha)	Stripping depth	Limitations to stripping
fine sandy clay subsoil				rock
Lb 4 Moderately deep (0.5 – 1.0 m), acid to neutral, yellow-brown, massive sand to loam.	Yellow-Orthic or brown-orthic Tenosol	482	0.7m	Variable underlying rock
Ln Shallow to moderately deep (< 0.75 m), slightly gravelly, acid to neutral, red well-structured clay.	Red Dermosol	214	0.4m	Variable underlying rock
Tm1 Deep (0.9 – 1.2 m) texture contrast soil with thick sandy surface over acid to neutral, massive, yellow-brown fine sandy clay subsoil	Yellow or brown Chromosol	3,037	0.9m	Sodic/dispersive subsoil and underlying rock
Tm2 Deep (> 1.0 m) texture contrast soil with thick loamy surface over acid to neutral, well structured, yellow-brown fine sandy clay subsoil.	Yellow or brown Chromosol	188	1.0m	Variable underlying rock
Tm4 Deep (> 1.0 m) texture contrast soil with thick, bleached, sandy to loamy surface over alkaline, mottled, yellow-brown fine sandy clay subsoil.	Yellow or brown Sodosol or Chromosol	903	0.3m	Sodic/saline subsoil
Mr2 Moderately deep, gravelly, acid to neutral bleached sand to loam	Bleached-Leptic Tenosol	695	0.6m	Variable underlying rock
Eb1 Texture contrast soil with thick, bleached sandy to loamy surface over alkaline, mottled, yellow-brown fine sandy clay subsoil.	Yellow or brown Sodosol	951	0.4m	Sodic/saline subsoil
Eb2 Grey, brown or red cracking clay with hard-setting surface and moderate to strong gilgai or melon holes.	Red, brown or grey Vertosol	2,199	Not recommended for reuse	shallow depth to saline/sodic subsoil, frequent melon holes
Eb3 Texture contrast soil with moderately thick, bleached loamy surface over alkaline, mottled, yellow-brown medium clay subsoil.	Yellow or brown Chromosol or Sodosol	639	0.3m	Sodic/saline subsoil

Soil Description	Australian soil classification	Area (Ha)	Stripping depth	Limitations to stripping
Mb2 Yellow-brown, acid to neutral, massive, bleached sand to loam.	Bleached-Orthic Tenosol	1,347	0.9m	High fine sand content
Mb3 Red, acid, massive sand to loam.	Red-Orthic Tenosol	2,795	0.9m	High fine sand content
Mb4 Yellow to brown, acid, massive sand to loam.	Yellow-Orthic and Brown-Orthic Tenosol	1,653	0.9m	High fine sand content
Cr1 Acid to neutral, yellow-brown, massive and loose, sand to loam	Yellow-Orthic and Brown-Orthic Tenosol	949	0.9m	High fine sand content
Cr3 Texture contrast soil with moderately thick loamy surface over alkaline red, wellstructured light medium clay subsoil.	Red Chromosol	531	0.7m	Strongly alkaline subsoil
Cr4 Texture contrast soil with moderately thick sandy to loamy surface over acid to neutral, brown, massive to weakly structured light medium clay subsoil.	Brown Chromosol	129	0.9m	High fine sand content
Eroded areas	NA	257	NA	NA

13.28.3 Potential Impacts

Table 13-88 - Potential Environmental Impacts – Construction and Operation

Activity	Potential Environmental Impact
All vegetation clearing and earthworks	Exposure of soils to erosive forces, resulting in loss of soil resource Loss of soil growth media through mixing with spoil Reduced viability of topsoil/subsoil to support native plants and pasture due to mixing of top soils and sub soils or sterilisation of soils through poor handling Inability to rehabilitate the mine area Reduced agricultural productivity and associated economic impacts

13.28.4 Performance Outcome

Topsoil and subsoil resources are retained and protected in a viable form to support the proposed post mining land use.

13.28.5 Proposed Controls

13.28.5.1 Design, Procurement and pre-construction

Table 13-89 – Soils – Design, Procurement and Preconstruction Controls

Control	Responsibility	Timing	Evidence
Prepare a topsoil management plan for construction and the first five years of mining: ◗ Clear delineation of area to be disturbed and soil types within this area ◗ Proposed depth of stripping for each soil type and volume generated ◗ Any pre-stripping treatment requirements (for example weed control) ◗ Whether single or two phase stripping is required ◗ Whether each soil type is to be immediately placed on an area prepared for rehabilitation or stockpiled ◗ Location for rehabilitation placement or stockpiling of each soil type ◗ Segregation of soils according to soil type, soil properties and potential for weed infestation ◗ Management requirements while stockpiled ◗ Intended use for each soil type in rehabilitation, having regard to: – Timing when area will become available for rehabilitation – Potential for soils to contain native plant seeds or introduced	Area manager / Environmental Manager	Prior to any earthworks	Topsoil management plan documentation

Control	Responsibility	Timing	Evidence
plant seeds – Surface cover requirements and required volume – Slope and drainage – Spoil characteristics – Intended revegetation scenario.			
Develop a topsoil register for recording: ◗ Soil type ◗ Source location ◗ Date of stripping ◗ Location of stockpile placement ◗ Volume in stockpile ◗ Date of required management actions (turning, seeding) ◗ Date and location of replacement	Area manager	Prior to any earthworks	Topsoil Register in place prior to stripping
Identify a suitable location or locations for topsoil stockpiling. The area should not be subject to significant overland flow, or flow should be diverted around the area. Risk of accidental disturbance should be minimised.	Area manager	Prior to any earthworks	Documented in Mine Planning / Layouts
Provide details to NRM regarding proposed footprint relative to State land such that NRM can determine whether there is a need to salvage quarry material or forest products	Environmental Manager	6 months prior to disturbance	Correspondence

13.28.5.2 Construction and Operations

Table 13-90 – Soils - Operational Controls

Control	Responsibility	Timing	Evidence
Update topsoil management plan	Area manager	Annually or as required to address revisions in the mine plan	Topsoil management plan
Survey soils types to confirm stripping depths and other limitations such as sodicity, slaking and alkalinity. Optimal characteristics for rehabilitation success include: ◗ particle size distribution that is dominated either by the coarse sand fraction; or alternatively the reactive clay fraction; preferably with limited fine sand and/or silt fractions ◗ pH range appropriate for intended plant growth ◗ non-sodic/non-dispersive physical behaviour, particularly in the case of clay ◗ material; ◗ very low levels of soluble salts. ◗ fertility levels appropriate for the plant species to be grown. Avoid subsoils with elevated levels of soluble salts (soluble chloride contents >300-600 ppm or EC1:5 >0.6 dS/m).	Area manager	Annually, or as required based on mine plan progress	Topsoil register
Document relevant details in topsoil register and determine topsoil storage requirements and optimal reuse in rehabilitation for each soil type. Determine	Area manager	Annually, or as required based on	Topsoil register

Control	Responsibility	Timing	Evidence
treatment or amelioration requirements to maintain topsoil viability while stockpiled or placed in rehabilitation areas.		mine plan progress	
Strip topsoil prior to any earthworks or other surface disturbance. Topsoil stripping depths and other requirements will be set out in the topsoil management plan.	Area manager	Prior to any earthworks or disturbance	Tospsoil register
Place topsoil in stockpiles no more than 1.5m in height and with side slope steepness depending on the nature of the topsoil such that stockpiles do not fail. Details for placement of and segregation of soil types in stockpiles will be set out in the topsoil management plan. Placement should occur immediately after stripping without any additional handling or intermediate stockpiling.	Area manager	Immediately on stripping of topsoil	Topsoil register
Details of stripped topsoil volumes, placement location (stockpile or rehabilitation area) and any treatment such as seeding to be entered into the topsoil register.	Area manager	On placement in stockpile or rehabilitation area	Topsoil register
If stockpiles are to remain in place for more than six months, rip and seed topsoils. Seeding may be with native grass species or a sterile introduced grass species. This should be recorded on the topsoil register.	Area manager	Immediately after placement in stockpile	Topsoil register
Use water sprays to prevent wind erosion	Area manager	As required	Visual inspections
Design and conduct rehabilitation trials to test effectiveness of amelioration measures in relation to soil fertility and suitability for placement on slopes.	Environmental manager	On commencement of mining	Rehabilitation trial records

13.28.6 Monitoring and Corrective Action

Table 13-91 – Soils Monitoring and Corrective Action

Monitoring action	Responsibility	Frequency	Performance Requirement	Corrective Action
Test soils for pH, EC, chloride, exchangeable cations, particle size and dispersion.	Area manager	Prior to stripping	NA (documented in topsoil register)	Identify constraints to stockpiling and rehabilitation and treatment or amelioration to required to maximise rehabilitation success
Visual inspection of topsoil stockpile areas	Environmental manager	In high wind conditions	Minimal dust lift off	Apply water Seed stockpiles if necessary
Visual inspection of topsoil stockpile areas	Environmental manager	Monthly and after rainfall (>10mm)	◗ Stockpiles are intact and not slumping ◗ Management requirements in topsoil register have been implemented ◗ Stockpiles greater than 6 months have been seeded ◗ Vegetation cover is healthy (where required) ◗ No sign of erosion	Reshape stockpiles Apply seed to stockpiles Apply water

13.28.7 Proposed Environmental Authority Conditions

Topsoil

F1 Topsoil must be strategically stripped ahead of mining in accordance with a Topsoil Management Plan.

F2 Topsoil and subsoils must be managed to ensure stability and minimise the release contaminants. Measures must include:

- vegetating stockpiles;
- minimising the height of stockpiles; and
- re-using stockpiles as soon as possible.

F3 A topsoil inventory which identifies the topsoil requirements for the Carmichael Coal Mine project and availability of suitable topsoil on site must be detailed in the Plan of Operations.

13.29 Aboriginal Cultural Heritage

13.29.1 Legislative Framework

Protection of Aboriginal cultural heritage is largely achieved through the *Aboriginal Cultural Heritage Act 2003* which establishes a duty of care in relation to managing impacts on items and places of Aboriginal cultural heritage significance. For the Carmichael Coal mine, the duty of care will be discharged through the preparation and implementation of cultural heritage management plans, which are to be agreed by Adani and the relevant Aboriginal parties.

There are no Aboriginal cultural heritage places or items within the mining area that are listed under either Federal or Queensland heritage protection legislation (Commonwealth *Aboriginal and Torres Strait Island Heritage Protection Act 1984*, *Environment Protection and Biodiversity Conservation Act 1999*, *Queensland Heritage Act 1992*).

13.29.2 Environmental Values

The Project affects one native title/Aboriginal party area , being located within the external boundaries of the Wangan and Jagalingou People registered native title claim (QUD85/04, QC04/6)

Details of places and items of Aboriginal cultural heritage significance will not be disclosed in any public documentation. In general, the following Aboriginal cultural heritage values are associated with the mine site:

- Culturally significant sites within the Project Area should be viewed as connected to the broader landscape outside the Project Area boundary, particularly known ceremonial grounds, rock art, pathways, camp sites, scarred trees and scattered artefacts
- The Carmichael River, Cabbage Tree Creek and a network of creeks and the northern creek system were generally identified as seasonal camping areas and pathways through the broader landscape. Artefact finds are more likely in these areas.

- Artefacts identified include a variety of stone artefacts, scarred trees, grinding grooves. Artefacts were present as discrete items or scatters, with denser scatters associated with potential camping places.

As a complete survey of the mining area has not been undertaken, there is potential for inadvertent discovery of other sites and artefacts.

13.29.3 Potential Impacts

13.29.3.1 Construction

Potential Aboriginal cultural heritage impacts during the construction phase are summarised in Table 13-92.

Table 13-92 - Potential Cultural Heritage Impacts – Construction

Activity	Potential Cultural Heritage Impact
Vegetation clearing and ground disturbance	◗ Vegetation clearing and ground disturbance will disturb and potentially destroy artefacts ◗ The contextual setting of artefacts will also be effectively destroyed by ground disturbance
Disturbance and erosion of streams and drainage lines	◗ Erosion may expose artefacts on stream banks and drainage lines, with subsequent loss to downstream environments

13.29.3.2 Operations

Potential operational impacts on Aboriginal cultural heritage are summarised in Table 13-93. It should be noted that it is not intended to divert or otherwise alter the Carmichael River as part of the proposed mine.

Table 13-93 - Potential Cultural Heritage Impacts – Operation

Activity	Potential Cultural Heritage Impacts
Vegetation clearing and ground disturbance	◗ Vegetation clearing and ground disturbance will disturb and potentially destroy artefacts ◗ The contextual setting of artefacts will also be effectively destroyed by ground disturbance
Spoil placement	◗ Spoil placement will permanently conceal any artefacts not already disturbed by vegetation clearing
Disturbance and erosion of streams and drainage lines	◗ Erosion may expose artefacts on stream banks and drainage lines, with subsequent loss to downstream environments
Subsidence	◗ Artefacts may be exposed due to ground movement and cracking ◗ Weathering processes may then destroy or degrade artefacts or alter the context in which the artefacts are located

13.29.4 Performance Outcome

Cultural heritage management plan requirements are met.

13.29.5 Proposed Controls

13.29.5.1 Design, procurement and pre-construction

During the design and pre-construction phase

Table 13-94 Indigenous Heritage – Design, procurement and preconstruction controls

Control	Responsibility	Timing	Evidence
Cultural heritage management plans will be finalised and approved	CEO	Pre-Construction	Approved Plans
Any required pre-clearing surveys for construction areas will be undertaken in accordance with the CHMP	Construction Manager	Pre-Construction	Survey Reports
If significant finds are made, consideration will be given to whether infrastructure footprints can be altered to avoid disturbance	Construction Manager	Pre-Construction	Design Review
If keeping places are required, these will be established.	Construction Manager	Pre-Construction	Established places as required

13.29.5.2 Construction

Table 13-95 Indigenous Heritage – Construction Controls

Control	Responsibility	Timing	Evidence
Monitoring of ground disturbing activities at certain locations. Protocols in relation to monitoring, including giving of notice to the relevant Aboriginal parties to provide monitors, the activities of these monitors during monitoring activities and requirements if a cultural heritage find is made are set out in the CHMPs.	Construction Manager	Ongoing	Compliance with CHMP
Collection and management of any artefact finds.	Construction Manager	Ongoing	Compliance with CHMP

13.29.5.3 Operation

Table 13-96 Indigenous Heritage – Operation Controls

Control	Responsibility	Timing	Evidence
Monitoring of ground disturbing activities at certain locations. Protocols in relation to monitoring, including giving of notice to the relevant Aboriginal parties to provide monitors, the activities of these monitors during monitoring activities and requirements if a cultural heritage find is made are set out in the CHMPs.	Mine General Manager	Ongoing	Compliance with CHMP
Collection and management of any artefact finds.	Mine General Manager	Ongoing	Compliance with CHMP

13.29.6 Monitoring and Corrective Action

Monitoring and corrective action requirements are set out in the CHMPs developed for the Carmichael Coal project.

13.29.7 Proposed Environmental Authority Conditions

Environmental authority conditions are not proposed in relation to Aboriginal cultural heritage.

13.30 Non-Indigenous Cultural Heritage

13.30.1 Legislative Framework

Legislation protecting non-Indigenous cultural heritage is as follows:

- The EPBC Act, administered by DSEWPaC, protects listed national heritage places.
- The Queensland Heritage Act 1992 (QH Act), administered by the Department of EHP identifies and protects places of state heritage significance. It applies to discovery and protection of any previously unidentified archaeological artefacts or archaeological places.

The Charter for the Conservation of Places of Cultural Significance (The Burra Charter) 1977 is used to define cultural significance in Queensland and derives its philosophical principles from the International Council on Monuments and Sites (ICOMOS).

13.30.2 Environmental Values

There are no listed non-indigenous cultural heritage sites present within the mining area. Some items associated with pastoral activities may have limited, localised cultural heritage significance, however no particular values have been identified.

The potential for inadvertent discovery of significant non-indigenous cultural heritage items is considered low.

13.30.3 Potential Impacts

Potential impacts related to inadvertent discovery of non-indigenous cultural heritage items will arise from vegetation clearing and ground disturbance and hence, are similar during both the construction and operation phases. Potential impacts are shown in Table 13-97.

Table 13-97 - Potential Cultural Heritage Impacts – Construction and Operation

Activity	Potential Cultural Heritage Impact
Vegetation clearing and ground disturbance	◗ Inadvertent finds of items of actual or potential cultural heritage significance

13.30.4 Performance Outcome

Previously unknown sites of non-indigenous cultural heritage significance are identified and contribution that these sites may make to understanding of pastoral activities and use of the area is recorded.

13.30.5 Proposed Controls

Table 13-98 – Non-Indigenous Cultural Heritage – Construction and Operation Controls

Control	Responsibility	Timing	Evidence
In the event that an inadvertent find of potentially significant cultural heritage material is made cease work and notify the environmental officer or environmental manager	All staff	Ongoing	Incident register
Determine whether further action is required and archaeological assessment and/or salvage if required	Environmental Manager	If a find is made	Incident register

13.30.6 Monitoring and Corrective Action

In the event that a significant non-indigenous cultural heritage place or item is identified, monitoring requirements may need to be developed.

13.30.7 Proposed Environmental Authority Conditions

Environmental authority conditions are not proposed.

13.31 Subsidence Management

13.31.1 Legislative Framework

The requirement for subsidence management arises from:

- requirements under the Mineral Resources Act 1993 and environmental authority issued under the EP Act to restore mining sites such that a stable and sustainable landform is created.
- Obligations under the EP Act and environmental authority to prevent environmental harm.

13.31.2 Environmental Values

The surface topography within the Project Area consists of low-lying gently sloping plains of generally less than 2% gradient. The lowest points on the surface above the proposed longwalls are at 225 metres AHD, near the Carmichael River. The highest point is at approximately 315 metres AHD above the proposed Longwall 109.

The seams dip towards the west within the proposed mining area at approximately 2 to 4 degrees. The depth of cover to the AB1 seam varies within the proposed mining area from 80 metres in the north west corner of proposed Longwall 201 to 480 metres in the south east corner of proposed Longwall 210.

The Carmichael River is the regional drainage line in the area, which flows towards the east in the southern part of the mining lease area. It is not intended to cause subsidence within a 500m buffer either side of the Carmichael River.

A number of small drainage lines in the Carmichael Creek and Eight Mile creek catchments traverse the mining footprint, mostly running roughly perpendicular to the longwall orientation. These are ephemeral creeks with small catchments. For the northern mining area (north of Carmichael River), a ridgeline runs just west of the mining lease boundary and hence, watercourse catchments upstream of the underground mining area are small. Streams in this section drain largely towards Eight Mile Creek.

South of the Carmichael River, streams are somewhat discontinuous due to flatter topography and drain towards the Carmichael River and Belyando River.

13.31.3 Potential Impacts

Subsidence will occur in two stages as first the AB1 seam and then the D1 seam is mined with the panels offset. The total depth of subsidence once both seams have been mined has been estimated to be up to 7.5m. As subsidence depends on a range of geological and geotechnical factors, there could be some variation from this estimate and subsidence may not be even across the footprint.

Table 13-99 Potential Subsidence Impacts – Construction and Operation

Activity	Potential "Subsidence Impact
Altered topography	Maximum subsidence will be about 7.5 metres, however as the mine layout for the two seams is offset, the final pattern of subsidence will be a series of parallel troughs 3-4m deep and about 150m wide. Length of the troughs will be variable.
	Alteration in drainage patterns due to altered topography. Bed profiles of streams will be affected by the subsidence profile.
	There will be a small reduction in downstream flows due to capture of water in the subsidence troughs.
	Tension cracks in the ground surface. The width and depth of tension cracks will depend on the underlying geology and also the speed at which subsidence occurs. As subsidence will be staged, this may reduce the formation of tension cracking.
	Root zones of vegetation may be affected either by the relatively rapid change in ground surface or by tension cracks. Altered hydrology may also result in wetter or dryer conditions for plants. Affected vegetation may fall over, or become less able to withstand windy conditions or more gradual impacts may occur due to changes in water availability to root systems.
	Changes in hydrology of streams and overland flows may exacerbate erosion, however sediment mobilisation will be into the centre of the subsidence troughs and little if any sediment will be carried downstream.
	Depending on the size and depth of tension cracks, these may present a hazard to humans and cattle and possibly other ground dwelling native animals.

13.31.4 Performance Outcomes

A stable and sustainable landform is created over subsided areas which maximises opportunities for the subsided areas to support native vegetation and fauna and to be utilised for cattle grazing

13.31.5 Proposed Controls

13.31.5.1 Design, Procurement and pre-construction

Table 13-100 – Subsidence – Design, Procurement and Preconstruction Controls

Control	Responsibility	Timing	Evidence
If mining infrastructure is to cross the underground mining footprint, design infrastructure to be resistant to the effects of subsidence	Design manager	During detailed design of infrastructure	Design checklist
Design creek diversions around the open cut areas to remain functional after subsidence	Design manager	Prior to development of diversions	Design checklist

13.31.5.2 Operations

Table 13-101 – Subsidence Operational Controls

Control	Responsibility	Timing	Evidence
Establish monitoring locations including: ◗ One point immediately upstream, one mid point and one point immediately downstream of underground footprint on each mapped watercourse ◗ Vegetation characteristics and health monitoring transects and control points ◗ Habitat value transects ◗ Topographical survey transects ◗ Photo-monitoring points corresponding with each of the above monitoring	Environmental Manager / Underground Manager	One year prior to commencement of underground mining	Subsidence Management Plan

Control	Responsibility	Timing	Evidence
locations			
Determine detailed monitoring methodologies for vegetation health, habitat value and characteristics, stream condition and photo monitoring, drawing on established methodologies.	Environmental Manager	One year prior to commencement of underground mining	Subsidence monitoring plan
Establish exclusion zones and remove cattle from underground mining footprint. Construct fences outside subsidence footprint to keep cattle from the subsided area.	Underground Manager	Prior to underground mining	Visual inspection
Develop a detailed Subsidence Management Plan, setting out: ◗ Monitoring locations and methods ◗ Detailed baseline and performance criteria, drawing on baseline monitoring results ◗ Management responses to failure to meet performance criteria ◗ A system for recording monitoring data, required management responses and confirmation that management responses have been implemented effectively ◗ Rehabilitation success criteria for subsided areas.	Underground Manager	Prior to commencement of underground mining	Subsidence Management Plan

13.31.6 Monitoring and Management Responses

Table 13-102 – Subsidence Monitoring and Management Responses

Monitoring action	Responsibility	Frequency and duration	Performance Requirement	Management Responses
Determine baseline conditions for: ◗ Stream characteristics ◗ Vegetation health and characteristics ◗ Habitat features and values ◗ Topography.		At least four stream and vegetation health surveys prior to commencement of underground mining over a minimum period of two years.	Baseline conditions are documented	None
Inspect subsided areas for new and existing tension cracks. Document locations and size of cracks and changes in crack size.		Annually until performance requirements have been achieved (more frequently if there is a risk to humans or infrastructure)	◗ Cracks do not present a safety risk two years after forming ◗ Water is not preferentially flowing into cracks and underlying strata	Grade and/or fill cracks with inert material, cover with topsoil and revegetate. Use small scale equipment to minimise damage to intact vegetation and soils.
Monitor vegetation health and changes in vegetation characteristics in subsided areas using established transects. Monitor habitat		Annually until no further changes	◗ Regional ecosystem classifications have not changed ◗ Habitat suitability for native fauna species is retained ◗ Weed presence is not	Management responses may include: ◗ Weed control ◗ Revegetate with suitable native species ◗ Provide offsets for areas

Monitoring action	Responsibility	Frequency and duration	Performance Requirement	Management Responses
characteristics and values.			increasing	where composition of native vegetation has changed such that regional ecosystem classification has changed and/or habitat suitability is degraded.
Monitor stream condition and geomorphological characteristics at nominated points		October and April of each year until no further changes observed	◗ Significant erosion is not occurring ◗ Where channel deepening is occurring, this is not causing destabilisation of bed and banks ◗ Where preferential flow paths are forming, these do not threaten the open cut/final voids	Management responses may include: ◗ Stabilise bed and banks using “soft engineering” solutions ◗ Divert or reform channels ◗ Consider pre-subsidence stabilisation of streams not yet subsided
Monitor extent of ponding in subsidence troughs		February of each year until performance requirements are achieved	◗ Ponding is not causing risk to safety of humans or other animals on the surface ◗ Ponding is not causing adverse environmental impacts ◗ Water is not flowing into underground workings	Partially or fully drain ponds.

Monitoring action	Responsibility	Frequency and duration	Performance Requirement	Management Responses
Check stream diversions adjacent to subsided areas		First wet season post subsidence of longwalls adjacent to diversions	◗ Diversions remain stable and effective	Relocate or stabilise diversions

13.31.7 Proposed Environmental Authority Conditions

F15 The holder of this Environmental Authority must maintain a Subsidence Management Plan that will address the following matters:

a) the changes in the surface relief and drainage due to underground mining at the site;

b) subsidence modelling (predictions) ahead of mining;

c) the management of erosion arising from subsidence;

d) the monitoring of stream bank and bed erosion rates pre and post subsidence; and

e) rehabilitation methods and timeframes.

F16 The Subsidence Management Plan must be reviewed each calendar year and a report prepared by an appropriately qualified person and provided to the administering authority at the time of the annual return. The report must include:

- assess the plan against the requirements under condition FXX;
- include recommended actions to ensure actual and potential environmental impacts are effectively managed for the coming year; and
- identify any amendments made to the Subsidence Management Plan following the review.

13.32 Emergency Management and Response

13.32.1 Emergency Response Plan

An emergency response plan will be developed for the mine as required by HSE-CG-015 and will include:

- An identification and risk assessment of potential emergencies and incidents, including those that might cause environmental harm
- Roles and responsibilities in relation to emergency response, reporting and notification
- Up-to-date site location and layout (HSE Compliance Guideline HSE-CG-027)
- Emergency phone numbers (internal and external)
- Type, use and location of emergency response equipment, including PPE
- Hazardous materials on site, including location, quantity, types, method of storage, handling, fire-fighting methods to be used and environmental hazards (refer HSE Compliance Guideline HSE-CG-024)
- Procedures for response to all reasonably foreseeable incidents and emergencies
- The arrangements for alert or alarm situation (who should be notified, how, etc.).

Local emergency services will be consulted in preparation of the emergency response plan and the plan will be made available to local emergency services.

Likely emergencies or incidents which may have environmental impacts are shown in Table 13-103. In relation to environmental incidents and emergencies, requirements for prevention will be included in relevant sub-plans within this EMP.

Table 13-103 – Emergencies with Potential Environmental Impacts

Incident	Potential Environmental Impact	Prevention	Emergency Response
Spills of environmentally hazardous materials	◗ Contamination of soil ◗ Contamination of surface water and groundwater ◗ Toxicity to animals and plants ◗ Water resources cannot be uses for identified beneficial uses	◗ Design of storages (Section 13.27.5) ◗ Storage and handling procedures (Section 13.27.5) ◗ Training (Section 13.8) ◗ Spill containment and clean up equipment in place at risk areas for small, medium and large spills	◗ Contain spill ◗ Remove all contaminated materials or remediate contamination in-situ
Bushfire	◗ Loss of native vegetation and habitat ◗ Death or injury of native animals ◗ Death or injury to humans ◗ Air pollution – particulates and greenhouse gas emissions	◗ Management of combustible materials and ignition sources as per HSE-CG-045 and including vehicle movements across grassed areas and cigarettes. ◗ Fuel reduction where necessary and consistent with fire regimes for native vegetation ◗ Fire protection and fire fighting equipment ◗ Training (Section 13.8)	◗ Fight fire using trained crews and equipment and with assistance from Queensland emergency services as required
Accidental releases of mine affected water	◗ Degradation of water quality such that beneficial uses are unable to continue	◗ Design of mine water storages ◗ Mine water management system	◗ Contain flows and discharge where possible
Spontaneous combustion	◗ Air pollution – particulates and greenhouse gas emissions	◗ Minimise time in stockpiles	◗ Spread stockpile and cool with water sprays

Incident	Potential Environmental Impact	Prevention	Emergency Response
	◗ Loss of coal resource		◗ Reform stockpile and compact to prevent oxygen ingress

13.32.2 Incident Reporting and Notification

Incident reporting requirements will be set out in the Emergency Response Plan and will include those set out in Table 13-104.

Table 13-104 – Incident Reporting and Notification

Type of Incident	Report to	Report by	Timing
All serious incidents	Environment Manager	First on scene	Immediately
incidents involving actual or potential environmental harm	Environmental Manager and/or officers	First on scene	Immediately
Incident involving non-compliance with environmental authority	EHP – pollution hotline	Mine Manager or Environment Manager	Within 24 hours (initial notification)
	EHP – representative officer	Mine Manager	Within 14 business days (full report)
Incident involving non-compliance with another approval	Relevant agency	Mine Manager	On becoming aware of the non-compliance
Incidents causing actual or potential serious or material environmental harm (1)	EHP Owner and occupier of affected land All persons at the affected land	Mine Manager or Environment Manager (2)	Within 24 hours of becoming aware

1) Note Environmental harm is defined in Sections 14-17 of the EP Act http://www.legislation.qld.gov.au/acts_sls/Acts_SL_E.htm

2) Note that if the mine manager or Environmental manager is not available, the person who first became aware of the potential or actual environmental harm must themselves make a report to EHP and the owners and occupiers of the affected land

13.32.3 Incident Investigation

Incident investigation requirements are set out in Section 4.4 of HSE-CG-006.

In relation to environmental incidents, reports to the administering authority of the EP Act must include “the event, its nature and the circumstances in which it happened”.

Environmental incident investigations and reports will cover:

- A description of the incident, including witness accounts

- A description of any releases to land, air or water or other environmental harm that may have occurred, including loss of native plants or habitat for native animals
- A description of the environmental values affected or potentially affected
- Whether releases or other harm caused by the incident was in excess of prescribed standards or requirements (for example, whether particulate emissions exceeded compliance levels, or whether vegetation was cleared outside areas where clearing was authorised).
- Whether a formal non-compliance with legislative requirements or approval conditions occurred
- Whether the incident constituted serious or material environmental harm as defined under the EP Act
- Whether internal procedures or requirements were breached
- Formal and informal reports and notifications made internally and externally
- A review of the causes of the incident or near miss
- Recommendations in relation to actions required to rectify any environmental harm or damage that may have occurred
- Recommendations in relation to preventing a recurrence of the incident or near miss. These may include:
  - Disciplinary action against individual employees
  - Revisions to procedures and work methods
  - Maintenance, repairs or re-design of infrastructure, facilities or equipment.

All recommendations from incident investigations will be included in the corrective action register.

13.33 Community

13.33.1 Legislative Framework

A key focus of the EP Act is to protect amenity and beneficial uses of the environment for humans, particularly in relation to noise, air quality, waste management, land contamination and surface and groundwater quality. Management measures to minimise impacts on these values are contained within this EMP. It is a condition of the environmental authority that if complaints are received in relation to any of these issues, these complaints are investigated and responded to.

The Queensland Government has introduced a requirement for many Significant Projects being assessed under the SDPWO Act or the EP Act to include a social impact management plan (SIMP). The SIMP contains a range of measures to mitigate and monitor social impacts of a project on members of the community. Hence, this EMP only addresses impacts on the community in relation to the environmental values protected under the EP Act.

13.33.2 Environmental Values and Potential Impacts

Environmental values and potential impacts in relation to the community are set out in this EMP as follows:

- Air quality – Section 13.16

- Noise – Section 13.18
- Water quality – Section 13.19 and 13.20
- Scenic amenity – Section 13.25.

13.33.3 Performance Outcome

Community amenity and beneficial uses of air, noise and water resources are not degraded when compared to requirements set out in the environmental authority.

13.33.4 Proposed Controls

If complaints or inquiries are received from a member of the community or other external party:

Table 13-105 Community – Pre Construction, Construction and Operation Controls

Control	Responsibility	Timing	Evidence
The complaint or inquiry will be recorded in the Consultation Manager database, including details of the complainant and the nature of the complaint	Community and Stakeholder Manager	Ongoing	Records and Actions
If an investigation of the complaint is required, this will be undertaken using the incident investigation procedure established under the HSE system	Community and Stakeholder Manager	Ongoing	Procedure followed as evidenced by incident reports
Any corrective actions identified will be entered into the corrective action register	Community and Stakeholder Manager	Ongoing	Records and Actions
Any community non-compliances with conditions of the environmental authority will be notified to the administering authority	Community and Stakeholder Manager	Ongoing	Records and Actions

13.33.5 Proposed Environmental Authority Conditions

Complaint Response

(R1) The holder of this environmental authority must record the following details for all complaints (which are neither frivolous nor vexatious nor based on mistaken belief in the opinion of the authorised officer) received and provide this information to the administering authority on request:

a) name, address and contact number for complainant (if not available record – not identified);

b) time and date of complaint;

c) investigations undertaken;

d) conclusions formed;

e) actions taken to resolve complaint;

f) any abatement measures implemented; and

g) person responsible for resolving the complaint.

(R2) The holder of this environmental authority must, when requested by the administering authority, undertake relevant specified monitoring within a timeframe nominated or agreed to by the administering authority to investigate any complaint of environmental harm. The results of the investigation (including an analysis and interpretation of the monitoring results) and abatement measures, where implemented, must be provided to the administering authority on request once the investigation is completed.

13.34 Rehabilitation and Closure

13.34.1 Legislative Framework

Under the *Mineral Resources Act 1993*, restoration of mining areas is a condition of all mining leases, and a mining lease cannot be surrendered until:

- restoration has been satisfactorily undertaken
- the environmental authority for the mining lease has been surrendered.

An environmental authority for a mining lease issued under the EP Act will also contain conditions in relation to rehabilitation and the environmental authority cannot be surrendered until the holder has demonstrated that rehabilitation success criteria have been achieved.

13.34.2 Environmental Values

In relation to rehabilitation, environmental values include:

- Soil resources suitable for supporting native pasture and native vegetation
- Stable and sustainable landform
- Protection of safety of the public
- Land use of grazing
- Habitat for native plants and animals including vegetation communities and species of conservation significance
- Surface water runoff and drainage patterns and surface water quality.

13.34.3 Potential Impacts

The mine will result in permanent changes to the landform of the mine site and surrounds including:

- residual voids where open cut mining has been undertaken. While in-pit spoil placement is proposed, it will not be possible to backfill entire pits to reinstate pre-mining surfaces. Residual voids are predicted to contain water but not to fill and overflow

- out-of-pit spoil stockpiles. These will be located to the east of the open cut mining area and will have a maximum height of 100m and side slopes of 10%.
- creation of subsidence troughs above the underground footprint. Subsidence troughs are likely to contain water but are not predicted to fill and overflow.
- permanent diversions of minor watercourses around open cut and spoil dump areas. These diversions will not be able to be restored to original flow paths because of permanent changes in topography.

Only minor streams are proposed to be diverted. The Carmichael River will not be diverted.

If rehabilitation is not undertaken, the mine may have ongoing adverse impacts on the environment and community including:

- mobilisation of sediment into surface waters and by wind
- drawdown of groundwater due to evaporation from voids
- a public safety risk associated with unstable landforms
- permanent loss of any viable land use of the site
- a permanent barrier to east-west movement of native animals
- Degradation of visual amenity

Note that the placement of mine waste will have taken into account the need to place potentially acid forming or saline materials such that long term impacts on surface and groundwater quality do not occur.

13.34.4 Performance Outcomes and Completion Criteria

Overarching objectives for rehabilitation of all lands disturbed by the mining activity are:

1. Creation of a stable and self sustaining post disturbance landform
    - Is safe for human access and use
    - Is safe for wildlife and cattle.
2. Preservation of surface water and groundwater quality and quantity such that environmental values and beneficial uses present pre-mining are maintained.
3. Achievement of post-mining land-uses as specified in Table 13-106

Table 13-106 – Domains and Post Mining Land Use

Domain	Post mining land use
Mining infrastructure areas	Grazing on a mosaic of native pasture and woodland habitat
Tailings storage facility	Grazing on a mosaic of native pasture and woodland habitat
Water storage areas, including MAW dams, raw water dams and sediment ponds	Either: (1) farm water supply; or (2) Grazing on a mosaic of native pasture and woodland

Domain	Post mining land use
	habitat
Stream diversions	Stable watercourses
Open cut slopes and voids	Water body with stable slopes Suitability for grazing use to be determined
Out of pit spoil dumps	Suitability for grazing use to be determined
Underground mining area	Grazing on a mosaic of native pasture and woodland and wetland habitat
Carmichael River Corridor	Wildlife corridor and wildlife habitat Grazing as consistent with management of wildlife habitat

It is important to note that the proposed mine life is approximately 90 years and in this time, a number of changes may occur, including:

- Effects of climate change, including effects on water resources and temperature and associated changes in vegetation communities
- Changes in government policies in relation to environmental protection, rehabilitation requirements and land use
- Changes in economic factors affecting demand for land and water resources
- Advances in methods and technologies available for rehabilitation.

With this in mind, rehabilitation outcomes, completion criteria and rehabilitation techniques set out in this EMP may not remain current and will need to be revisited as mining and rehabilitation progresses. Initial rehabilitation indicators and completion criteria for identified domains are shown in Table 13-107.

Table 13-107 – Completion Criteria for Rehabilitation Domains

Domain	Key Outcomes	Completion criteria
Mining infrastructure areas	Safe and stable	Slopes do not exceed 10% Drainage is restored such that ponding and scouring (concentration of flow) is avoided. This has been demonstrated over at least three wet seasons.
Areas disturbed by construction activities		Contamination assessment indicates that soil contaminant levels are within guideline levels in place at the time of closure for human and other animal exposure All above ground infrastructure has been removed from the site Below ground infrastructure has been made safe such that it will not be exposed in the long term and no access from the surface is possible

Domain	Key Outcomes	Completion criteria
		Pipelines have been drained and sealed Location of all below ground infrastructure left in place is recorded
	Non polluting	Contamination assessment indicates that there is no risk to downstream water quality from leaching of contaminants from soils based on comparison to guidelines in place at the time of closure Surface is stable and erosion rates are similar to nearby areas that have not been affected by mining
	Land use suitability	70% cover of grasses Trial the establishment of native grass, shrubs and trees at a density supported by soil conditions to achieve targeted environmental values Weed infestation is similar or below pre-disturbance levels and levels on adjacent un-mined areas
Water storage areas, including MAW dams, raw water dams and sediment ponds	Safe and stable	For storages that are to be retained: ◗ Storages have been inspected and certified against dam safety guidelines in place at the time of decommissioning ◗ FIA or similar risk assessment tool in place at the time of closure indicates risk from dam failure is at an acceptable level ◗ a copy of inspection and certification reports provided to the landholder ◗ landholder has been made aware of any ongoing inspection and maintenance requirements in relation to ongoing use of storages. For storages to be removed: ◗ Contents have been fully drained ◗ Walls have been breached such that water can no longer be retained ◗ Walls left in place have been graded where necessary such that slopes do not exceed 20% ◗ Walls have been revegetated (see land use suitability) ◗ Contaminated materials have been removed and remaining material contains contaminants below guideline levels that are in place at the time of closure in relation to human and other animal exposure

Domain	Key Outcomes	Completion criteria
		◗ Drainage is restored such ponding and scouring (concentration of flow) is avoided and this has been demonstrated over at least three wet seasons
	Non-polluting	Contamination assessment indicates that there is no risk to downstream water quality from leaching of contaminants from soils based on comparison to guidelines in place at the time of closure Surface is stable and erosion rates are similar to nearby areas that have not been affected by mining
	Land use suitability	For decommissioned dams: ◗ 70% cover of grasses ◗ Trial the establishment of native grass, shrubs and trees at a density supported by soil conditions to achieve targeted environmental values ◗ ◗ Weed infestation is similar or below pre-disturbance levels and levels on adjacent un-mined areas
Tailings storage facility	Safe and stable	Structure has been assessed and certified against dam safety guidelines in place at the time of decommissioning FIA or similar risk assessment tool in place at the time of closure indicates risk from dam failure is at an acceptable level Ongoing maintenance is not required to maintain risk classification External slopes less than 20% Surface slopes less than 5% No ponding or scouring Surface is able to support heavy vehicles, cattle and residential or small farm buildings OR an exclusion zone has been established and clearly marked and all relevant stakeholders notified of restrictions
	Non-polluting	Beneficial uses of surface and groundwater are not affected by leachate from tailings storage facility as evidenced by three years of monitoring
	Land use suitability	70% cover of grasses Trial the establishment of native grass, shrubs and trees at a density supported by soil conditions to achieve targeted environmental values

Domain	Key Outcomes	Completion criteria
		Weed infestation is similar or below pre-disturbance levels and levels on adjacent un-mined areas
Stream diversions	Safe and stable	Stream diversions are able to pass flows from significant rain events without jeopardising human safety Stream diversions are not eroding and meet criteria for stability as defined in DNRW stream diversion guidelines as detailed in the guideline *Watercourse Diversions – Central Queensland Mining Industry, (*Natural Resources and Water, January 2008) or similar guidelines in place at the time of closure Any requirements of watercourse diversion licences issued have been met
	Non-polluting	Stream diversions are not contributing excess sediment load to downstream watercourses when compared to a suitable reference site.
	Land use suitability	Stream diversions are stable enough for cattle access, or cattle access is restricted
Open cut pits and voids	Safe and stable	No evidence of slumping of slopes High-wall slopes are stable and angled at a maximum slope of 17% (to be determined from geotechnical investigations) Low-wall slopes are stable with slopes not exceeding 10%. Surface drainage has been restricted from entering final voids Spontaneous combustion is minimised
	Non-polluting	Groundwater quality in final voids does not compromise beneficial uses of groundwater in the region as evidenced by three years of monitoring
	Land use suitability	70% cover of grasses Trial the establishment of native grass, shrubs and trees at a density supported by soil conditions to achieve targeted environmental values Weed infestation is similar or below pre-disturbance levels and levels on adjacent un-mined areas Cattle access is restricted from areas where slope precludes safe access
Out of pit spoil dumps	Safe and stable	No evidence of slumping of slopes Outer face slope angle does not exceed 10% Inner face slope angle is 10-20% and forms a smooth profile with adjacent open cut areas
	Non-polluting	Runoff and seepage from out of pit spoil dumps does not affect

Domain	Key Outcomes	Completion criteria
		beneficial uses of surface and groundwater, as evidenced from three years of monitoring.
	Land use suitability	70% cover of grasses Trial the establishment of native grass, shrubs and trees at a density supported by soil conditions to achieve targeted environmental values Weed infestation is similar or below pre-disturbance levels and levels on adjacent un-mined areas
Underground mining area	Safe and stable	Slopes are stable with no sign of slumping No surface cracking that poses a risk to cattle or humans Subsided surfaces are free of active rill, gully or sheet erosion as demonstrated by three years of monitoring
	Non-polluting	Subsided areas are not contributing excess sediment load to downstream watercourses when compared to a suitable reference site. Subsidence has not caused connection between surface waters and groundwaters
	Land use suitability	70% cover of grasses Trial the establishment of native grass, shrubs and trees at a density supported by soil conditions to achieve targeted environmental values Weed infestation is similar or below pre-disturbance levels and levels on adjacent un-mined areas
Carmichael River Corridor	Safe and stable	Stream bed and banks are stable, compared to a reference site upstream For flood protection levees: ◗ Levees have been removed where not required for flood protection of voids ◗ Levees are stable and vegetated ◗ Levees have been inspected and certified against dam safety guidelines in place at the time of decommissioning ◗ FIA or similar risk assessment tool in place at the time of closure indicates risk from levee failure is at an acceptable level ◗ ongoing maintenance is not required to maintain risk classification

Domain	Key Outcomes	Completion criteria
		◗ a copy of inspection and certification reports provided to the landholder.
	Non-polluting	River and floodplain are not contributing excess sediment load to the Carmichael River downstream of the mining area when compared to a suitable reference site.
	Land use suitability	70% cover of grasses Trial the establishment of native grass, shrubs and trees at a density supported by soil conditions to achieve targeted environmental values Presence of microhabitat including hollows, roosts, logs and rocks Evidence that Carmichael River corridor is utilised by native animals in a similar manner and density compared to pre-mining, and to a nearby reference site Weed infestation is similar or below pre-disturbance levels and levels on adjacent un-mined areas

13.34.5 Proposed Controls

13.34.5.1 General Rehabilitation Methods

General rehabilitation methods for each domain are identified in Table 13-108.

Table 13-108 – General Rehabilitation Methods

Aspect	Method
Mining infrastructure areas and construction areas	Rehabilitation approach to consist of: a) Removal of all above ground infrastructure. Components suitable for reuse at other mining of industrial operations will be reused. Otherwise, recyclable materials will be recovered and non-recyclable components will be disposed of at authorised facilities. b) Conduct of a risk assessment of all below ground infrastructure and components to determine what can be left in place and what needs to be removed. Impacts of surface disturbance associated with removal of below ground infrastructure and components to be considered in addition to potential for contamination to arise. c) Removal of below ground infrastructure where risk assessment indicates that this is the most appropriate course of action.

Aspect	Method
	Recovery of recyclable components and disposal at authorised facilities of non-recyclable components. d) Making safe below ground infrastructure that is to be left in place. For pipelines, this will include draining and sealing pipelines. Recording of location of all infrastructure and other components left in place e) Removal of any wastes, contaminated soils or other potential sources of contamination. In this regard, reference will be made to incident registers to identify locations where spills have occurred and contaminants may remain in-situ f) Conducting contaminated soil assessments as required g) Grading and re-contouring all areas such that surface drainage is restored and ponding and scouring will not occur h) ripping or otherwise de-compacting compacted surfaces i) placing topsoil as per topsoil management plan and topsoil register j) seeding or planting vegetation k) watering vegetation l) managing weeds and revegetation until 70% cover is achieved.
Water storage areas, including MAW dams, raw water dams and sediment ponds	Rehabilitation approach for all water storages will consist of: ◗ testing of water quality in all dams, and sediment quality in sediment ponds, MAW dams and other dams that may have received mine affected or contaminated water ◗ determination, in consultation with the landholder, whether any water storages may be of beneficial use for ongoing use of the site for grazing. Only water storages where water quality and sediment quality meets stock watering criteria in place at the time of closure will be allowed to be used ◗ for those storages that are to be removed: – treating water as required to meet water quality requirements for either discharge to a final void or to Carmichael River – draining of water, with discharge as determined based on water quality assessment and treatment – removal of any contaminated sediments. Contaminated sediments will either be encapsulated in active open cut mining areas, if this can be done without compromising final void water quality, or removed for disposal at an authorised waste disposal facility.

Aspect	Method
	– breaching of walls such that the storage can no longer contain water – Grading and re-contouring all areas such that surface drainage is restored and ponding and scouring will not occur – ripping or otherwise de-compacting compacted surfaces – placing topsoil as per topsoil management plan and topsoil register – seeding or planting vegetation – watering vegetation – managing weeds and revegetation until 70% cover is achieved. ◗ For those storages to be left in place for future use: – conduct of inspections and checks as per dam safety guidelines in place at the time of decommissioning – depending on outcome of inspections, undertaking of any maintenance requirements, or determining that the structure must be decommissioned – provision of information on dam design and safety to the landholder
Temporary tailings storage facility	Rehabilitation will involve: a) design and placement of an engineered cap b) conduct of inspections and checks as per dam safety guidelines in place at the time of decommissioning c) depending on outcome of inspections, undertaking of any maintenance requirements such that further maintenance is not required d) placing topsoil as per topsoil management plan and topsoil register e) seeding or planting vegetation f) watering vegetation g) managing weeds and revegetation until 70% cover is achieved.
Stream diversions	As permanent changes to the landform will have occurred as a result of mining, and given that only minor, ephemeral watercourses are to be diverted, it is not intended to restore original flow paths. For stream diversions: h) Assess condition of stream diversion against stream diversion and/or stream assessment guidelines in place at the time of

Aspect	Method
	closure and against conditions of any approval given under the *Water Act 2000* i) Undertake works as required to rehabilitate diversions to meet guidelines.
Open cut voids	Open cut voids will be progressively backfilled from the low wall with overburden and mine waste throughout the mining activity as described in Section 13.21, with potentially acid forming, saline or sodic materials encapsulated. Pre-strip materials from development of adjacent open cuts will also be placed in finished open cuts where possible to reduce the volume and slopes of any final void. Overland flow and ephemeral streams will already have been permanently diverted prior to commencement of each open cut. The final landform for each open cut and void will be achieved through : a) Initial geotechnical appraisal of high-wall stability and suitable final slope angle b) Blasting and dozing of the high-wall to achieve a stable slope with safe edges c) Assessment of the potential for spontaneous combustion to occur from exposed coal seams and ameliorative works as required to reduce risk d) Re-profiling the low-wall to final angle of 10%, with consideration to potential for overland flow from incident rainfall to cause scouring and erosion. Placement of water retention or diversion devices on slopes as required. For low-wall slopes and, where suitable, high-wall slopes, revegetation will be achieved by e) ripping or otherwise de-compacting compacted surfaces f) placing topsoil as per topsoil management plan and topsoil register g) seeding or planting vegetation h) watering vegetation i) managing weeds and revegetation until 70% cover is achieved. Water quality in final voids is not predicted to cause degradation of adjacent or downstream surface or ground water resources, but testing will be carried out prior to and during rehabilitation to establish whether water quality matches that of adjacent aquifers. If water quality is degraded, a more detailed assessment of risk to water resources will be undertaken, including groundwater monitoring and modelling and mitigation and treatment methods determined.

Aspect	Method
Out of pit spoil dumps	Placement of material in the out of pit spoil dumps will aim to achieve profiles as close as possible to completion criteria as possible. Potentially acid forming, saline or sodic materials will be encapsulated. Rehabilitation of out of pit spoil dumps will be undertaken progressively and will consist of: ◗ re-profiling of dumps to achieve slopes not exceeding 10% on outer face and 10-20% on inner face ◗ shaping and contouring to manage overland flow from incident rainfall such that this does not cause scouring or erosion. This may include placement of retention structures. o ripping or otherwise de-compacting compacted surfaces o placing topsoil as per topsoil management plan and topsoil register o seeding or planting vegetation o watering vegetation o managing weeds and revegetation until 70% cover is achieved.
Underground mining area	As per subsidence management plan (Section 13.31)
Carmichael River Corridor	Habitat restoration for the Carmichael River corridor will be undertaken at commencement of mining and will include: a) amelioration or augmentation of topsoil as required to facilitate revegetation with native species b) seeding and planting of native species using local provenance seed c) maintenance of revegetated areas until vegetation cover criteria are achieved d) weed control as required before and during revegetation e) placement of artificial micro-habitat as required to support species known or likely to use the area. For levees, closure will require: f) conduct of inspections and checks as per dam safety guidelines in place at the time of decommissioning g) depending on outcome of inspections, undertaking of any maintenance requirements h) revegetation of exposed surfaces i) provision of information on levee dam design and safety to the landholder

Aspect	Method
Topsoil placement	◗ Topsoil stripping and management will be in accordance with topsoil management plan and register as set out in Section 13.28. ◗ Topsoil will either be directly transposed from topsoil stripping areas or from stockpiles ◗ Topsoil types will be matched to underlying landforms wherever practicable ◗ Testing will be undertaken prior to placement in areas available for rehabilitation to determine the need for soil amelioration to address limiting properties and enhance rehabilitation success ◗ Test results and the need for amelioration will be recorded in the topsoil register ◗ Soil amelioration will be carried out as indicated by test results and this will be recorded in the topsoil register ◗ Prior to topsoil placement compacted surfaces will be ripped or otherwise de-compacted as far as possible to provide for friction between topsoil and the underlying surface, and to promote drainage and infiltration ◗ Topsoil will be spread at a depth of 50-100mm ◗ On slopes, methods developed through trials will be used to maintain stability of soils after placement ◗ On slopes, drainage will be managed to minimise topsoil erosion risk
Revegetation	◗ Seeds will be collected from local plant stocks. Seeds will be dried and stored ◗ Where trials indicate, seedlings will be grown for use in revegetation ◗ Species mixes for each rehabilitation area will be identified for each area to be rehabilitated based on: – End land use including, for designated native vegetation areas, habitat requirements – Slope and drainage characteristics – Available topsoil for placement in rehabilitation areas ◗ Revegetation will take place immediately on placement of topsoil using a mixture of seeding and planting of seedlings ◗ Revegetation techniques will be developed through revegetation trials ◗ Seeded or planted areas will be watered regularly, with frequencies to be determined through trials ◗ Weed inspections and control will be undertaken monthly until vegetation cover criteria are met and then annually until weed levels are below pre-disturbance levels

Aspect	Method
Habitat Development	Microhabitat requirements for targeted native species, including listed species known to have utilised the mining area prior to mining will be determined based on literature and trials in offset areas. Microhabitat may include: ◗ Nesting boxes and roosts ◗ Logs, felled trees and rocks salvaged from cleared areas ◗ Water sources.

13.34.5.2 Rehabilitation Management

Table 13-109 – Rehabilitation Management

Control	Responsibility	Timing	Evidence
Prepare a Rehabilitation Management Plan including: a) design criteria and completion criteria for rehabilitation of each domain b) reference sites to be used to develop rehabilitation success criteria; c) statistical design of monitoring programs for revegetation success in rehabilitated areas and comparison to reference sites ; d) detail rehabilitation methods applied to each domain; e) landform design criteria consistent with surrounding topography; g) schematic representation of final landforms for areas to be disturbed in each ten year mining cycle, including: i. drainage design and features; ii. slope designs; iii. cover design; iv. erosion controls proposed on reformed land; h) methods for native fauna habitat rehabilitation, including rehabilitation of fauna corridors i) rehabilitation monitoring and maintenance requirements to be applied to all areas of disturbance; j) contingency plan and corrective actions for rehabilitation maintenance or redesign.	Mine Manager	Prior to commencement of mining Reviewed and updated every five years	Rehabilitation Management Plan
Undertake a risk assessment in relation to demolition or decommissioning of all buildings, facilities and infrastructure as per Section 4.1 of HSE-CG-019. Record any requirements in relation to environmental management, such as management of hazardous materials material reuse and waste disposals in the demolition plan.	Area Manager	Prior to commencing any demolition or decommissioning work	Demolition plan

Control	Responsibility	Timing	Evidence
Collect local provenance seeds for use in rehabilitation	Environmental Manager	Prior to clearing	Seed collections
Identify reference sites for rehabilitation comparison. Reference sites should include: a) Areas of vegetation similar to that desired for rehabilitated areas b) Reference streams similar to those disturbed by diversions c) Upstream locations on the Carmichael River.	Environmental Manager	Ongoing	Reference site monitoring reports
Develop a detailed monitoring program for rehabilitation success criteria relating to native vegetation and habitat. Program should include: ◗ Success criteria in terms of similarity to pre-mining and reference site conditions ◗ Methods for determining presence and usage of rehabilitated areas by native fauna	Environmental Manager	Before commencement of rehabilitation Updated every five years	Documented in Rehabilitation Management Plan
Conduct rehabilitation trials in offset areas and mining areas awaiting revegetation. Trials to cover: ◗ Methods for placement of topsoil on slopes (rehabilitation areas) ◗ Soil treatment and amelioration techniques to promote pasture and/or native vegetation growth (rehabilitation and offset areas) ◗ Methods for preparation of surfaces prior to placement of topsoil	Environmental manager	Ongoing program, commencing when mining commences	Trial methodologies Reports of trials

Control	Responsibility	Timing	Evidence
(rehabilitation and offset areas) ◗ Revegetation techniques (rehabilitation and offset areas) ◗ Micro-habitat restoration (rehabilitation and offset areas).			
Revise rehabilitation methods based on outcomes of trials	Environmental Manager	Ongoing	Updated rehabilitation management plan
Develop and maintain a rehabilitation register within the Plan of Operations setting out: ◗ On an annual basis, the areas of: Active mining activities Areas available for rehabilitation Areas where rehabilitation has commenced Areas where rehabilitation is complete when assessed against completion criteria ◗ For areas where rehabilitation has commenced: Actions taken and dates on which actions were undertaken Results of monitoring against completion criteria Corrective actions required where completion criteria have not been achieved	Mine Manager	Annual	Mine rehabilitation register in Plan of Operations

Control	Responsibility	Timing	Evidence
Conduct rehabilitation activities progressively as areas become available. Indicative program is shown in Table 13-110.	Mine manager	As per Table 13-110	Mine rehabilitation register

Table 13-110 – Indicative Rehabilitation Program

		Period 1	Period 2	Period 3	Period 4	Period 5	Period 6	Period 7	Period 8	Period 9	Period 10	TOTAL
		2013	2014	2015	2016	2017	2027	2037	2047	2067	2103	
Disturbance and Rehabilitation												
Area Disturbed	ha	1,200	615	352	301	577	1,670	3,148	1,840	4,118	4,159	17,981
Area Rehabilitated	ha	0	0	0	0	0	1,158	3,344	2,063	5,716	9,692	21,973
WASTE MOVED												
Prime Waste	'000 bcm	20,930	55,814	83,721	133,941	158,872	2,163,743	2,612,705	2,342,584	5,201,292	10,157,942	22,931,544
Out-of-Pit Waste	'000 bcm	20,930	55,814	83,721	123,565	98,553	585,202	676,098	153,120	491,360	391,057	2,679,419
% of Out of pit waste to Prime		100%	100%	100%	92%	62%	27%	26%	7%	9%	4%	12%
COAL MINED												
Total ROM Production	'000 ROMt	0	580	1,203	22,824	24,918	529,664	606,413	609,443	1,244,861	1,927,075	4,966,981
Rejects TOTAL	'000 bcm	0	1,741	3,608	68,471	74,754	25,741	31,589	36,551	121,834	249,981	614,271

13.34.6 Monitoring and Corrective Action – Rehabilitation

Table 13-111 – Rehabilitation Monitoring and Corrective Action

Monitoring action	Responsibility	Frequency	Performance Requirement	Corrective Action
Monitor rehabilitation	Mine manager	Bi-annually for all areas	Completion criteria in Table	◗ Carry out maintenance or

Monitoring action	Responsibility	Frequency	Performance Requirement	Corrective Action
progress against completion criteria		under rehabilitation	13-107 are met	repairs as required ◗ Update rehabilitation methods and techniques where opportunities for improvement are identified
Monitor reference sites for comparison to rehabilitated areas	Mine Manager	Bi-annually or as required for comparison to rehabilitated areas	Reference site continue to be valid for use as reference sites	Seek new reference sites if existing sites have been subject to external influences which render the sites inappropriate as reference sites.

13.34.7 Proposed Environmental Authority Conditions – Rehabilitation

F26 All areas significantly disturbed by mining activities must be rehabilitated to a safe and stable landform with a self-sustaining vegetation cover in accordance with Table 13-112 and Table 13-113.

Table 13-112 Final Land Use and Rehabilitation Schedule

Domain	Estimated area (ha)	Post mining land use	Vegetation cover
Mining infrastructure areas		Grazing on a mosaic of grasses, native pasture and woodland habitat	70%
Tailings storage facility		Grazing on a mosaic of grasses, native pasture and woodland habitat	70%
Water storage areas, including MAW dams, raw water dams and sediment ponds		Either: ◗ farm water supply or ◗ Grazing on a mosaic of grasses, native pasture and woodland habitat	0% (if retained for water supply) 70%
Stream diversions		Stable watercourses	NA
Open cut slopes and voids		Water body with stable slopes Suitability for grazing use to be determined	0%
Out of pit spoil dumps		Suitability for grazing use to be determined	70%
Underground mining area		Grazing on a mosaic of grasses, native pasture and woodland and wetland habitat	70%
Carmichael River Corridor		Wildlife corridor and wildlife habitat Grazing as consistent with management of wildlife habitat	70%

Table 13-113 Landform Stability Criteria

Domain	Rehabilitation method	Slope and Stability Criteria
Mining infrastructure areas	Remove above ground components and make below ground components safe. Remove all contaminated	Such that effective drainage is facilitated

Domain	Rehabilitation method	Slope and Stability Criteria
	material. Grade, place topsoil and revegetate	
Tailings storage facility	Install engineered cover, place topsoil and revegetate	Surface slope of less than 5% External wall slope less than 20%
Water storage areas, including MAW dams, raw water dams and sediment ponds	Handed over to landholder; or Breached and graded so that water is not retained and contaminated sediments removed	No slopes more than 20% Structure can no longer retain water
Stream diversions	NA	Able to pass flows without creating flood threat
Open cut slopes and voids	Batter slope angles Topsoil and revegetate slopes less than 20% (angle to be confirmed)	High-wall slopes not exceeding XX% (to be determined) Low-wall slopes no more than 17%
Out of pit spoil dumps	Grade as required. Place topsoil and revegetate.	Outer face slope angle does not exceed 10% Inner face slope angle is 10-20%
Underground mining area	Ongoing management of subsidence	Stable surfaces and slopes with no sign of slumping or surface cracking
Carmichael River Corridor	Revegetation	Stream bed and banks are geomorphologically stable

F28 Progressive rehabilitation must commence within 5 years of areas becoming available within the operational land.

Rehabilitation Management Plan

(L4) Prepare a rehabilitation management plan for disturbed areas and submit a report to the administering authority proposing acceptance criteria prior to the commencement of mining activities. The rehabilitation management plan must, at a minimum:

a) develop design criteria for rehabilitation of each domain; identify success factors and completion criteria for each domain;

b) identify three reference sites to be used to develop rehabilitation success criteria;

c) describe the monitoring of reference sites inclusive of statistical design;

d) detail rehabilitation methods applied to each domain;

e) contain landform design criteria including end of mine design;

f) detail how landform design will be consistent with the surrounding topography;

g) provide schematic representation of final landform inclusive of:

i. drainage design and features;

ii. slope designs;

iii. cover design;

iv. erosion controls proposed on reformed land;

h) explain planned native vegetation rehabilitation areas and corridors;

i) describe rehabilitation monitoring and maintenance requirements to be applied to all areas of disturbance;

j) develop a contingency plan for rehabilitation maintenance or redesign; and

k) describe end of mine landform design plan and post mining land uses across the mine.

(L5) Once rehabilitation has commenced, the holder of the EA must conduct a Rehabilitation Monitoring Program every second year, which must include sufficient spatial and temporal replication to enable statistically valid conclusions as established under the rehabilitation program.

(L6) The Rehabilitation Monitoring Program must be developed and implemented by a person possessing appropriate qualifications and experience in the field of rehabilitation management, nominated by the EA holder.

(L7) Verification of rehabilitation success, determined by the rehabilitation success criteria developed as per condition (L2) is to be carried out as follows:

a) the minimum sampling intensity must be specified for the monitoring of progressive rehabilitation;

b) justification of the suitability of the minimum sampling intensity must be provided;

c) monitoring must include sufficient replication to enable statistical analysis of results at an acceptable power; and

d) undertaken at two yearly intervals.

Residual void outcome

(F6) Residual voids must not cause any serious environmental harm to land, surface waters or any recognised groundwater aquifer, other than the environmental harm constituted by the existence of the residual void itself and subject to any other condition within this environmental authority.

(F7) Complete an investigation into residual voids and submit a report to the administering authority proposing acceptance criteria to meet the outcomes in condition XX. The report must be reviewed and updated every three (3) years. The investigation must at a minimum include the following:

a) a study of options available for minimising final void area and volume,

b) develop design criteria for rehabilitation of final voids,

c) a void hydrology study, addressing the long-term water balance in the voids, connections to groundwater resources and water quality parameters in the long term,

d) a pit wall stability study, considering the effects of long-term erosion and weathering of the pit wall and the effects of significant hydrological events,

e) a hydrological study into the long-term risk of the Isaac River / final void interaction, including erosion of the banks and spoil and extreme hydrological events, and the consequences of such interaction to the long-term stability of the final voids,

f) a study of void capability to support native flora and fauna, and

g) proposal/s for end of mine void rehabilitation success criteria and final void areas and volumes.

The recommendations of these studies are to be followed during the life of the mine, and will include detailed research and modelling.

Infrastructure

(F14) All infrastructure, constructed by or for the Environmental Authority holder during the licensed activities including water storage structures, must be removed from the site prior to surrender, except where agreed in writing by the post mining land owner / holder.

NOTE: This is not applicable where the landowner / holder is also the Environmental Authority holder.

Post Closure Management Plan

(L8) A Post Closure Management Plan for the site must be developed and submitted to the administering authority at least 18 months prior to the final coal extraction on site and implemented for a nominal period of:

a) at least 10 years following final coal processing on site; or

b) a shorter period if the site is proven to be geotechnically and geochemically stable and it can be demonstrated to the satisfaction of the administering authority that no release of contaminants from the site will result in environmental harm.

(L9) The Post Closure Management Plan must include the following elements:

a) operation and maintenance of:

i. wastewater collection and reticulation systems;

ii. wastewater treatment systems;

iii. the groundwater monitoring network;

iv. vegetative cover.

b) monitoring of:

i. surface water quality;

ii. groundwater quality;

iii. seepage rates;

iv. erosion rates;

v. the integrity and stability all slopes, ramps and voids; and

vi. the health and resilience of native vegetation cover.