CONTENTS

TABLES

13. WASTE MANAGEMENT

13.1. INTRODUCTION

Waste management refers to any unwanted materials – solid, liquid, or gaseous produced by human activity and the appropriate actions undertaken in their collection, storage, treatment or disposal to reduce their effect on health, the environment and aesthetics. Management practices can be employed to recover reusable resources from waste material.

Waste management practices vary for different industries and locations depending on what waste streams are produced and what facilities are available. Due to the relative isolation of some coal mines, waste management options can sometimes be limited.

This Section describes the potential waste streams and volumes, potential impacts of waste generation and management measures to minimise the impacts at the South Galilee Coal Project (SGCP).

13.2. WASTE MANAGEMENT LEGISLATION AND REGULATIONS

The regulatory requirements governing waste management are contained within the following legislation and guidelines:

- Queensland *Environmental Protection Act 1994* (*EP Act*)
- Queensland *Environmental Protection Regulation 2008 (EP Regulation)*
- Queensland Waste Reduction and Recycling Act 2011 *(WRR Act)*
- Queensland Waste Reduction and Recycling Regulation 2011 *(WRR Regulation)*
- *Queensland's Waste Reduction and Recycling Strategy 2010–2020* (QLD Waste Strategy) (DERM, 2010)
- Queensland Guideline: Landfill Siting, Design, Operation and Rehabilitation *(DEHP, 2012)*.

13.2.1. Waste Definition

Section 13 of the *EP Act* defines 'waste' as anything that is:

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

The *EP Regulation* defines 'general waste' as waste other than regulated waste. 'Regulated waste' is defined by type in Schedule 7 of the *EP Regulation* as waste that:

- contains a significant quantity and concentration of a hazardous contaminant, or
- the hazardous contaminant exhibits hazardous characteristics because of its toxicity, carcinogenicity, mutagenicity, teratogenicity, flammability, corrosivity, reactivity, ignitability or infectiousness, through its physical, chemical or biological characteristics, or
- the waste may cause environmental harm if improperly transported, treated, stored, disposed or otherwise managed.

Coal mines produce a range of wastes typical to heavy industry and manufacturing operations, however there are also specific wastes from the mining and processing of coal. These wastes include the waste rock material created from the excavation of overburden that lies between the topsoil and the economic coal seam as well as coarse and fine rejects from the processing activities.

13.2.2. Waste Management Principles

The Proponent is committed to minimising the impact of waste on the environment and the community, wherever practicable, through the adoption of the waste and resource management hierarchy principles in the *WRR Act* as well as the goals identified in the QLD Waste Strategy (DERM, 2010).

The QLD Waste Strategy aims to:

- reduce waste
- optimise recovery and recycling
- develop sustainable waste industries and jobs.

A Waste Management Plan (WM Plan) will be developed prior to commencement of the SGCP and will be based on the following principles:

- effective implementation of the waste management hierarchy by focusing on:
    - waste avoidance and reduction – by implementing practices that aim to reduce the amount of waste produced
    - waste reuse – by ensuring reuse practices are encouraged and regular monitoring of industry developments to identify opportunities for external reuse programs
    - waste recycling – by implementing a recycling program with the aim of recycling all waste materials

that have some value and where recycling options are available. Materials such as metals, oils, solvents, glass, paper and plastics will be assessed for recycling suitability

- energy recovery – monitoring of developments within the industry to identify potential opportunities for the generation of energy from waste materials
- waste disposal – if no other options are available, non-recyclable wastes generated will be disposed of at the landfill facility.

- continual development and improvement of waste management practices involving water conservation, treatment and reuse, waste reduction and resource recovery
- compliance with National and State waste management policies, the *EP Act* and associated regulatory instruments as a minimum.

The WM Plan will be reviewed and updated as required.

The waste management objectives, strategies and principles to be employed throughout the construction, operation and decommissioning phases of the SGCP are included in the Environmental Management Plan (EM Plan) (**Section 21—Environmental Management Plan**) and will include:

- waste stream characterisation and separation
- assessment of waste reduction opportunities for identified waste
- management of waste in accordance with the waste management hierarchy.

Waste management training will be provided to appropriate personnel and contractors.

13.3. DESCRIPTION OF ENVIRONMENTAL VALUES

At all stages of the SGCP, waste will be managed to minimise direct or indirect impacts on the life, health and well being of people, the diversity of ecological processes and land use capability. This is consistent with the objective of the *WRR ACT*. The specific values of these aspects are discussed in **Section 8—Nature Conservation**, **Section 17—Social**, **Section 18—Economic Environment** and **Section 19—Hazard and Risk**.

Waste will be managed in a manner that protects downstream water quality values. The specific water quality values are discussed in detail in **Section 9—Water Resources**.

13.4. WASTE MANAGEMENT STRATEGY

Natural resource efficiency, cleaner production, pollution prevention and waste minimisation are all important components of the overall SGCP waste management strategy. Waste management strategies will apply over the construction, operational and decommissioning phases.

The protection of water quality, air quality and land resources are the main objectives of the waste management strategy, along with responsible management of wastes so that any direct or indirect impacts on the health and well-being of people and the environment are avoided.

Waste management will aim to promote sustainable waste management practices in accordance with the *WRR Act*.

13.4.1. Natural Resource Efficiency

Project alternatives, including waste disposal options, were assessed as described in **Section 2—Project Rationale and Alternatives**. During the planning process, a number of project alternatives and options were considered, including:

- a range of mining methodologies, including improvements in energy consumption and natural resource efficiencies
- coal processing alternatives
- waste rock and coal reject disposal alternatives
- general waste treatment/disposal options
- water treatment/management alternatives.

The selection of the preferred development option for each component of the SGCP was made taking into account leading industry practices, energy efficiency opportunities, as well as regulatory, technical, commercial, environmental, social and economic assessment criteria. Decision-making and project planning undertaken for the SGCP have addressed the principles of Ecologically Sustainable Development (refer to **Section 2—Project Rationale and Alternatives**).

In order to minimise inputs, natural resources (e.g. water, waste or process by products) will be recycled where practicable as described in **Table 13-1** and **Table 13-4**). The disturbance footprint associated with the SGCP has been minimised where practicable (by utilising a combination of underground and open cut mining methods), or the location of disturbance optimised in consultation with landholders.

13.4.2. Cleaner Production

The *EP Act* lists the key principles of cleaner production. These principles will form an important component of the SGCP's waste management system and can be achieved through one or a combination of the following techniques:

- production process modification – using the best available practical technology to eliminate or reduce waste streams
- input substitution
- product reformulation
- improved operations and maintenance
- reuse of resources that will otherwise be classified as wastes
- closed-loop recycling – where a product is recycled and reused in the same form.

Cleaner production refers to the continuous development and implementation of strategies to reduce waste generation. Cleaner production also aims to reduce the risks to public health and safety and the environment.

The Proponent recognises that cleaner production has both economic and environmental benefits. Techniques to maximise the reuse of waste water and recycling of waste products will be applied to the SGCP with appropriate refinement on the basis of operational experience.

The cleaner production techniques that apply to the SGCP include:

- production process modification—the Coal Handling and Preparation Plant (CHPP) comprises a facility that employs leading practice technology in terms of coal resource recovery and waste minimisation
- input substitution—this refers to the selection and use of products which are less polluting and have a longer 'product life' (such as lubricants and coolants)
- product reformulation—this technique is not currently available for the SGCP
- production selection—wherever practicable, non-hazardous products are selected in preference to hazardous materials
- improved operation and maintenance—this will involve the selection and use of the most appropriate and practicable fixed and mobile plant and equipment for use in coal extraction, transportation and processing including vehicles, and high levels of maintenance to ensure items are operating efficiently at the SGCP

- reuse of resources—reuse of resources that will otherwise be classified as wastes is the most common cleaner production technique applicable to the SGCP (e.g. reuse wooden pallets, cleared vegetative material, waste water, metals, lead from batteries) (refer to **Table 13-1** and **Table 13-4**)
- closed-loop recycling—where a product is recycled and used again in the same form (e.g. wooden pallets), is applicable to the SGCP.

The planning and design of the SGCP aims to maximise natural resource efficiency:

- water use efficiency is described in **Section 9—Water Resources**
- energy efficiency is discussed in **Section 2—Project Rationale and Alternatives**.

A continuous improvement approach will be adopted for the SGCP over the life of the mine. This approach will involve reviewing and modifying processes, materials and operating practices throughout the mine life when required. The development of quantifiable key performance indicators will be included in the WM Plan.

13.4.3. Regulated Wastes

The definition of Regulated Wastes is provided in **Section 13.2.1**. Based on this definition and an appraisal of the waste generating activities anticipated for the SGCP, the following materials and substances are classified as Regulated Wastes:

- batteries
- waste hydrocarbons/fuel
- contaminated soils
- oil interceptor sludge
- oil water emulsions and mixtures
- solvents
- paints
- hazardous chemicals used in maintenance
- oily rags
- treatment tank sludge and residues (including sewage tank sludge and residues)
- tyres
- vehicle wash down waters.

All regulated wastes will be segregated as required and will comply with all regulatory requirements and Australian Standards for their transport, handling, use, storage and disposal. A discussion of the waste management regulations applicable to the SGCP is provided in **Section 3—Project Approvals**.

13.4.4. Spill Containment and Remediation

The waste management strategies developed for the SGCP will include procedures for the storage, handling, disposal and spill response for potentially hazardous waste materials. This will include the provision of spill containment equipment and materials at workshops and fuel/chemical storage areas.

Spillage of flammable and combustible liquids will be contained within an on-site containment system (primarily bunding) and controlled in a manner that prevents environmental harm and maintained in accordance with Section 5.9 of *Australian Standard 1940—The storage and handling of flammable and combustible liquids* (AS 1940). Any soil affected by minor spills will be collected and disposed of appropriately. The establishment of a hydrocarbon landfill will be investigated.

The spill prevention and containment system consists of bunds constructed around the bulk fuel, oil storages tanks and waste oil tanks as per AS 1940.

In accordance with the EM Plan, training will be provided to personnel and contractors in the management of chemicals, hydrocarbons and wastes. Personnel and contractors will be made aware of the correct procedures for the prevention, management and clean-up of chemical and fuel spills. Spill management kits will be retained in the workshop and on service vehicles. Sites that become contaminated will be investigated and managed in accordance with the remediation, reporting and monitoring requirements of the contaminated land provisions of the *EP Act*. A register of all chemicals stored at the SGCP will be maintained.

Proposed spillage controls are detailed in **Section 19—Hazard and Risk**. Measures to prevent groundwater contamination are described in **Section 9—Water Resources**.

13.4.5. Waste Tracking

The movement of regulated waste other than that specified in Section 17 of the *EP Regulation* is required to be monitored by a waste tracking system. Waste tracking will be undertaken at the SGCP with any wastes generated to be tracked in accordance with the *EP Regulation*.

The WM Plan will include procedures for identification and management of trackable wastes associated with the SGCP. All employees and waste management contractors must act in compliance with these procedures. Trackable wastes will be transported by licensed waste transport contractors to a facility licensed to accept waste of this nature.

Trackable wastes can only be transported by an operator approved by the local government authority under Section 369 of the *EP Act*. The operator must also be licensed by the Department of Environment and Heritage Protection (DEHP) as a Regulated Waste transporter. The site where the regulated waste is disposed of must be licensed by the DEHP. Where the Proponent and/or a contractor carry out these activities, the Proponent and the contractor will be required to hold the appropriate approvals. This requirement will be incorporated into the WM Plan.

Waste management will be subcontracted to a licensed waste management contractor. The types of actions required under the contract would typically include:

- supply and maintenance of suitable waste receptacles
- collection and transport of specified waste materials
- recycling of materials where practicable and cost effective
- accurate and timely documentation and reporting
- targeted workforce awareness presentations
- preparation and distribution of awareness materials
- assistance in the implementation of site waste management strategies
- development and implementation of waste reduction, improvement and segregation activities.

13.4.6. Monitoring Program

Tracking of regulated waste other than that specified in Section 17 of the *EP Regulation* is described in **Section 13.4.5**. Monthly waste monitoring and auditing will be undertaken at the SGCP and be included as a component of the site WM Plan. The WM Plan will include provision for identification of matters to be improved through auditing and review. The purpose of monitoring the activities and outcomes related to waste management include:

- providing baseline data for the continuous development and improvement of waste management measures throughout the life of the SGCP
- assessing actual waste results against forecasted waste volumes
- monitoring for potential environmental impacts.

Monitoring will include the recording of waste types and volumes generated on-site (e.g. general waste, bulk general waste, regulated waste, scrap metal and recyclables) and waste being transported off-site. Records will be maintained in order to determine where large quantities of certain wastes are being produced. Records will be reviewed on a regular basis and appropriate corrective actions formulated to reduce or eliminate waste generation or impacts associated with waste.

Ongoing geochemical sampling and monitoring of potential impacts of waste on surface water/groundwater are described in **Section 7—Land** and **Section 9—Water Resources**, respectively.

13.4.7. Waste Reporting

In addition to the Queensland Government's regulatory requirements for waste management, discussed in **Section 13.2**, the SGCP will be required to comply with relevant National Environmental Protection Measures (NEPM) developed by the National Environmental Protection Council (NEPC). The relevant NEPM for the SGCP is the National Pollutant Inventory (NPI), under which emissions and wastes are reported. All NPI information is accessible to the community, industry and government through the NPI website.

The NPI is a database designed to provide the community, industry and government with information on the types and amounts of certain substances being emitted to land, air and water. The NPI NEPM provides the framework for the establishment of the NPI and sets out the requirements for reporting, including how a facility triggers a reporting obligation and what substances are on the reporting list.

The SGCP will trigger a reporting obligation under the NPI and consequently, the Proponent will be required to estimate and report mine emissions to the NPI on an annual basis in accordance with the *National Pollutant Inventory Guide* (Department of Sustainability, Environment, Water, Population and Communities [SEWPaC], 2011) and associated manuals (e.g. *Emission Estimation Technique Manual for Mining* [SEWPaC, 2011]).

13.5. POTENTIAL IMPACTS AND MITIGATION MEASURES

The objective of waste management will be to minimise the impacts of waste on the environment by managing the following aspects of the operation effectively:

- mine wastes
- coal processing waste (coarse and fine rejects)
- Regulated Waste
- general construction and operational wastes.

The SGCP will aim to promote sustainable waste management practices in accordance with the *WRR Act*.

Section 19—Hazard and Risk addresses the hazards associated with waste storage, handling and disposal and proposes appropriate control measures.

13.5.1. Waste Inventory

The primary coal mining specific wastes generated by the SGCP will include:

- waste rock
- coarse and fine reject material.

Other sources of waste generation are shown in **Table 13-1** and **Table 13-4**. These include:

- used machinery parts and other scrap metal, such as wire cables
- expired diesel and lubricants
- waste oil and filters
- hydrocarbon drums
- sewage
- gaseous emissions
- general waste
- wooden pallets.

The management methods proposed in **Table 13-1** and **Table 13-4** are based on minimising the potential environmental impacts associated with waste generation at the SGCP.

Potential impacts associated with waste management include:

- degradation of water quality through contact with waste products in operational areas, including potentially saline or acid generating overburden material (refer to **Section 9—Water Resources**)
- gross waste accumulation
- loss of aesthetic value (refer to **Section 7—Land**)
- risk of vector-borne diseases from waste disposal sites (refer to **Section 19—Hazard and Risk**)
- degradation of air quality through gaseous emissions (e.g. carbon monoxide (CO), nitrogen oxide (NOx), sulphur dioxide (SO_2) emissions from fuel combustion and blasting), (refer to **Section 10.3.3.3**)
- land contamination through inappropriate storage and handling of wastes (refer to **Section 7—Land**).

As described in **Section 13.4.6**, monitoring and auditing will be undertaken to quantify the types, volumes and locations of waste produced on-site and transported off-site. The effectiveness of waste management at the SGCP can also be measured by monitoring relevant water quality indicators.

The proposed surface water and groundwater quality monitoring programs are described in detail in **Section 9—Water Resources**. In the event that monitoring indicates measurable environmental impacts associated with waste generation, appropriate corrective actions will be implemented, as described in **Section 13.5.2** to **Section 13.5.4**, **Section 7—Land**, **Section 9—Water Resources**, **Section 10—Air Quality** and **Section 19—Hazard and Risk**.

13.5.2. Construction Wastes

During the construction phase of the SGCP, wastes will be associated with vegetation clearing, construction of infrastructure (including but not limited to roads, water management infrastructure and accommodation village) and electricity generation. Domestic wastes and waste water will also be produced by the on-site accommodation village during the construction phase. Schematic diagrams of processes to be used at each distinct stage of the project are provided in **Figure 4-2** to **Figure 4-12**.

An on-site landfill facility (refer to **Section 13.6**) will be established at the start of the construction phase following the approval of Mining Lease Application (MLA) 70453.

Indicative estimates of waste streams and volumes produced during the two year construction phase at the SGCP are shown in **Table 13-1**.

Where appropriate, the justification for waste volumes is described in **Table 13-1**. Where justification is not specifically provided, waste volumes have been generated by extrapolation from publicly available waste generation rates for similar existing or proposed coal mines (on the basis of workforce numbers or production rates).

A detailed inventory of waste streams and volumes will be developed as part of the Definitive Feasibility Study (DFS) and detailed engineering design processes.

Table 13-1 Waste Management – SGCP Construction Phase

Type	Source(s)	Management	Approximate Quantity of Waste	Environmental Impact Statement (EIS) Section Where Potential Impacts are Addressed
Concrete and masonry	Mine infrastructure area, accommodation village, CHPP, conveyors, power transmission lines, water management infrastructure.	Minimise waste by producing/procuring what is necessary. Reuse where practicable (e.g. by crushing and using as road base). Disposal at the on-site landfill facility.	1,705 tonnes (t)	**Section 9—Water Resources**, **Section 10—Air Quality**
Wooden pallets and other processed timber	Construction activities (e.g. CHPP, warehouse).	Those that are recyclable will be reused or returned to the supplier/owner. Any unserviceable pallets will be sent to general waste.	1,705 t	**Section 9—Water Resources**, **Section 10—Air Quality**
Steel and scrap metal	Accommodation village, CHPP, mine infrastructure area, power transmission lines.	Only procure the amount necessary. Segregation and collection with transportation off-site by a licensed regulated transporter for recycling at a licensed waste recycling facility. Non-recyclable scrap metal will be disposed of to landfill as a last resort.	500 t	**Section 9—Water Resources**, **Section 10—Air Quality**
Sealants, paints and resins	Mine infrastructure area, CHPP.	Procure only the amount necessary. Collection on-site and stored in a bunded area. Transportation to occur off-site by a licensed regulated waste transporter.	Minor amounts	**Section 9—Water Resources**, **Section 10—Air Quality**
Electrical wastes	Waste from construction activities or temporary structures.	Segregation and collection on-site. Transportation by a waste contractor for off-site recycling or reprocessing where possible.	570 t	**Section 9—Water Resources**, **Section 10—Air Quality**

Table 13-1 Waste Management – SGCP Construction Phase (cont)

Type	Source(s)	Management	Approximate Quantity of Waste	Environmental Impact Statement (EIS) Section Where Potential Impacts are Addressed
Green waste	Cleared vegetation for construction phase.	Reuse on-site as habitat features, erosion control or rehabilitation material as much as practicable.	105,300 t (based on 585 hectares [ha] of vegetation clearance, with 180 t biomass/ha) (Westman and Rogers, 1977).	**Section 8—Nature Conservation** **Section 9—Water Resources**, **Section 10—Air Quality**
General wastes including putrescible & organic (food waste), some plastics and paper	Construction offices, accommodation village, workshops.	General waste will be disposed of at the on-site landfill facility.	28,800 t	**Section 9—Water Resources**, **Section 10—Air Quality**
Paper and cardboard, plastics, glass, aluminium cans	Construction offices, accommodation village.	Collection and segregation on-site. Transportation by a waste contractor for off-site recycling.	2,000 t	**Section 9—Water Resources**, **Section 10—Air Quality**
Grease trap wastes	Accommodation village.	Placed in a bunded storage container and collected by a licensed waste contractor for reuse, reprocessing, recycling or disposal.	6 t	**Section 9—Water Resources**, **Section 10—Air Quality**
Waste oil and containers	Servicing of vehicles and equipment, construction and assembly of mining equipment, workshops.	Collected and stored on-site in a bunded area. Transported off-site by a licensed regulated waste transporter, to a licensed regulated waste receiver, for recycling.	5,100 t	**Section 9—Water Resources**, **Section 10—Air Quality**

Table 13-1 Waste Management – SGCP Construction Phase (cont)

Type	Source(s)	Management	Approximate Quantity of Waste	Environmental Impact Statement (EIS) Section Where Potential Impacts are Addressed
Batteries	Light vehicles, machinery, radios, mobile phones.	Collection and segregation on-site. Transported by a licensed waste contractor for off-site recycling or reprocessing.	34 t	**Section 9—Water Resources**, **Section 10—Air Quality**
Tyres	Light and heavy vehicles.	Where an economic off-site tyre recycling option is identified, the Proponent will consider tyre recycling. Until then tyres will be stored and appropriately disposed of in overburden material once mining operations commence. No water interaction following in-pit placement of tyres will occur.	1,070 t (based on the assumption that heavy vehicle tyres are changed every 12 months and weigh 3 t, while light/medium vehicle tyres are changed every 24 months and weigh 50 kilograms [kg]).	**Section 9—Water Resources**, **Section 10—Air Quality**
Sewage effluent	Construction offices, accommodation village, mine infrastructure area.	Sewage pump stations will be located at the accommodation village, mine infrastructure area and CHPP. The sewage wastewater will feed directly into the Sewage Treatment Plant (STP) where it will be treated to meet a Class B quality standard (Australian National Water Quality Guidelines). During construction an additional modular system will be required to deal with the waste flow associated with the workforce of 1,600 personnel.	280 megalitres (ML)	**Section 9—Water Resources**, **Section 10—Air Quality**
Sewage sludge	Sewage Treatment Plant	Collected and transported off-site by a licensed waste contractor for disposal at a licenced waste disposal facility.	80 t	**Section 9—Water Resources**, **Section 10—Air Quality**
Gaseous emissions of CO, NO_x, SO_2 and CH_4	Combustion of diesel and burning of cleared vegetation.	Direct and indirect measures (refer to **Section 10—Air Quality** and **Section 11—Greenhouse Gas Emissions**).	Refer to **Section 10—Air Quality** and **Section 11—Greenhouse Gas Emissions** for the breakdown of air quality emissions at the site.	**Section 9—Water Resources**, **Section 10—Air Quality**, **Section 11—Greenhouse Gas Emissions**

13.5.3. Operational Wastes

13.5.3.1. Mine Waste Quantities

Mining wastes include the overburden and interburden material above and between the coal seams (waste rock) and the reject material produced through the processing of coal at the CHPP.

As described in **Section 4—Project Description**, the SGCP is anticipated to produce up to 19 million tonnes per annum (Mtpa) of run-of-mine (ROM) coal from open cut and underground mining activities. **Table 13-2** provides the volume of mine waste generated from mining and coal processing over the life of the SGCP. A detailed breakdown of waste rock and reject production over the life of the SGCP is provided in **Section 4—Project Description**.

Table 13-2 Waste Management – SGCP Operational Phase

Waste Material	Estimated Total Volume of Waste	Waste: Product Coal (v:v)
Waste rock	919.04 million bank cubic metres	2.14: 1
CHPP waste (coarse and fine rejects)	48.06 Mt	1: 8.95

13.5.3.2. Mine Waste Geochemistry

A detailed description of the geochemical characteristics of coal mine wastes is provided in **Section 7—Land** and **Appendix I—Geochemistry Technical Report**. Waste rock characterisation, including geochemical analysis, indicates that:

- the bulk of the overburden and interburden material is likely to be non-acid forming(NAF) waste
- the roof within 5 metres (m) of the D1 seam appears to be the main potentially acid forming (PAF) horizon, with a number of other lower capacity PAF horizons associated with coal seams and also within interburden between seams D1 and D2
- PAF materials are likely to be fast reacting, with little or no lag time (days to weeks) once exposed to atmospheric conditions.

Geochemical characterisation of the coal rejects indicates that this material is likely to be mainly PAF.

Geochemical sampling and assessment will continue to be undertaken over the life of the SGCP to validate mine waste characteristics and the proposed management measures.

13.5.3.3. Mine Waste Management

Appropriate storage of the waste rock and coal rejects has been a major component of the planning process for the SGCP to mitigate sources of environmental contamination.

13.5.3.3.1. Waste Rock

Prior to the commencement of mining operations, topsoil will be removed and stockpiled for later use in progressive mine rehabilitation.

A portion of the boxcut waste material will be used for the construction of flood prevention berms and the remainder will be stored in waste rock emplacements. Overburden removed by draglines will be placed in previous strips.

All PAF material will be selectively handled where practicable to ensure that the potential for acid rock drainage is limited. The major potential source of PAF material will be the waste material that is found within 5 m of the coal seams. This can be split into the waste above the top seam (D1) or interburden (between the D1 and D2 seams). The waste above the D1 seam will be removed using draglines and will be mixed with NAF. This mixed waste would then be placed in the portion of the waste rock emplacement known as dragline waste rock.

The interburden waste will be dumped in-pit where practicable. The remaining interburden that cannot be dumped in-pit shall be trucked to the waste rock emplacements and tipped into voids between the dragline waste rock piles. Reject material from washing the coal will also be dumped within the dragline waste rock piles. Once all PAF material has been placed, a 10 m cover of NAF material will be applied over the entire waste rock emplacement area to ensure that the PAF waste is not exposed. The proposed handling and management of PAF materials is expected to be sufficient to manage significant environmental impacts as a result of potential acid mine drainage and salinity at the SGCP.

Topsoil will be placed onto re-profiled slopes. A description of the progressive rehabilitation and final landforms is provided in **Section 5—Rehabilitation and Decommissioning**.

The final landform will be physically stable and suitable for the agreed post mining land use so as not to affect the receiving environment. The landform will be shaped to shed runoff in order to minimise any potential leaching or erosion.

A geotechnical assessment has been undertaken to identify any significant constraints to operations. Based on the assessment undertaken to date, the following key geotechnical conditions will apply to the SGCP open cut mining:

- **Pit wall stability**—application of the pit wall design parameters detailed in **Table 4-4** and **Figure 4-16** (refer to **Section 4—Project Description**) are expected to ensure adequate levels of stability for the low and high walls formed during progressive mining. Provision of pre-split drill and blast for the highwalls is considered mandatory in this regard but will not avoid the effects of adversely oriented faults that are likely to be encountered at various stages. Wall stability will be further enhanced by good operational scaling practice.

- **Material excavatability**—overburden removal should be readily accomplished through all Tertiary materials and to approximately 80 % of the depth of weathered Permian by large excavation equipment in face shovel or backhoe configuration. The remaining approximately 20 % of weathered Permian and all fresh Permian will require drill and blast to uncover coal economically.
- **Trafficability**—trafficability on the D2 seam floor will be affected to some degree by the predominance of siltstone and carbonaceous mudstone over sandstone in this stratigraphic position. However, most floor rock is medium strength and only one of the 16 geotechnical drillholes contained carbonaceous mudstone which would be classified as low strength rock.
- **In-pit waste rock emplacement**—instability is unlikely to be an issue at SGCP through a combination of low floor dip and the apparent absence of bedding parallel shears in the floor rock types.

Design parameters based on the geotechnical assessment are provided in **Table 13-3**.

Table 13-3 Open Cut Low Wall, Highwall and Waste Rock Emplacement Design Parameters

Geotechnical Unit	Design Parameter
Tertiary	15 m (vertical) face height at 40 degrees (°) (from horizontal) with 5 m wide intermediate benches at 15 m vertical spacing.
Weathered Permian	Maximum 15 m (vertical) face height at 50° (from horizontal) with 5 m wide intermediate benches at 15 m vertical spacing and an 8 m wide bench at top of fresh rock.
Fresh Permian overburden, interburden and coal seams	A 15 m wide bench at top of fresh rock then a 70° pre-split face to the floor of D2 seam with a maximum vertical face height of 65 m above the floor of D2 seam. A 15 m wide intermediate bench is to be incorporated into the highwall face when 65 m vertical height is exceeded.
Non-coal material types from all of above units as feed for waste rock emplacements	Set-back from crest of box cut low wall to toe of waste rock emplacement should be the same as the vertical height from the low wall crest to the D1 or D2 seam floor – whichever is the lower unit being mined. Allow 25° angle of repose for Tertiary and 35° for all Permian materials with 20 m maximum vertical height between 10 m wide benches in dump.

Source: AMCI and Bandanna Energy (2011)

13.5.3.3.2. Coal Rejects

Coarse reject material from the CHPP and the open cut sizing stations will be transferred on the rejects conveyor to a 300 t reject surge bin located adjacent to ROM Station 2.

The rejects system will treat all <0.125 millimetres (mm) material that enters the CHPP from the ROM stockpiles. The rejects system will consist of a "high-rate" thickener coupled with a conventional clarified water return system, followed by belt press filters. Standard flocculant mixing and batching systems will be installed and dosing will be controlled by automated clarometer systems. The cake from the belt filter press will be deposited on the CHPP rejects conveyor as part of the combined CHPP reject.

The mining truck fleet will transport rejects to the waste rock emplacement, where they will be covered with a 10 m NAF cover. Coal reject material will not be placed at the base of any waste rock emplacements.

Measures to ensure the stability of the waste rock emplacements are detailed in **Section 5—Rehabilitation and Decommissioning** and **Section 7—Land**.

Detailed surface water management and mitigation measures are provided in **Section 9—Water Resources** and **Appendix F—Surface Water Technical Report**.

13.5.3.4. Other Wastes

The type, source, projected quantities and management of other operational wastes (apart from waste rock and coal washing wastes) to be produced during the operational phase of the SGCP are presented in **Table 13-4**.

Where appropriate, the justification for waste volumes is described in **Table 13-4**. Where justification is not specifically provided, waste volumes have been generated by extrapolation from publicly available waste generation rates for similar existing or proposed coal mines (on the basis of workforce numbers or production rates).

A detailed inventory of waste streams and volumes will be developed as part of the DFS and detailed engineering design processes.

During both construction and operation, colour-coded, signed bins will be used to segregate and collect food wastes, paper and any other recyclables. The bins will be located throughout offices and site infrastructure areas 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, birds and vermin.

General wastes will be collected regularly and transported for disposal to the on-site landfill facility.

Table 13-4 Waste Management—SGCP Operation Phase

Type	Source(s)	Management	Annual Quantity	EIS Section Where Potential Impacts are Addressed
Concrete and masonry	Minor maintenance works	Stockpiled for reuse on-site (e.g. as road base) or disposed of to landfill.	Minimal	**Section 9—Water Resources**, **Section 10—Air Quality**
Wooden pallets and other processed timber	Mine Infrastructure Area (MIA), CHPP, minor maintenance works.	Wooden pallets or wood that is recyclable will be reused on-site or returned to the supplier/owner. Any unserviceable pallets will be sent to general waste.	600 kg	**Section 9—Water Resources**, **Section 10—Air Quality**
Green waste	Cleared vegetation for construction phase and early works.	Reused on-site as habitat, erosion control or rehabilitation material as much as practicable.	The waste associated with all required clearing is provided in **Table 13-1**.	**Section 8—Nature Conservation**, **Section 9—Water Resources**, **Section 10—Air Quality**
General wastes including putrescible & organic (food waste), some plastics and paper	Offices, kitchenettes, crib rooms, administration area, workshop, accommodation areas.	General waste will be disposed of at the on-site landfill facility.	3,000 t	**Section 9—Water Resources**, **Section 10—Air Quality**
Paper and cardboard, glass, plastics and aluminium cans	Workshop, offices, accommodation areas.	Collection and segregation on-site. Transportation off-site by a licensed regulated waste contractor for off-site recycling.	180 t	**Section 9—Water Resources**, **Section 10—Air Quality**
Scrap metal	CHPP, MIA, accommodation village.	Minimise waste by producing/procuring only the amount necessary. Segregation and collection on- site. Transportation off-site for recycling.	1,200 t	**Section 9—Water Resources**, **Section 10—Air Quality**

Table 13-4 Waste Management—SGCP Operation Phase (cont)

Type	Source(s)	Management	Annual Quantity	EIS Section Where Potential Impacts are Addressed
Waste oil	Vehicle and plant maintenance operations, CHPP, workshop.	Oil will be collected, and then transported off-site by a licensed regulated waste transporter to a licensed regulated waste receiver, for recycling.	1,200 t	**Section 9—Water Resources**, **Section 10—Air Quality**
Oily sludge, absorbent, grease and oily rags (hydrocarbon contaminated material)	CHPP, workshop.	These will be collected on-site before being transported off-site by a licensed regulated waste contractor, for recycling or treatment and disposal.	1,700 t	**Section 9—Water Resources**, **Section 10—Air Quality**
Waste oil/hydrocarbon drums	Vehicle and plant maintenance operations, CHPP, workshop.	Drums will be transported off-site by waste contractor for off-site reuse, recycling or disposal. Oil will be collected, and then transported off-site by a licensed regulated waste transporter to a licensed regulated waste receiver for recycling.	185 t	**Section 9—Water Resources**, **Section 10—Air Quality**
Batteries	MIA.	Collection and segregation on-site. Transported by a licensed waste contractor for off-site recycling or reprocessing.	23 t	**Section 9—Water Resources**, **Section 10—Air Quality**
Conveyor belts	Conveyors, workshops.	Where an economic off-site conveyor belt recycling option is identified, the Proponent will consider conveyor belt recycling. Until then conveyor belts will be stored and appropriately disposed of in overburden material once mining operations commence.	100 t	**Section 9—Water Resources**, **Section 10—Air Quality**

Table 13-4 Waste Management—SGCP Operation Phase (cont)

Type	Source(s)	Management	Annual Quantity	EIS Section Where Potential Impacts are Addressed
Blasting waste (detonating cord)	Blasting.	No specialist management is proposed as most detonating cord becomes buried during blasting and is disposed of in waste rock emplacements during the overburden removal process.	Minimal	**Section 9—Water Resources**, **Section 10—Air Quality**
Electrical wastes	Minor maintenance.	Stockpiled for removal by a licensed waste contractor for reuse, recycling or disposal.	500 kg	**Section 9—Water Resources**, **Section 10—Air Quality**
Waste water	CHPP, washdown areas, contaminated drainage.	Where practicable, runoff water (i.e. 'clean water') will be diverted away from mining operations and redirected back into existing drainage and creek systems. Runoff that cannot be diverted away from mining operations (i.e. 'mine affected water') will be collected in sediment ponds or sumps and where practicable, reused for operational purposes (e.g. at the CHPP, for dust suppression on haul roads or for vehicle washdown). The consumption of raw water will be kept to a minimum by implementing water efficient work practices and recycling where practicable. Further details of surface water management are included in **Section 9—Water Resources.**	Refer to **Section 9—Water Resources** and **Appendix F—Surface Water Technical Report**.	**Section 9—Water Resources**

Table 13-4 Waste Management—SGCP Operation Phase (cont)

Type	Source(s)	Management	Annual Quantity	EIS Section Where Potential Impacts are Addressed
Sewage sludge	Sewage Treatment Plant.	Collected and transported off-site by a licensed waste contractor for disposal at a licenced waste disposal facility.	34 t	**Section 9—Water Resources**, **Section 10—Air Quality**
Sewage effluent	Construction offices, accommodation village, mine infrastructure area.	Sewage pump stations will be located at the accommodation village, mine infrastructure area and CHPP. The sewage wastewater will feed directly into the STP where it will be treated to meet a Class B quality standard (Australian National Water Quality Guidelines).	112 ML	**Section 9—Water Resources**, **Section 10—Air Quality**
Grease trap wastes	Accommodation village, workshops.	Waste grease to be placed in a bunded storage container to be collected by a licensed contractor for reuse, reprocessing, recycling or disposal.	2.5 t	**Section 9—Water Resources**, **Section 10—Air Quality**
Tyres	Workshops.	Where an economic off-site tyre recycling option is identified, the Proponent will consider tyre recycling. Otherwise burial of scrap tyres will be in the water rock emplacement. Positioning of the tyres within the in-pit waste rock emplacement will ensure stability is not compromised. No water interaction following in-pit placement of tyres will occur. Tyres will be stored further than 10 m from any combustible or flammable material. The size of scrap tyre stacks will be managed by storing for the least amount of time possible prior to disposal.	1,895 t	**Section 9—Water Resources**, **Section 10—Air Quality**
Gaseous emissions of CO, NO_x, SO_2 and CH_4.	Combustion of diesel, blasting, burning of cleared vegetation, and methane emissions (fugitive) from coal.	Direct and indirect measures (refer to **Section 10—Air Quality** and **Section 11—Greenhouse Gas Emissions**).	Refer to **Section 10—Air Quality** and **Section 11—Greenhouse Gas Emissions** for the breakdown of air quality emissions at the site.	**Section 9—Water Resources**, **Section 10—Air Quality, Section 11—Greenhouse Gas Emissions**

13.5.3.4.1. Waste Water

The results of site water balance modelling and a water management schematic are provided in **Section 9—Water Resources**. All dams, levees and diversions will be designed to appropriate standards and sized in accordance to calculations from water balance models.

Water management designs will allow for the segregation of clean and mine affected water, by ensuring all water that comes into contact with coal stockpiles, hardstands, workshop areas, waste rock emplacements and haul roads is directed into adequately sized sediment retention ponds. This water is used for dust suppression on roads and product stockpiles when necessary. The SGCP will recycle water stored in these dams for use in the CHPP and for haul road watering purposes.

Rainwater falling on undisturbed areas is classified as clean water and diverted away from disturbed areas by grass and/or rock-lined drainage lines. Water management designs for the SGCP are detailed in **Section 9—Water Resources** and will enable the separation of clean and mine affected water.

The consumption of raw water will be kept to a minimum by implementing water efficient work practices and recycling where practicable.

13.5.3.4.2. Green Waste

Green waste (e.g. cleared vegetation) will be produced during the development of the SGCP. **Section 8—Nature Conservation** considers the nature and extent of the vegetation that will be cleared as a result of the SGCP.

Vegetation clearing for fire breaks will be conducted as required. Vegetation clearing will be performed around infrastructure, to ensure a buffer distance separates infrastructure from the potential of bushfire.

The SGCP will ensure a sustainable approach for any land clearing, involving pre clearing surveys to identify any commercially useful plant or timber, and the organisation of a local contractor to remove and make use of any vegetation that is not of benefit to the mine. Where practicable, any vegetation that has no direct commercial value will be cleared and stockpiled until spreading on the final landform as a natural habitat in line with the proposed final land use. Where material cannot be used or stockpiled or poses an increased fire risk, it will be burned in a controlled manner under appropriate permits.

13.5.3.4.3. Transportation Wastes

Transportation waste, such as plastic crates, may be generated through inefficient material transport logistics. Contractors employed to manage SGCP wastes will be expected to demonstrate best practice and environmental efficiency by minimising waste and appropriate selection of transport routes to and from the mine site. Inefficient transportation practices also have implications for fuel wastage and increased emissions.

Buses will be used to transport the majority of the workforce to and from the operational mine, including during the construction phase, reducing fuel consumption and subsequent emissions.

13.5.3.4.4. Domestic Wastes

Personnel on-site will generate food scraps, paper and recyclables on a daily basis from the lunchrooms, administration offices and accommodation village. To manage this waste during operation, point source segregation will be implemented to achieve maximum economic waste recovery. Separate colour-coded, labeled bins will be provided for domestic waste products along with adequate signage and regular education.

The location of all bins throughout offices, administration and maintenance areas will be subject to site health and safety assessments. These bins will be emptied into skips regularly by the waste management contractor. Segregated domestic waste will be collected and disposed of at the on-site landfill facility on a regular basis to prevent nuisance caused by odour or vermin on site. Recyclables will be transported to an appropriate recycling facility.

The economics of alternative disposal methods for organic materials (e.g. food scraps) produced at the accommodation village will be considered in order to reduce the volume disposed of to landfill. Appropriate waste management procedures will be undertaken to prevent nuisance caused by odour or vermin on site.

13.5.3.4.5. Used Tyres

Heavy and light vehicle tyres will be replaced on a regular basis throughout the mine life, creating used tyre waste. Tyres will be segregated, stored and stacked in a single designated tyre storage area before disposal in accordance with the DEHP's *Disposal and Storage of Scrap Tyres at Mine Sites* (DERM, 2010). Any on-site disposal of used tyres will be documented in accordance with the site EM Plan and EA conditions.

13.5.3.4.6. Blasting

Blasting will generally be undertaken using ammonium nitrate fuel oil and initiated with boosters and detonators. The main waste product from blasting will be fragments of expired detonating cord. The minimal volumes of this waste product will not require specialist management as most cord becomes interspersed with the waste rock material and buried during the overburden removal process.

13.5.3.4.7. Hydrocarbon Wastes

Solvents, oils and lubricants produced by the vehicle maintenance workshops, vehicle washdown and minor leaks from refueling activities will result in the generation of waste oils and hydrocarbon residues. The management practices adopted for these wastes include:

- segregation into several categories including grease, lubricants, oily absorbents, oily rags and contaminated soil
- storage in colour-coded and labelled bins placed within designated areas of workshops and around fuelling depots

- removal off-site by an appropriately licensed waste management service provider for either disposal at an appropriately licensed facility, or processing for solvent recovery.

Each chemical brought onto site will be supplied with a Material Safety Data Sheet (MSDS) that provides details of the chemical and safety requirements with respect to use and disposal of the chemical. The information provided on the MSDS sheets will be reviewed prior to handling and disposal of any chemicals.

There is a potential for spillage of fuel in other areas of the SGCP from the refueling of vehicles in the field and from burst hydraulic hoses. Where this occurs, spill containment material (e.g. absorbent materials) and spill cleanup kits located at workshops and/or in vehicles themselves will be used to control spills and assist in cleaning spillages.

Any spillages that may occur will primarily be within the waste storage areas or within contained refueling areas. Sumps within the containment areas will be kept clean and pumped regularly with both liquid and solid fractions stored in separate containers and removed off-site by a licensed hazardous waste management contractor.

The focus of hydrocarbon waste management will be the reduction of wastes generated, maximum recovery of wastes (prevention of contamination of land and water) and spill clean-up. All hydrocarbon and chemical storage areas will be designed, constructed and stored in accordance with AS 1940.

Appropriate actions will be taken to ensure potential impacts of regulated wastes on land are minimised. Regulated wastes will be stored in a designated location to ensure that there is minimal risk of accidental release of regulated wastes to land. Regulated waste will be removed from site by a licensed regulated waste management contractor and wastes will be taken to a licensed landfill that can accept regulated wastes.

The storage of fuel on-site will include:

- approximately 16,000 litre (L) medium/light vehicle refuelling facility
- two 100,000 L portable refuelling stations
- 1 ML tank located in the MIA
- two 1 ML heavy vehicle refuelling tanks
- two 1 ML tanks located at the rail unloading point.

Fuel will be stored in tank modules that are designed and manufactured in accordance with AS 1940.

Regular inspections will be conducted and spill response and management procedures will be in place. Sites that become contaminated will be investigated, managed and remediated in accordance with the requirements of the contaminated land provisions of the *EP Act*.

13.5.3.4.8. Sewage

Sewage produced by the SGCP will be managed on site. The sewage treatment plant (STP) will be operated in accordance with manufacturer's recommendations and will be subjected to regular inspections to ensure efficient operation of the system. If service or maintenance of the system is required a licensed plumber or qualified operator will be contracted to undertake the works.

Effluent will be treated to a Class B quality standard and then pumped into the Raw Water Dam nearby for storage and to be reused on-site for haul road watering and usage at the CHPP.

The operation of the STP is expected to generate small volumes of waste bio-solids or sludge. A licensed waste contractor will be employed to remove the waste material and transport it to a licensed landfill.

13.5.3.4.9. Gaseous Emissions

The combustion of diesel in mining machinery, blasting, fugitive emissions from coal and burning of cleared vegetation will result in gaseous emissions of CO, NOx, SO_2 and CH_4. In practice, the sources of these gaseous emissions are widely dispersed and have relatively low emission levels and a highly localised impact. Thus the likelihood of exceeding acceptable environmental air quality levels beyond the SGCP boundary is low.

Air quality mitigation measures, including greenhouse gas abatement measures are detailed in **Section 10.6** of **Section 10—Air Quality** and **Section 11—Greenhouse Gas Emissions**. These measures reflect the waste management hierarchy principles listed in the *WRR Act*, by focusing predominantly on waste avoidance and reduction.

13.5.4. Decommissioning Wastes

As described in **Section 5—Rehabilitation and Decommissioning**, decommissioning will involve the removal of mine infrastructure and services and the rehabilitation of all disturbed areas. Decommissioning will occur on a staged basis over several years following the cessation of mining operations but prior to formal mine closure.

Amounts of decommissioning wastes may change depending on the amount of salvageable materials and legislation applicable at the time. Some infrastructure areas may remain after decommissioning with agreement from the landholders. A detailed inventory of waste streams and volumes for the decommissioning phase will be developed during the DFS and detailed engineering design processes. For the purposes of this EIS, the waste streams, volumes and management measures for decommissioning have been assumed to be the same as for the construction phase (refer to **Table 13-1**).

A detailed WM Plan will be prepared prior to the decommissioning phase once waste quantities, sources and management measures are confirmed.

A contaminated site assessment will be conducted as part of the Final Rehabilitation Report.

13.6. ON-SITE LANDFILL FACILITY

A landfill facility is proposed to be constructed on-site due to the remote location of the SGCP and the anticipated waste volumes (refer to **Table 13-1** and **Table 13-4**). The conceptual location of the landfill facility is shown on **Figure 4-2** (refer to **Section 4—Project Description**).

The SGCP landfill facility will be constructed and managed in accordance to the *Guidelines for Landfill Siting, Design, Operation and Rehabilitation, Queensland* (DERM, 2010). All relevant approvals will be sought prior to the construction of the landfill facility.

The proposed landfill will be a long-term engineered facility which will receive general waste from construction and operational activities. The landfill facility will be located approximately 1 kilometre (km) east of the product stockpile area.

The following hierarchy of aspects has been considered in the preliminary screening of potential landfill sites:

- community needs and expectations
- landfill type and ancillary activities
- adjacent and future land users (appropriate buffer distances will be maintained between the landfill and incompatible land uses e.g. surface waters, noise, dust or odour sensitive places, unstable areas, aerodromes)
- groundwater resources
- surface water system
- biodiversity
- external infrastructure
- geological setting.

The landfill site will feature a liner and leachate collection system. The liner system will consist of a prepared sub-base of 300 mm, a low permeability clay layer of at least 600 mm thickness and a drainage layer of 300 mm. The sub-base and clay liner construction will be accompanied by level one geotechnical testing as set out in Appendix B of *AS 3798 – Guidelines on earthworks for commercial and residential developments*. The landfill facility will be fenced to prevent unauthorised entry. A gatehouse and weighbridge will be installed to ensure site security and to facilitate waste record keeping.

The design of the on-site landfill facility will be finalised during the DFS and detailed engineering processes.

The landfill site will be monitored over the life of the SGCP and will be rehabilitated as described in **Section 5—Rehabilitation and Decommissioning**.

13.7. CUMULATIVE IMPACTS

Other proposed mining projects in the Galilee Basin are expected to produce similar waste streams and volumes as the SGCP. The development of coal mining in the region is anticipated to increase the demand for waste collection, transport, treatment, reuse, recycling and/or disposal. This demand will likely have the effect of stimulating growth in waste service provision (Hancock Galilee Pty Ltd, 2011).

Cumulative impacts on the environmental values of land, terrestrial and aquatic ecosystems, water and air quality are assessed in **Section 7—Land**, **Section 8—Nature Conservation**, **Section 9—Water Resources** and **Section 10—Air Quality**, respectively.

Health and safety impacts associated with waste are described in **Section 19—Hazard and Risk**. The cumulative impacts of the SGCP on health and safety of the community are expected to be well within acceptable limits as a result of the management and mitigation measures proposed. Overall, the impacts can be classified as minor on a local level and negligible to non-detectable on a regional, state or national level.