ENVIRONMENTAL IMPACT STATEMENT

RED HILL
MINING LEASE

Section 15
Waste Management

Section 15 Waste Management

15.1 Introduction

The Red Hill Mining Lease is located adjacent to the existing Goonyella, Riverside and Broadmeadow (GRB) mine complex in the Bowen Basin, approximately 20 kilometres north of Moranbah and 135 kilometres south-west of Mackay, Queensland.

BHP Billiton Mitsubishi Alliance (BMA), through its joint venture manager, BM Alliance Coal Operations Pty Ltd, proposes to convert the existing Red Hill Mining Lease Application (MLA) 70421 to enable the continuation of existing mining operations associated with the GRB mine complex. Specifically, the mining lease conversion will allow for:

- An extension of three longwall panels (14, 15 and 16) of the existing Broadmeadow underground mine (BRM).
- A future incremental expansion option of the existing Goonyella Riverside Mine (GRM).
- A future Red Hill Mine (RHM) underground expansion option located to the east of the GRM.

The three project elements described above are collectively referred to as 'the project'.

Wastes from the Broadmeadow extension will be managed as part of the existing approved BRM waste management procedures and are not further considered in this assessment.

The objective of this section of the environmental impact statement (EIS) is to respond to the requirements related to the management of general waste outlined in the Coordinator-General's (September 2013) Terms of Reference (TOR). This section identifies and describes likely sources, quantities and options for management of waste generated during construction, operation and decommissioning phases of the project. This assessment focuses on the management of solid and liquid general waste streams on the basis of planning documentation available at the time of the assessment.

The management of mining related waste such as waste rock, excavated waste and tailings (refer to **Section 6**) will rely on the strategies proposed for decommissioning and rehabilitation of the project (refer to **Section 5.5**). Air emissions and industrial wastewater discharge associated with the project are discussed separately in **Section 11** and **Section 7.3.3**, respectively.

15.2 Description of Environmental Values

15.2.1 Definition

Environmental values are defined in Queensland legislation (refer to **Section 15.2.2**) as:

- a quality or physical characteristic of the environment that is conducive to ecological health or public amenity or safety; or
- another quality of the environment identified and declared to be an environmental value under an environmental protection policy or regulation.

Environmental values with the potential to be impacted upon by waste include:

- visual amenity;

- receiving environments such as land, air, surface water, and groundwater;
- flora and fauna; and
- health and hygiene of human receptors.

The environmental values to be protected during this project are the life, health and wellbeing of people and the diversity of ecological processes and associated ecosystems surrounding the mine. More information on these values is presented in other sections of this EIS including **Section 5.2** (scenic amenity), **Section 5.3** (soils), **Section 7** (water), **Section 9** (terrestrial ecology), **Section 10** (aquatic ecology) and **Section 20** (health, safety, and risk). During construction and operational phases of the project, waste will be managed at the mine to minimise adverse impacts on these values.

The following section details how waste management has been regulated to protect the existing environmental values of the project.

15.2.2 Legislative Requirements

The Coordinator-General's TOR (Coordinator-General 2013) requires that project waste be managed with regard to best practice management strategies and the relevant legislative frameworks set out by the *Waste Reduction and Recycling Act 2011* (WRR Act) and under the *Environmental Protection Act 1994* (EP Act), including the Environmental Protection Regulation 2008 (EP Regulation) and the Environmental Protection (Waste Management) Regulation 2000 (EP (Waste Management) Regulation).

This section highlights the legislative drivers and regulatory framework relevant to the construction and operation of the project.

15.2.2.1 Commonwealth Requirements

The *National Waste Policy: Less Waste, More Resources* (EPHC 2009) builds on the National Strategy for Ecologically Sustainable Development (ESD) commitments to improve resource efficiency and reduce the environmental impacts of waste disposal (COAG 1992). This strategy supports streamlined and accurate business reporting to a national pollutant inventory (and under a national product stewardship framework in the future).

The National Pollutant Inventory (NPI) National Environmental Protection Measure (NEPM) was established to assist in reducing existing and potential impacts of emissions of certain substances to achieve the national goals of the NEPM (NEPC 2008). The NPI is an internet database of emissions from various industrial and diffuse sources designed to provide publicly available information on the types and amounts of certain substances being emitted to air, land and water.

Emissions to land, air and water from the project will be reported annually in accordance with the NPI Guide (DSEWPaC 2011), which provides direction and guidance on NPI substances, trigger thresholds and reporting of emissions and transfers of waste. Where the use of an NPI substance triggers the established threshold for that substance, emissions of that substance must be estimated and reported to the NPI in accordance with the most current Emission Estimation Technique Manuals (published online). The project's emissions will be reported to the Australian Government Department of the Environment (DoE) and will be publicly accessible via the NPI database at www.npi.gov.au.

15.2.2.2 State Requirements

In 2011, the Queensland Government introduced the WRR Act to strengthen 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 by, among other things, introducing a waste disposal levy on industry waste sent to landfill.

Under the EP Act, the strategic framework and regulatory requirements for managing waste are defined within the WRR Act, EP (Waste Management) Regulation and EP Regulation.

The WRR Act outlines the preferred waste management hierarchy – avoidance, reuse, recycling, energy recovery and safe disposal – and the principles for achieving good waste management (refer to **Section 15.3.2**). Under the WRR Act, a development condition may be imposed on a development approval, or as a condition on an environmental authority (EA), requiring a waste management program to be prepared for the authorised activities.

The WRR Act also requires that 'cleaner production' be considered in determining how waste is managed. According to WRR Act, a cleaner production program means:

> 'a program to identify and implement ways of improving a production process so that the process –
>
> a) uses less energy, water or another input; or
> b) generates less waste; or
> c) generates waste that is less environmentally harmful.'

The EP (Waste Management) Regulation includes:

- offences for littering, waste dumping, unlawful disposal of hypodermic needles and unlawful activities at waste facilities;
- a waste tracking system that tracks the movement of specific waste to ensure correct disposal;
- clinical and related waste management planning including segregation, storage and disposal;
- requirements for managing polychlorinated biphenyls (PCBs); and
- design rules for waste equipment.

Under the EP Regulation, certain waste management activities, including disposal and transport of regulated waste, are considered to be environmentally relevant activities (ERAs) and require approval. The EP (Waste Management) Regulation also contains requirements for handling specific waste streams and requires tracking of certain regulated wastes from the point of generation to the point of final processing, recycling or disposal (refer to section 17 of EP (Waste Management) Regulation).

Operational policies for regulated waste transport (DERM 2010a) and disposal and storage of scrap tyres at mine sites (DERM 2010b) apply to the project development.

15.2.2.3 Local Authority Requirements

The proposed development is located within the Isaac Regional Council local government area and is subject to provisions established in the Planning Scheme for Belyando Shire (July 2008). Relevant requirements relating to effluent and waste disposal and use of uncontaminated fill are applied in the development of the project's waste management strategy.

15.2.3 Existing Waste Management Facilities

Existing waste management facilities and services need to be considered in assessing the potential impact and suitable management program for wastes generated from the project. Apart from dewatered tailings, coal rejects and spoil (discussed in **Section 6**), waste streams generated by the future RHM and GRM incremental expansion are considered to include:

- reusable or recyclable waste (such as paper, wood pallets, scrap metal);
- general waste, including food waste and non-recyclable packaging, suitable for disposal to landfill;
- sewage effluent and sludge; and
- regulated wastes such as waste oil and oily wastes, sewage sludge, redundant chemicals, engine coolant, solvents, batteries, and tyres.

Regional waste facilities and services include:

- solid waste landfills (domestic and commercial/industrial) operated by local councils;
- sewage treatment plants (STP) operated by local councils;
- materials recycling facility (MRF) at Clermont (privately operated);
- regulated waste treatment in Townsville (privately operated); and
- various licensed contractors for transport.

Currently, solid waste generated at GRB mine complex is removed and disposed of by an authorised waste management contractor. The contractor will utilise a number of licensed landfill operations in the Bowen Basin and charge nominal rates for the disposal of general wastes and individual fees for contaminated and/or regulated wastes.

Recyclable waste from GRB mine complex is taken to an authorised recycling centre for initial processing, typically involving segregation, crushing and baling for transport to various companies in Queensland for recycling.

Regulated wastes are transported to an authorised resources recovery facility for disposal.

Sewage is treated at existing onsite STPs with sludge removed by a licensed contractor for treatment and processing offsite. The GRB mine complex EPML00853413 (formerly EA MIN100921609) also allows reuse for dust suppression, or disposal by evaporation or irrigation.

15.3 Description of Waste

15.3.1 Definition of Waste

The EP Act defines ‘waste’ as anything that is:

a) left over or unwanted by-product from an industrial, commercial, domestic or other activity; or
b) surplus to the industrial, commercial, domestic or other activity generating wastes.

The EP (Waste Management) Regulation defines 'general waste' as waste other than regulated waste. 'Regulated waste' is defined in section 65 of the EP (Waste Management) Regulation as:

'(1) regulated waste is waste that—

a) is commercial or industrial waste, whether or not it has been immobilised or treated; and
b) is of a type, or contains a constituent of a type, mentioned in schedule 7 (of EP (Waste Management) Regulation).

(2) waste prescribed under subsection (1) includes—

a) for an element—any chemical compound containing the element; and
b) anything that contains residues of the waste.'

15.3.2 Waste Management Hierarchy

The WRR Act provides a strategic framework for managing waste in Queensland by establishing principles for achieving good waste management and a preferred waste management hierarchy, which moves from the most preferred to least preferred method as follows:

- waste avoidance;
- waste re-use;
- waste recycling;
- energy recovery from waste; and
- waste disposal.

The preferred waste management hierarchy will form the basis of a framework for prioritising waste management practices to achieve an acceptable environmental outcome on site. The production of waste is avoided where possible on site; however where the production of waste is unavoidable, waste re-use is the preferred option, followed by waste recycling and, finally, waste disposal.

15.3.3 Waste Management Strategies

The project integrate with the waste management program in place at the GRB mine complex (BMA 2011a) and use the GRB waste management system as a basis for developing a project specific program to guide the waste management principles and practices implemented on the project. A site-specific waste management plan will be developed based on the results of this impact assessment. The plan will outline effective practices for minimisation and management of waste generated from the concept and planning stages through design, construction and operation phases of the project.

The principle objective of the waste management strategy for the project is to minimise the impacts of waste generation and disposal on land resources, water quality and air quality, and to avoid direct or indirect impacts on the environment or health of the project workforce or local community.

The main strategies that will be adopted for the project include waste minimisation, segregation for reuse or recycling, cleaner production and appropriate waste disposal consistent with the relevant waste and environmental management legislation and guidance.

15.4 Potential Impacts

The Broadmeadow extension will generate additional mine waste over the life of mine; however the total production and annual quantities of mine waste currently generated by BRM will not materially change as a result of the proposed panel extensions.

The future RHM underground expansion option and GRM incremental expansion will generate additional annual and total waste with the GRB mine complex waste management system.

There are a number of potential environmental impacts associated with waste generation at the project, including:

- wastage of raw materials (e.g. wastage of construction materials such as steel and concrete);
- consumption of landfill air space (where waste is sent to local landfills);
- generation of landfill leachate and landfill gas to be managed (from waste sent to local landfills);
- risks to human health or safety (e.g. dust, odour, exposure to hazardous substances);
- pollution of soil, groundwater, or surface water (through accidental spills or releases); and
- lost opportunity for resource re-use/recycling if product is disposed.

The types and volumes of waste expected to be generated by RHM underground expansion option and GRM incremental expansion are not considered to be unusual and can be adequately managed using standard waste management equipment, infrastructure and landfill design already in place in the region. There are commercial waste services active in the area which specialise in storage, handling, transport, treatment and disposal of mine waste. These services are required to hold development permits in relation to conduct of environmentally relevant activities, and these permits specify conditions that must be met to protect environmental values. Provided that waste service providers adhere to approval conditions environmental values should not be adversely affected.

Landfills and other waste disposal facilities are operated as commercial enterprises and private sector waste generators such as the proposed project are required to pay a fee for waste management and disposal services, based on the quantity and type of waste material. Operators of waste management and disposal facilities have business imperative to plan ahead to develop adequate facilities to meet demand. As the overall waste quantities to be produced by the project are quite low, the project will not cause a sharp increase in demand for landfill or other waste management services and is not expected to affect overall availability and capacity of waste management facilities.

15.5 Management Approach

15.5.1 Waste Generation and Management

Waste generation will occur throughout construction, operation and decommissioning phases of the project. The sources, volumes and characteristics of wastes expected to be generated by the project are described in this section with corresponding management measures, in order to evaluate the efficiency of resource use and appropriateness of the proposed management approach as required by the TOR (Coordinator-General 2013).

The waste streams generated from construction (**Section 15.5.1.1**) and operation (**Section 15.5.1.2**) of the project were quantified and characterised based on existing waste management documentation provided by BMA or, alternatively, construction and operation of similar projects of this type and scale. While it is difficult to provide any detail on decommissioning wastes, general waste sources and management approaches are discussed in **Section 15.5.1.3**.

15.5.1.1 Construction Waste

The timeframe for construction of the RHM underground expansion option and GRM incremental expansion will depend on the rate of development determined by the project owners. The scenario presented for the purposes of modelling the potential impacts of the project assumes that construction is expected to take two to three years.

Waste generated during site preparation and construction will be segregated for reuse onsite or subsequent collection by a third party waste contractor for recycling or disposal at the existing Moranbah landfill.

Construction activities will be carried out by one or more contractors who will be responsible for minimising waste and managing waste generated. Waste quantities and proposed management methods are indicative only for the purposes of demonstrating that anticipated waste streams can be properly managed.

The quantity of site preparation and construction waste for the main construction period was estimated through the application of the following methods and reference data:

- information available in the EIS Submission Support, Waste Management Construction Phase (SKM 2011);
- self-assessed wastage rates for building services (EPA 2002) as a percentage of incoming construction materials;
- composition of residential construction waste (EPA 2002) adjusted to account for additional waste materials diverted and reused onsite (e.g. earthen fill, green waste) or generated at lower levels (e.g. bricks, pavers and plasterboard); and
- publicly available waste data for similar large mine developments.

Conservative estimates of waste generation for the construction phase of the project are presented in **Table 15-1**. It is expected that pre-fabrication of some concrete and steel structures will further reduce on site waste generation. The waste management strategies identified in **Table 15-1** demonstrate the application of the preferred waste management hierarchy in promoting options for on site reuse, recycling and treatment initiatives. Waste management strategies for each waste stream will be revisited prior to commencement of construction to take into account current conditions.

Table 15-1 Construction Waste Inventory

Waste	Source	Estimation Method	Quantity	Units	Management Strategy
Cleared vegetation	Vegetation cleared during construction of mine and associated industrial facilities and amenities.	Vegetation to be cleared on as-needs basis to minimise area disturbed. As land cleared previously for agricultural purposes, expect minimal quantities (SKM 2011).	Minimal	tonnes	Green waste stockpiled and mulched for reuse onsite for rehabilitation, landscaping and erosion control (SKM 2011). Burning of green wastes will only occur as a last resort, subject to obtaining necessary permits and approvals.
General waste	General waste, including food waste and packaging materials, from workshops, site offices, crib rooms or accommodation.	General waste quantity derived from a comparison of recently constructed and operational Bowen Basin coal mines (SKM 2011).	204	tonnes	General refuse is to be collected in green bins and removed regularly (at least weekly) for transport off site for disposal at Moranbah Landfill.
Co-mingled recycling (e.g. paper, card, plastics, aluminium, glass)	Workshops, offices, crib rooms or accommodation.	Recycling derived from the Waste Management Construction Phase Assessment (SKM 2011).	30	tonnes	Recycling will be collected in lilac waste containers for transport to a contractor facility for processing (i.e. sort, crush and bale for transport to Brisbane).
Waste electrical and electronic equipment (WEEE)	Administration buildings or maintenance activities.	Expect minimal quantities. Data sourced from other operating coal mines and scaled for size.	0.5	tonnes	Set up WEEE collection service with licensed WEEE recycling operator.
Printer cartridges	Administration buildings.	Expect minimal quantities. Data sourced from other operating coal mines and scaled for size.	0.1	tonnes	Used or empty laser and inkjet printer cartridges can be recycled if quantities justify.
Excavated material	Material excavated during bulk earthworks, access roads and site establishment.	No information available, subject to geotechnical investigations to be completed in detailed design.	unknown	cubic metres	Reuse all suitable material to meet fill requirements. Dispose of unsuitable or excess material in GRB mine complex spoil dump areas.

Waste	Source	Estimation Method	Quantity	Units	Management Strategy
Concrete and bricks	Waste concrete and bricks from new construction activities, access and circulating roadways and car parking areas.	Concrete will be batched off site, with the potential for an on site batching plant being investigated. Data sourced from GCE EIS Submission Support - Waste Management Construction Phase (SKM 2011).	37	tonnes	Concrete and brick will be stockpiled in designated storage areas for reuse (e.g. fill material) or recycling (e.g. crushed for road base) or alternatively disposed on site.
Waste timber	Waste timber (e.g. pallets and off cuts) from new construction activities or temporary structures.	Data sourced from Waste Management Construction Phase assessment (SKM 2011).	302	tonnes	Stockpiled in designated storage area for reuse on site or alternatively removed by licensed contractor for reuse, reprocessing or final disposal.
Electrical wastes	Waste from new construction activities or temporary structures.	Calculated as 2% mass equivalent of total construction waste stream (EPA 2002).	1	tonnes	Stockpiled in designated storage area to be removed by licensed contractor for reuse, reprocessing or final disposal.
Metals	Steel/metal offcuts from new construction activities or temporary structures.	Data sourced from Waste Management Construction Phase assessment (SKM 2011).	27	tonnes	Scrap metals will be sourced, separated and collected in blue skip for recycling by scrap metal merchants.
Sealers, resins, solvents and paints	Waste from new construction activities.	Expect minimal quantities (SKM 2011). Estimated on basis of similar projects.	0.5	tonnes	Purchase only amount required on an as needs basis. Collected at a waste management pad for intermediate storage prior to removal by a licensed contractor to an authorised facility for processing. Waste tracking applies.

Waste	Source	Estimation Method	Quantity	Units	Management Strategy
Sewage effluent	Sewage effluent from offices, crib rooms, accommodation, kitchen and amenities.	The construction workforce will generate an estimated additional 26 tonnes per year of sewage (BMA 2011a). Sewage effluent projected on basis of project workforce numbers (240 L/person/day) – up to 3,000 peak construction workforce (BMA 2011a).	500	megalitres	Effluent treated in existing STP to Class A+ quality for reuse as dust suppression, disposal by land irrigation or to the GRB water management system.
Sewage sludge	Solids removed from STP.	Volumetric fraction of solids in sewage effluent.	300	tonnes	Sludge will be dewatered, transported and disposed of by a licensed contractor to a licensed facility off site (SKM 2011). Waste tracking applies.
Waste oils	Workshop generated waste oil and drums (small, bulk and other containers that typically contained oils and greases) through routine servicing of plant, equipment and vehicles.	Data sourced from Waste Management Construction Phase assessment (SKM 2011).	148	tonnes	Waste oil to be collected and stored in tan-coloured bins for bulk transport to an authorised waste management facility for either recycling or for further re-use as oil or utilisation as a fuel (e.g. at Collinsville Power Station). Waste tracking applies.
Hydrocarbon-contaminated waste	Drums, containers, filters and rags sourced from routine servicing of plant, equipment and vehicles in workshop.	Derived from GRB waste reports (BMA 2010).	30	tonnes	Empty drums, used oil and fuel filters to be collected in containers at a waste management pad for bulk transport to an authorised waste management facility for processing. Filters are crushed, residual oil and fuel recycled and the metal carcass put into scrap metal. Waste tracking applies.

Waste	Source	Estimation Method	Quantity	Units	Management Strategy
Tyres	Tyre failure and routine servicing of plant, equipment and vehicles in workshop.	Estimate 60 heavy vehicles require annual tyre change. Assume each tyre weighs up to 3 tonnes. Estimate 100 (SKM 2011) light and medium-sized service vehicles (i.e. excludes dump truck and large rubber tyred vehicles) will require tyre change once during construction. Assume each tyre weighs about 50 kg.	2,540	tonnes	If waste tyres cannot be reused on site (e.g. barriers), then tyres will be stockpiled for removal off site for reprocessing or buried in spoil at the GRB mine complex site. Waste tracking applies.
Grease trap waste	Workshop and accommodation village kitchen.	Data sourced from Waste Management Construction Phase assessment (SKM 2011).	2,900	litres	Grease trap waste is stored in drums at a waste management pad for transport to a regulated waste facility for disposal by high temperature incineration or treated for disposal to landfill. Waste tracking applies.
Explosives (blasting residue and packaging from use of explosive, boosters and detonators)	Defective explosives and packaging.	Up to 15 tonnes of explosive may be required for drift construction.	<0.1	tonnes	If required, explosive materials are to be treated in accordance with AS2187.2-2006 'Explosives Storage, Transport and Use', Part 2, Use of Explosives. Disposal to landfill is not suitable method of disposal. Cardboard packaging cannot be recycled due to potential explosive residues. Any out of date or faulty explosives will be returned to the manufacturer.
Batteries	Wet cell batteries from vehicles and dry cell batteries from phones, radios and other equipment.	Data sourced from Waste Management Construction Phase assessment (SKM 2011).	5	tonnes	Stored on a bunded pallet at a waste management pad for removal from site by a licensed contractor for recycling. Waste tracking applies.

Green Waste

Green waste includes vegetation cleared across the mining lease area associated with project construction. The quantity of green waste generated is expected to be moderate, as the land has generally been cleared by past land use practices, including agriculture. Further, clearing is only required for surface infrastructure and facilities and incidental mine gas (IMG) management infrastructure.

Preferentially, green waste will be reused on site as is, or mulched where required for land shaping and interim rehabilitation activities. Alternatively, as a last resort, green waste may be burnt subject to applicable permits and approvals (BMA 2011b). Where vegetation cannot be used on site, it will be transferred to a landfill green waste area.

General Waste

General municipal wastes will be generated from the construction of the Red Hill accommodation village, mechanical, electrical and structural material handling equipment, and the administration facilities. This waste stream will typically comprise food scraps and packaging such as paper, cardboard, glass, aluminium cans and plastics.

As per the current waste management program at the GRB mine complex (BMA 2011a), general waste will be source segregated to facilitate recycling by the provision of separate general waste and recycling bins around the construction accommodation village, site offices and amenities. Residual general (non-recyclable) waste would be collected by a licensed contractor and disposed to a licenced landfill facility.

Building Waste

Construction of the project buildings and infrastructure is expected to create concrete, masonry, metal, timber and other general building wastes. BMA proposes that the Red Hill accommodation village components made of concrete and steel are modularised and pre-fabricated and this will reduce the amount of waste generated and managed on site.

For the purposes of the EIS, building wastes generated as a result of total construction requirements are conservatively estimated (SKM 2011), and equate to approximately 10 per cent of the total building materials required (EPA 2002). This allows for defects, damage during transportation and off-cuts.

Where feasible, these wastes will be segregated to facilitate reuse onsite or recycling offsite by a contractor. In accordance with the operation policy titled ‘Licensing requirements for construction and demolition wastes’ (EPA 2002), if construction and demolition waste is separated into its constituent parts, the inert parts may be used as clean fill. Residual (non-recyclable) waste would be disposed to an authorised waste management facility.

Wastewater

During the construction phase, sewage will be generated from the Red Hill accommodation village and construction and administration areas associated with the mine industrial area (MIA) and coal handling and preparation plant (CHPP).

Sewage will be treated on site in package STPs and disposed of either by irrigation or reused for dust suppression. If disposal by irrigation is proposed, further assessment of soil types and irrigation area

requirements will be undertaken to determine the area required for irrigation and other irrigation management requirements. Effluent quality characteristics with regard to bacteriological characteristics will depend on the proposed disposal method and risk of human contact with treated wastewater.

It is expected that STPs installed for construction will continue to be used during the operation phase.

Regulated Waste Including Hazardous Waste / Hydrocarbon Waste

Limited vehicle and earthmoving equipment maintenance activities will occur on site during the construction stage. As a result of these activities, regulated waste may include used or surplus:

- tyres;
- hydrocarbon wastes (waste oils, oily water, oily sludge, grease, oily rags, oil filters, oil drums);
- coolants;
- detergents;
- sewage sludge;
- solvents;
- resins;
- batteries; and
- paints.

Preferentially, tyres will be reused for practical uses on site such as barriers, drainage and markers or removed by the tyre supplier for reprocessing. Stockpiling of tyres on site will be limited to minimise the risk of combustion, water retention and mosquito breeding.

Tyres may also be disposed of in spoil emplacements at the adjacent GRM open-cuts provided that tyres are placed as deep in the spoil as possible but not directly on the pit floor. If this method is used, placement will ensure scrap tyres do not impede saturated aquifers and do not compromise the stability of the final landform. Scrap tyre disposal sites will be recorded on the Department of Environment and Heritage Protection (EHP) environmental management register (EMR).

Hydrocarbon-contaminated wastes during construction will be limited in quantity. Such wastes will comprise used solvents, oils and lubricants and hydrocarbon contaminated materials produced from major production equipment, mobile equipment, minor vehicle maintenance and potentially minor leaks from refuelling operations. Hydrocarbon wastes will be collected in a suitably bunded (secondary containment) above ground waste storage tanks or other suitable containment devices and removed off site by a licensed contractor for reprocessing, recycling or final disposal.

Sewage sludge will be dewatered, transported and disposed of by a licensed contractor to a licensed facility (BMA 2011a). Reuse of sewage sludge will not be considered during the construction phase due to the relatively short duration of this phase.

Wet cell batteries will be stored in a central bunded facility for collection and removal off site by a licensed contractor for reprocessing, recycling or final disposal.

15.5.1.2 Operational Waste

The Broadmeadow extension will generate additional operational mine waste over the life of mine; however the total production and annual quantities of mine waste currently generated by BRM operations will not materially change as a result of the proposed panel extensions.

Over the project life, general operation of the RHM underground expansion option and GRM incremental expansion will include underground mining activities, surface industrial activities, rehabilitation of areas disturbed by IMG management infrastructure and subsided areas, maintenance of mobile and fixed plant, administration activities, and operation of the Red Hill accommodation village and associated services such as sewage treatment. A program of installing and managing IMG management wells and pipelines will also be undertaken.

In general, the quantity of operational waste for each year of the project life was estimated by scaling up existing waste data supplied by BMA within **Section 3.11** (BMA 2011a) and the EIS submission support documents (SKM 2011).

Conservative estimates of waste generation for the operations phase of the project are presented in **Table 15-2** including waste-specific management strategies and options for on site reuse, recycling and treatment to be implemented to minimise disposal to landfill.

General Waste

General municipal wastes will be generated from the Red Hill accommodation village, administration facilities and crib rooms, and will typically comprise food scraps, paper and cardboard, glass, aluminium cans, plastics and packaging. These wastes will be segregated to facilitate recycling by the provision of recycling bins around these buildings. Residual (non-recyclable) waste would be disposed to a licensed landfill.

Building Waste

Once the project is operational, the generation of building waste, including concrete, masonry, metals, timber and other general building wastes, will be minimal, except for minor ongoing maintenance works. Although it is unlikely that it will be possible to reuse building wastes on site, if opportunities do arise, this waste will be segregated to facilitate reuse on site or for recycling off site in accordance with the operation policy titled ‘Licensing requirements for construction and demolition wastes’ (EPA 2002). Residual (non-recyclable) waste would be disposed to a licensed landfill.

Wastewater

During the project’s operational phase, sewage will be generated from the administration facilities and accommodation village as well as workshops within the Red Hill MIA. The combined operational workforce will generate an estimated 80 megalitres per year of sewage (BMA 2011a). Sewage will be treated on site to Class A+ or Class B effluent quality, depending on the potential for human contact with treated sewage. Sewage from the Red Hill accommodation village may be used for irrigation of landscaped areas within the village, or disposed of by irrigation on adjacent lands. Further studies of soil types, required irrigation areas and irrigation management requirements will be undertaken as part of the detailed design stage and, if it is not feasible to use treated wastewater for irrigation, it will be piped to the mine water management system. Sewage from the MIA will be treated and returned to the MIA water supply dam for reuse.

Table 15-2 Operational Phase Waste Inventory (Annualised)

Waste	Source	Estimation Method	Quantity	Units	Management Strategy
General waste	Workshops, offices, crib rooms or accommodation.	General waste quantity derived from a comparison of recently constructed and operational Bowen Basin coal mines (SKM 2011).	4,736	tonnes	General refuse is to be collected in green bins and removed regularly (at least weekly) for transport off site for disposal a licensed landfill.
Vegetation waste	Clearing for incidental mine gas management infrastructure.	NA. Quantities will be highly variable depending on works undertaken and extent of vegetation cover.	Variable		Retain and reuse with or without mulching for stabilisation, habitat restoration and rehabilitation works.
Drill cuttings and drilling muds, trench spoil	Installation of incidental mine gas management wells and underground pipelines.	NA, Quantities will depend on extent of works undertaken in each year	Variable, minor		Reuse in rehabilitation activities or remove for disposal in spoil dumps in adjacent GRB mine complex (note that a contaminated land disposal permit may be required).
Co-mingled recycling (e.g. paper, card, plastics, aluminium, glass)	Workshops, offices, crib rooms or accommodation.	Data sourced from GCE – EIS Submission Support, Waste Management Operations Phase (SKM 2011).	2,110	tonnes	Recycling will be collected in lilac waste containers for transport to an licensed processing facility (i.e. sort, crush and bale for transport to Brisbane).
WEEE	Administration buildings or maintenance activities.	Expect minimal quantities. Estimated on basis of similar projects.	0.1	tonnes	Set up WEEE collection service with licensed WEEE recycling operator.
Printer cartridges	Administration buildings.	Expect minimal quantities. Estimated on basis of similar projects.	0.05	tonnes	Used or empty laser and inkjet printer cartridges can be recycled.
Concrete and bricks	Maintenance works.	Expect minimal quantities. Estimated on basis of similar projects.	>1	tonnes	Concrete and brick will be stockpiled in designated storage areas for reuse (e.g. crushed for road base) or alternatively disposed onsite or at a landfill. Contaminated material will be disposed to landfill off site.
Waste timber	Workshops and maintenance works.	Expect minimal quantities (SKM 2011).	10	tonnes	Stockpiled in designated storage area for reuse on site or alternatively removed by licensed contractor for reuse, reprocessing or final disposal.

Waste	Source	Estimation Method	Quantity	Units	Management Strategy
Electrical waste	Workshops and maintenance works.	Expect minimal quantities. Calculated as 2% mass equivalent of total construction waste stream (EPA 2002).	Minimal	tonnes	Stockpiled in designated storage area to be removed by licensed contractor for reuse, reprocessing or final disposal.
Metals	Workshops and maintenance works.	Data based on comparisons of similar Bowen Basin, BMA coal mines.	21	tonnes	Scrap metals will be source separated and collected in blue skip bins for transfer to a waste storage area for resale to scrap metal merchants.
Sealers, resins, solvents and paints	Workshops.	Data sourced from GCE EIS Submission Support - Waste Management Operations Phase (SKM 2011).	7	tonnes	Collected at a waste management pad for eventual removal by a licensed contractor to a licensed waste management facility for processing. Waste tracking applies.
Sewage effluent	Sewage effluent from offices, crib rooms, accommodation, kitchen and amenities.	Combined operational workforce will generate an estimated 80 megalitres per year of sewage (BMA 2011a).	147	megalitres	Sewage will be treated on site to Class A+ effluent quality to maximise opportunities for reuse on site.
Sewage sludge	STP	Volumetric fraction of solids in sewage effluent.	88	tonnes	Where on site reuse of sludge is not practical, sludge will be dewatered for transport by licensed contractor to an off site STP.
Waste oil	Workshop generated waste oil and drums (small, bulk and other containers that typically contained oils and greases) through routine servicing of plant, equipment and vehicles.	Data sourced from GCE EIS Submission Support - Waste Management Operations Phase (SKM 2011).	148	kilolitres	Waste oil to be collected and stored in tan-coloured bins, removed from site by a licensed contractor to a licensed facility for either recycling or for further reuse as oil or utilisation as a fuel (e.g at Collinsville Power Station). Waste tracking applies.

Waste	Source	Estimation Method	Quantity	Units	Management Strategy
Hydrocarbon-contaminated waste	Drums, containers, filters and rags sourced from routine servicing of plant, equipment and vehicles in workshop.	Derived from GRB waste reports (BMA 2010).	226	tonnes	Empty drums, used oil and fuel filters to be collected in containers at a waste management pad at Ahdens Compound for bulk transport to a licensed facility for processing. Filters are crushed, residual oil and fuel recycled and the metal carcass put into scrap metal. Waste tracking applies.
Tyres	Tyre failure and routine servicing of plant, equipment and vehicles in workshop.	Haul and support vehicles (estimate 10 heavy vehicles) require tyre change every 12-months. Each tyre weighs up to 3 tonnes. Estimate 50 light and medium-sized service vehicles will require tyre change once in 12-month period. Each tyre weighs approximately 50 kilograms.	450	tonnes	If waste tyres cannot be reused on site (e.g. barriers), then tyres will be stockpiled for removal off site for reprocessing or buried in spoil at the GRB mine complex site. Waste tracking applies.
Grease trap waste	Workshop and accommodation village kitchen.	Data sourced from GCE EIS Submission Support - Waste Management Construction Phase (SKM 2011).	45	kilolitres	Waste grease to be placed in a bunded storage container. Waste grease to be collected periodically by a licensed waste contractor for reuse, reprocessing, recycling or disposal. Where possible, pneumatic pumps should be used to transfer waste oil from machinery to bunded storage.
Batteries	Wet cell batteries from vehicles and dry cell batteries from phones, radios and other equipment.	Data sourced from GCE EIS Submission Support - Waste Management Operations Phase (SKM 2011).	5	tonnes	Stored on a bunded pallet at a nominated waste management pad for removal from site by a licensed contractor for recycling. Waste tracking applies.

Regulated Waste Including Hazardous Waste / Hydrocarbon Waste

Regulated waste generated during the operation of the project will be similar to that generated during construction and will be managed consistently. BMA will keep detailed records of waste removed from site, including details of contractors, treatment and final destination.

Preferentially, tyres will be reused for practical uses on site such as barriers, drainage and markers or will be removed by the tyre supplier for reprocessing. Stockpiling of tyres on site will be limited to minimise the risk of combustion, water retention and mosquito breeding. Tyres may also be disposed of in spoil emplacements at the adjacent GRM open-cuts provided that tyres are placed as deep in the spoil as possible but not directly on the pit floor. If this method is used, placement will ensure scrap tyres do not impede saturated aquifers and do not compromise the stability of the final landform. Scrap tyre disposal sites will be recorded on EHP's EMR.

Hydrocarbon-contaminated wastes during construction will be limited in quantity. Such wastes will comprise used solvents, oils and lubricants and hydrocarbon contaminated materials produced from major production equipment, mobile equipment, minor vehicle maintenance and potentially minor leaks from refuelling operations.

Laboratory testing of coal during the operation phase will also generate small quantities of wastes to be managed. These wastes will be handled in accordance with materials safety data sheets (MSDS) and product-specific practices with waste materials stored, handled and treated by a licensed operator for reprocessing, recycling or final disposal.

On site reuse of sewage sludge will be investigated, and where this is not practical, sludge will be dewatered and removed off site by a licensed contractor to a licensed disposal facility.

Wet cell batteries will be stored in a central bunded facility for collection and removal off site by a licensed contractor for reprocessing, recycling or final disposal.

15.5.1.3 Decommissioning

At the end of the project life, remaining infrastructure will be decommissioned and, unless there is an agreement with the landholder, removed from site in accordance with the appropriate waste management plan to be defined closer to the time of decommissioning. Conceptual decommissioning and rehabilitation strategies developed for the project are outlined in **Section 5.5**, including performance indicators to minimise residual impact on the environment.

Estimated waste generation for the decommissioning stage of the project is uncertain given that the number of buildings and associated structures to be removed or that will remain on site is currently unknown.

As demonstrated in **Table 15-1** and **Table 15-2**, waste management methods are available for the wastes potentially generated during decommissioning. However, as it is likely that waste management methods and available waste management facilities will change in the decades before decommissioning will occur, a detailed decommissioning waste management plan will be prepared prior to commencement of the decommissioning works. This will include estimated types and quantities of wastes expected to be generated, as well as and waste management measures to be implemented during this stage, and will be consistent with regulatory and good practice requirements in place at the time of decommissioning.

15.5.2 Cleaner Production and Waste Minimisation

Cleaner production during detailed design and within the RHM area and GRM incremental expansion will focus on implementing ways to improve resource efficiency and environmental performance of construction and production processes in order to:

- reduce the use of energy, water and other material resources;
- generate less waste in the production process; and/or
- generate waste that is less environmentally harmful or reusable for another process.

In general, cleaner production can be achieved through a selection of one or more of the following techniques:

- input substitution (such as fuels, solvents);
- production process modification (i.e. selection of the best available practicable technologies e.g. conveyors compared to trucks);
- improved operation and maintenance (i.e. selection and use of the most appropriate processes and equipment and management practices);
- reuse of resources that are otherwise wastes (such as putrescible waste, tailings); and/or
- closed-loop recycling (where a product is recycled and used again in the same form, such as water).

The following are being considered in project design studies and demonstrate potential for cleaner production:

- adoption of the waste management hierarchy as the cornerstone of waste management strategies;
- potential use of thick seam mining technology to increase coal recovery for similar levels of effort;
- location of the mining and infrastructure areas to maximise process efficiency;
- beneficial reuse of IMG;
- recycling of process water through the coal processing phases, including a closed loop waste system for the Red Hill CHPP; and
- recycling water from sewage treatment primarily to processing or irrigation.

The development and implementation of comprehensive earthmoving equipment and fixed plant maintenance programs will ensure optimum performance and energy efficiency for all mechanical equipment used on site and will help to generate less waste and less indirect environmental effects.

Contracts with construction companies will encourage contractors to adopt waste minimisation procedures. This includes the purchase of materials cut to standard sizes, reuse of concrete formwork where practicable and source separation and segregation of recoverable materials.

15.5.3 Handling, Storage, Collection and Disposal

The various project facilities will be set up and managed to ensure maximum opportunity for segregation of waste stream components. During both construction and operational phases of the project, a dedicated waste segregation, storage and transfer area will be set up at the MIA to accept and sort waste materials. Separate skips will be provided to collect and store nominated waste

materials from project construction and operation for reuse, recycling or disposal, including hazardous materials.

A smaller waste storage area will be established at the proposed Red Hill accommodation village for village wastes. If regulated wastes are generated at the accommodation village, these either be promptly removed by a waste contractor or transferred to the MIA waste storage area.

Colour-coded and signed bins will be used to identify points for collection and segregation of waste materials, including food waste, paper and recyclables to facilitate sorting and recovery of re-usable materials. The bins will be located throughout administration buildings and the accommodation village to achieve maximum economic waste recovery. These bins will be emptied into larger bins or skips regularly. All smaller bins and larger bins or skips will have lids to reduce the potential for attracting insects and vermin. Equipment and bin sizing requirements will be designed and adjusted to meet waste generation rates during construction and operation phases of the project.

The nominated waste management procedures will aim to control environmental impacts (such as odours, noise from transfer and transport, dust from transfer and transport, leachate from storage vessels and vermin/pests) through:

- designated location for waste collection, sorting and transfer to collection vehicles;
- designated traffic routes for waste transport;
- covered storage vessels to minimise odours and vermin/pests;
- housekeeping practices; and
- regular monitoring and reporting.

Site personnel, contractors and visitors will utilise personal protective equipment as appropriate to protect themselves against the hazards of dust and noise emissions in high exposure areas. Waste storage areas will be away from areas where workers may congregate, particularly at the Red Hill accommodation village.

General wastes will be collected regularly and transported for disposal by a licensed contractor to licensed landfill for disposal. Recyclables will be transported to a licensed landfill.

All incidents that deviate from the normal operating conditions will be reported internally and at such times immediate corrective actions initiated.

15.5.4 Waste Management Requirements

Detailed waste management plans will be developed to guide implementation of site-specific waste management procedures and practices for construction (by contractors), operation and decommissioning phases. These waste management plans would cover:

- roles and responsibilities in relation to waste management;
- identification of waste streams and establishment of a baseline measurement for each stream;
- use of the waste management hierarchy when selecting waste management strategies, with emphasis on minimising any hazardous waste;
- identification of solid, liquid or hazardous waste collection, storage and/or disposal strategies;

- storage, handling, transport of any hazardous or regulated waste in a manner compliant with relevant legislation including waste tracking requirements;
- procedures for safe and accountable handling of putrescible, non-regulated and non-recyclable wastes from collection to disposal;
- waste removal and transport from site by appropriately licensed contractors with disposal only to licensed reprocessing, recycling or waste disposal facilities;
- identification and administration of waste management activities that may be considered to be ERAs, and depending on the scale of the activity, require approval such as ERA 63 Sewage treatment;
- induction, training and awareness activities including:
  - information on general waste management requirements in site inductions;
  - signage in relation to minimisation, handling, storage, reuse and segregation;
  - waste management procedures and facilities applicable to the area of responsibility;
  - storage, handling, management and record keeping processes for regulated wastes;
  - tool box talks on specific aspects of waste avoidance, minimisation and management; and
  - inclusion of waste generation considerations in pre-start and job safety and environmental assessment processes;
- monitoring and recording of waste generation and management, including:
  - waste tracking records, including details of contractors, waste removal, treatment and final destination will be maintained;
  - provision of a monthly report by waste contractors which tracks waste generation at each location;
  - regular inspections of waste storage and management areas to check for proper storage and segregation;
  - segregation of bin contents checked weekly on rotational basis and score as either compliant (not contaminated) or non-compliant (contaminated);
  - six monthly review of waste generation to identify any significant increases or decreases as well as opportunities to avoid waste or continually improve waste reuse, recycling and minimisation; and
  - reporting against federal and state legislative requirements; and
- auditing against the waste management plan to track performance against overall objectives will identify trends and gaps so that the environmental team can identify corrective actions to enable targets to be achieved and promote continuous improvement.