## 4.4 WASTE

### 4.4.1 Description of Environmental Values

The environmental values to be enhanced or protected in regards to waste management on the Project willinclude:

*(a) The life, health and wellbeing of people;*

*(b) The diversity of ecological processes and associated ecosystems; and*

*(c) Land use capability, having regard to economic considerations.*

Waste will be generated during all phases of the Project, including, construction, operations and decommissioning. The following waste streams have been identified for the Project:

- Solid Waste – tailings/coarse rejects, excavated waste, general domestic waste and recyclables, batteries, scrap steel and tyres;
- Liquid Waste – sewerage, grey water,waste water, waste oil, solvents and grease; and
- Atmospheric Waste – particulate matter ($PM_{10}$ and $PM_{2.5}$), total suspended particulate matter and greenhouse gases.

The main waste types to be produced by the Project are shown in Table 4.43 along with their potential to impact on environmental values as described in other sections of this EIS.

**Table 4.43 Project Waste Streams**

| Waste Type | Potential Environmental Values Impacted | Reference to relevant Section of EIS |
|---|---|---|
| Excavated Waste | Surface Waterways | Section 3.6.3 and Section 4.5 |
| | Groundwater | Section 3.6.3 and Section 4.5 |
| | Land Contamination | Section 3.6.3, Section 4.2.1.7 and Section 4.2.2.4 |
| | Visual Amenity | Section 3.6.3,Section 4.2.1.11 and Section 4.2.2.7 |
| Coarse Rejects / Tailings | Surface Water | Section 3.6.4 and Section 4.5 |
| | Groundwater | Section 3.6.4 and Section 4.5 |
| | Soil/Land | Section 3.6.4 and Section 4.2 |
| | Land Contamination | Section 3.6.4, Section 4.2.1.7 and Section 4.2.2.4 |
| Sewerage | Surface Water | Section 3.5.5, Section 3.6.6 and Section 4.5 |
| | Groundwater | Section 3.5.5, Section 3.6.6 and Section 4.5 |

| Waste Type | Potential Environmental Values Impacted | Reference to relevant Section of EIS |
|---|---|---|
| Dirty/Contaminated Water | Surface Water | Section 3.6.6 and Section 4.5 |
| Air Emissions | Air Quality | Section 3.6.2 and Section 4.6 |
| Solid Waste | Surface Water, Groundwater | Section 3.6.5 and Section 4.5 |
| | Soil/Land | Section 3.6.5 and Section 4.2 |
| | Air Quality | Section 3.6.5 and Section 4.6 |

## 4.4.2 Potential Impacts and Mitigation Measures

This section describes the potential impacts on environmental values, and specific waste management and mitigation strategies for the various types of waste created on the Project site.

### 4.4.2.1 Potential Impacts

Waste generation at the Elimatta Project has the potential to impact upon environmental values if not managed effectively and efficiently. The following impacts have been identified for the Project with regards to waste management:

- Land, surface water and groundwater contamination from:
    - Landfill leachate run-off/seepage;
    - Seepage from inter / overburden and spoil dumps;
    - Contaminated run-off/seepage from the tailings/rejects dam; and
    - Sewerage effluent.
- Accumulation of waste oil and grease, tyres and batteries causing land contamination;
- General litter around the Project site may be a hazard in terms of injury and entrapment to fauna, fire starting potential and mosquito breeding habitat;
- Increase in animal scavenging in the landfill area from fauna such as feral pigs, black rats, feral cats, native rodents and scavenging bird species;
- Potential harm or death to animals, particularly birds, landing in or looking for water at the tailings/rejects dam;
- Contribution to greenhouse gas emissions through burning fuels and consuming electricity;
- Dust from the Project operations including coal dust, TSP, $PM_{10}$, $PM_{2.5}$ and metals contained in fugitive dust, as well as gaseous odour emissions;
- Impacts to visual amenity due to the planned spoil dumps of excavated waste; and

- Impacts to visual amenity associated with windblown domestic waste on and around the Project site.

#### 4.4.2.2 Mitigation Strategies

**Cleaner Production and Waste Minimisation**

Cleaner production programs are programs to identify and implement ways of improving a production process so that the process:

(a) Uses less energy, water or another input;

(b) Generates less waste; or

(c) Generates waste that is less environmentally harmful.

Various aspects of the Elimatta Project will be designed in order to encourage cleaner production and waste minimisation:

- The water usage system at Elimatta has been designed to ensure maximum recycling of water;
- Waste minimisation techniques will be actively sought out in order to remain contemporaneous with best-practice techniques throughout the life of the Project;
- Maintenance of all machinery will be carried out to ensure optimum efficiency; and
- Regular energy audits will be undertaken in accordance with the Greenhouse Gas Management Plan (Appendix AF) in order to identify further opportunities for cleaner production and new technology introduction.

Taroom Coal will remain informed of best practice waste minimisation and cleaner technology options for all waste streams throughout the life of the Project. Measures will be implemented to ensure cleaner technologies and processes are used.

**General Mitigation Strategies**

Detailed information concerning waste quantities, onsite handling, reuse or recyclability and the relevant waste destinations are described in Section 3.6 and Table 4.44.

Additional, general mitigation strategies for minimising the impacts associated with waste at the Project site will include the following:

- All regulated waste, including batteries, hydrocarbons and oily rags, will be bunded appropriately prior to removal from site by a licensed contractor;
- Prior to being discarded, tyres will be stockpiled so that all reasonable and practicable fire prevention measures have been taken, i.e. in a cleared area in piles less than 3m in height and less than 200 square metres ($m^2$) in area, and at least 10 m away from any other scrap tyre storage area;

- Scrap tyres that are buried within spoil dumps will be buried in a manner that maintains long-term dump stability;

- The putrescible and general waste landfill site, if required, will be covered on a regular basis (at least weekly) to reduce the food supply to feral animals e.g. cats and wild dogs, breeding of insects and minimise the generation of odour;

- The landfill site will be managed such that stormwater runoff is directed away from disposal cells and any direct rainfall is captured and evaporated, rather than being released to the environment;

- Waste Tracking provisions as described under the *Environmental Protection (Waste Management) Regulation 2000* (EPR (Waste Management)) will be adhered to for any Trackable Waste greater than 250 kilograms (kg) removed from the Project site;and

- Installation of a modular waste water treatment plant consisting of independent sewerage and grey-water treatment facilities.

**Excavated Waste and Tailings Management**

*Spoil Dumps*

Two out-of-pit dumps are planned for the Project. Overburden and interburden will be transported and disposed of in these dumps during the initial box cut and early years of mining. Thereafter waste will be used to backfill the active mining void.

Waste characterisation indicates overburden/interburden, floor, washery waste and coal materials are unlikely to be acid producing or release significant salinity or metals/metalloids, and will not require special handling for acid rock drainage (ARD) or neutral drainage control (EGI 2011). Initial sodicity testing indicates that some overburden/interburden materials are likely to be sodic and dispersive, and may be subject to surface crusting and high erosion rates if placed in the surface of dumps and exposed directly to rainfall (EGI 2011). Placement of spoil with known sodic/dispersion potential will preferentially avoid dump surface areas. Dump surface materials may be treated (with gypsum or lime) if erosion cannot otherwise be controlled.

Spoil dumps above the natural surface will be re-contoured to achieve a maximum slope of 1V : 6H. This outer slope geometry and surface treatment will ensure adequate geotechnical stability and safe assessability, while minimising the catchment and erosion potential of the slope. The final landform has been designed to be water shedding to minimise water infiltration. Rock lined drains will be installed, where required, to manage surface runoff and prevent erosion. The slopes and top of the spoil dumps will be topsoiled and deep ripped to bind the material before being revegetated with local plant species.

Implementation of a monitoring program recommended for the sampling and testing of washery wastes, overburden/interburden and floor materials will be carried out during operations to confirm the low salinity and low risk of neutral mine drainage and ARD indicated by testing to date. Leach column testing of these materials should be considered to better evaluate neutral mine drainage chemistry. Routine site water quality monitoring programmes will include pH, EC, acidity/alkalinity, SO4, Al, As, Co, Cu, Fe, Mn, Ni and Zn to monitor for indications of any acid and neutral mine drainage and identify the need for additional controls.

The distribution and extent of sodic/dispersive materials willbe investigated further.

More specific detailed information regarding geochemical characteristics of excavated waste, dump location, design, construction and rehabilitation is included in Section 3.6.3 and 3.7.11.4.

*Tailings Storage Facilities*

There are three TSFs proposed for the Project: Dam TDN, Dam TDNA and the Northern Void TSF.

Surface TSFs (TDN and TDNA)

The two surface TSF containment walls will be limited to a maximum height of 16 m. To ensure an adequate factor of safety (>1.5) against geotechnical instability in the long-term, it is anticipated that these relatively modest containment walls will likely require an outer slope angle of the order of 1(V) in 3(H), constructed as a single slope (without contour banks or down slope drains).

The surface treatment of the outer slopes will involve the placement of a rocky soil cover. The rock content will provide erosion protection, and the soil content will facilitate moisture retention to support and maintain native vegetation to form a corridor for native fauna, and to maintain visual amenity.

This outer slope geometry and surface treatment will ensure adequate geotechnical stability and safe assessability, while minimising the catchment and erosion potential of the slope. Excess rainfall runoff from the remediated tops of the surface TSFs will be directed to purpose-built drain structures and not be directed over the TSF outer slopes, to avoid the concentration of rainfall runoff and the heightened potential for erosion that would result.

Rehabilitation involves the placement of a cover to prevent contaminated seepage, improve revegetation success and achieve the agreed post-mining land use. The more geotechnically stable the washery wastes and the cover over them, the greater the potential for re-use. The geotechnical stability of the washery wastes and the placement of a cover are facilitated by dewatering, desiccation and strengthening of the full depth of the deposit.

The cover material will be durable, well-graded including coarse particles up to about 50 mm in size, and non-sodic so as to not inhibit rooting by subsequent vegetation. Once the cover material has ceased settling, the completed surface will be contoured to drain gently (at nominal slopes of about 1%) towards the location of the spillway, and then covered with a nominal 150 mm of topsoil and seeded.

In-Pit TSF (TDP)

Modelling suggests that TDP will become almost completely filled with tailings by the end of the mine life and could be covered with a soil cover for rehabilitation. However, if the tailings fill occurs to a level lower than the surrounding ground level, it is possible that TDP will subsequently become a residual void in which case it will be managed as such.

A separation layer over the exposed tailings surface will be required. This cover will form a capillary break over the underlying tailing surface. It is proposed that the cover will likely need to be placed by hydraulic means.

Water will first be drained from the tailings surface to facilitate cover placement, and to facilitate drainage of the cover itself following hydraulic placement to maximise the strength gain in the tailings. Cover placement will commence from the perimeter of the tailings, the cover will be built-up locally to about 2 m depth, and the discharge pipeline will be progressively extended out over the trafficable cover already placed, to complete the cover.

The cover material will be durable (that is, non-slaking), well-graded including coarse particles up to about 50 mm in size, and non-sodic so as to support vegetation if required, and not erode. Suitable fill for cover purposes will be sourced from the spoil excavated during mining. Selected spoil will be stockpiled during mining as close to the TSF as practicable for later use as cover material.

Gradual covering, by hydraulic means, of the tailings deposited in the Northern Void will promote drainage, consolidation and strengthening of the loaded tailings. This will allow the build-up of a 2 m thickness of fill to form a cover.

Characterisation of tailings to be generated from the processing plant, including additional design, construction and rehabilitation details of the TSF are provided in Section 3.6.4, 3.7.11.1 and 3.7.11.4.

Tailings mitigation and control strategies that will be implemented at the Project include:

- Clean rainfall runoff will be directed around the surface TSFs and pits to limit the ponding of rainfall runoff on stored tailings, the potential for overflow from the surface TSFs, and the potential for infiltration of ponded rainfall runoff and consequent seepage to the environment;
- Flood levees will be constructed along the Mining Lease boundaries to protect against flooding from the old creek during the first 5 years of operation, prior to it being diverted;
- The tailings discharge outlet will be moved around the perimeter of the surface TSFs to deposit tailings away from the containment wall. This will avoid the potential super-elevation of the tailings above the containment wall, minimising the potential for overtopping by tailings. It will also force the decant pond away from the containment wall, minimising the potential for overtopping by water;
- Tailings will be stabilised as quickly as possible by minimising the rate of rise of the tailings, efficiently coagulating (to settle out suspended fines) and recycling supernatant water back to the CHPP, and by facilitating consolidation and desiccation;
- To ensure that the stability of containment walls is maintained, regular inspections will be carried out, and instrumentation, including survey monuments, piezometers and boreholes for sampling groundwater for water quality testing, will be installed and monitored;
- The possibility of tailings pipeline breaks will be allowed for by containing the tailings pipeline between bunds, with temporary storage ponds for spilled tailings at intervals along the pipeline route; and
- A monitoring program will be implemented at the surface TSFs and Northern Void TSF in order to detect any seepage that may be occurring.

**Sewerage**

The mitigate the risk of contamination from release of treated effluent, the STP has been designed to achieve a Class A effluent quality and consists of a permanent module with capacity of 135 kl/day and a temporary module with capacity of 50 kl/day. The treatment plant is anticipated to produce approximately 240 L/capita/day during peak operation.

Treated waste water from the STP will be disposed of using low height sprays in a designated area. An effluent disposal system will be implemented to ensure that spray drift does not occur to any sensitive or commercial place. This will be achieved by the use of low pressure sprays with a greater

number of spray nozzles for the required disposal area. In addition, the design of the system will take into account the need to ensure no runoff from the disposal area takes place.

All effluent released will be monitored for pH and faecal coliforms and comply with the appropriate limits prescribed by the EA for the Project.

**Air Emissions**

The air borne wastes of significance emitted from the Elimatta Project will include:

- Particulate matter with equivalent aerodynamic diameters of 10 µm or less ($PM_{10}$);
- Particulate matter with equivalent aerodynamic diameters of 2.5 µm or less ($PM_{2.5}$);
- Total suspended particulate matter (TSP); and
- Greenhouse gases.

The mining and processing activities on the Project are not expected to produce any significant odour. The only activities to be conducted that could potentially cause odour would be the disposal of putrescibles wastes and the sewage treatment facilities. Given the distance of the nearest residence from these activities, it is highly unlikely that odour nuisance will occur.

Project related air emissions and proposed mitigation measures are further described in Section 4.6.

Taroom Coal is committed to effectively managing greenhouse gas emissions associated with the Elimatta Project. As the Elimatta Project is still in the design phase, Taroom Coal proposes to incorporate a number of features into the Project to reduce the greenhouse gas emissions from the outset of the Project. A Greenhouse Gas Management Plan, developed as part of the EIS and included as Appendix AF, will ensure that opportunities to reduce the Project's emissions further during operations will also be pursued.

**Waste Management Plan**

A Waste Management Plan (WMP) will be developed prior to commencement of the Project, detailing how each waste type will be reused, recycled, treated or disposed. This WMP will be created in accordance with Environmental Authority (EA) condition E3-1 and will be included in the Plan of Operations for the Project.

The objective of the Project's WMP is to ensure the integrity of ecological processes and environmental values and minimise impacts on land, water quality, air quality and visual amenity associated with the generation of waste at the Project site.

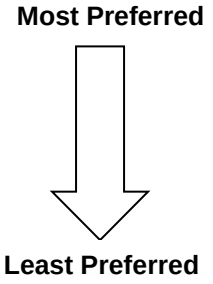
The WMP will include the following components:

- A waste inventory outlining the types of waste and quantities of each waste stream;
- A waste management strategy, outlined in Table 4.44, developed with regard to the EP *(Waste Management) Regulation 2000* (EPR (Waste Management)) and the waste hierarchy;

- Identification of cleaner production opportunities to optimise resource efficiency and minimise waste generation;
- The hazardous characteristics of the wastes generated including disposal procedures for hazardous wastes;
- A program for reusing, recycling or disposing of all wastes;
- Procedures for dealing with accidents, spills and other incidents;
- Details of any accredited management system employed, or planned to be employed, to deal with waste;
- How often the performance of the waste management program will be assessed; and,
- The indicators or other criteria on which the performance of the waste management program will be assessed.

*Waste Hierarchy*

The WMP will be focused on waste minimisation in accordance with the waste hierarchy. The waste hierarchy moves from the most preferred to least preferred management method:




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

*Waste Avoidance*

Waste avoidance is defined as the prevention of or reduction in waste generation. Waste generation will be avoided by:

- Purchasing products/inputs in bulk to minimise waste packaging;
- Using products that can be re-used or recycled where alternatives are available;
- Suppression of dust and particulate matter through watering;
- Regular maintenance of vehicles and equipment; and
- Continually seeking cleaner production strategies to minimise waste generation and optimise resource efficiency.

*Waste Re-use*

Re-using waste without treatment or substantial change in form. Waste re-use will be employed by:

- Re-using scrap materials where recoverable;
- Seeking offsite alternatives for re-using waste where it cannot be re-used onsite; and
- Ensuring appropriate facilities are available for storing materials.

*Waste Recycling*

Recycling of waste involves the treatment of waste to create a new product. Recycling opportunities for the Project include recycling treated effluent for use in the CHPP.

*Waste Treatment and Disposal*

Treating and disposing of waste in the most appropriate manner. Waste will be treated and disposed of by:

- All waste will be managed according to the waste hierarchy;
- Waste that cannot be managed through one of the above strategies will be treated and disposed of in the manner appropriate to the particular waste type;
- Only general waste will be disposed of in local council waste and recycling facilities; and
- If necessary, prior to disposal, waste will be stored or stockpiled in an appropriate and safe manner; for example, with regard to fire safety and feral animals.

*Waste Inventory*

The waste inventory and waste management strategy that will be detailed within the WMP has been summarised in Table 4.44, which describes approximate quantities of waste generated by the Project, on-site treatment, and methods of disposal.

**Table 4.44 Waste Management Strategy**

| Waste Type | Approx. Quantity Total | Waste Management Strategy | | | | |
|---|---|---|---|---|---|---|
| | | Avoidance | Reuse/ Recycle | Treatment/ Destruction | Disposal/ Storage Sites | Comments |
| Total suspended particulate matter | Mining: 4,600,981 kg/yr<br>WSL operation: 473 t/yr | Watering for dust suppression, minimisation of disturbance areas | n/a | n/a | n/a | Additional detailed mitigation strategies are further detailed in Section 4.6 |
| $PM_{10}$ | Mining: 1,377,865 kg/yr<br>WSL operation: 172 t/yr | Watering for dust suppression, Minimisation of disturbance areas | n/a | n/a | n/a | Additional detailed mitigation strategies are further detailed in Section 4.6 |
| $PM_{2.5}$ | 149,657 kg/yr | Watering for dust suppression, Minimisation of disturbance areas | n/a | n/a | n/a | Additional detailed mitigation strategies are further detailed in Section 4.6 |
| Greenhouse Gas | Mining: 314.1 kt $CO_2$-e/yr<br>WSL operation: 15.877 kt $CO_2$-e/yr<br>WSL construction: 19.388 kt $CO_2$-e/yr | Design and implement the Project in accordance with best practice technologies with regard to greenhouse emissions | n/a | n/a | n/a | An Action Plan for Reducing Greenhouse Gas Emissions at the Project has been included in Section 4.6 |

| Waste Type | Approx. Quantity Total | Waste Management Strategy | | | | |
|---|---|---|---|---|---|---|
| | | Avoidance | Reuse/ Recycle | Treatment/ Destruction | Disposal/ Storage Sites | Comments |
| Tailings and coarse rejects | A total of 81,423 Mt of dry plant rejects for the life of the mine | n/a | Supernatantwater will be recycled back to the CHPP | n/a | Tailings will be pumped to one of three locations throughout the Project life: Dam TDN, Dam TDNA or the Northern Void.<br><br>Coarse rejects will be trucked to the spoil dump for disposal. All TSFs have been designed in accordance with the Technical Guidelines for the Environmental Management of Exploration and Mining in Queensland (DME). | Threats to environmental values will be minimised by ensuring adequate containment of the tailings in the two proposed surface storages and in-pit.<br><br>The design of containment infrastructure will consider human and environmental risks associated with failure to contain and dam break scenarios.<br><br>Section 3.6.4 includes further detail of excavated waste disposal and the chemical and physical properties of the excavated waste. |

| Waste Type | Approx. Quantity Total | Waste Management Strategy | | | | |
|---|---|---|---|---|---|---|
| | | Avoidance | Reuse/ Recycle | Treatment/ Destruction | Disposal/ Storage Sites | Comments |
| Excavated Waste | Total waste from the life of the mine is 1,152,535,104 bcm. | n/a | n/a | n/a | Excavated waste will be disposed of in in-pit and out-of pit spoil dumps. A maximum final slope of 1V:6H is proposed for out-of-pit dump slopes to ensure long term stability. Rock lined drains and or sized rock mulch will be utilised to prevent erosion of dumps where required. Due to the swelling effect of excavated waste, in pit dumps will be elevated above the natural surface level to a maximum height of 40-50 m. | Section 3.6.3 includes further detail of excavated waste disposal and the chemical and physical properties of the excavated waste. |
| Domestic Waste | A total of 225 tpa or 7,200 t for the life of the mine | Bulk ordering to minimise packaging waste | n/a | n/a | n/a | n/a |

| Waste Type | Approx. Quantity Total | Waste Management Strategy | | | | |
|---|---|---|---|---|---|---|
| | | Avoidance | Reuse/ Recycle | Treatment/ Destruction | Disposal/ Storage Sites | Comments |
| Domestic Waste - Recyclables | | Bulk ordering to minimise packaging waste | Recycling bins for paper, plastic, aluminium | n/a | Removed from site by licensed contractors or disposal to onsite landfill facility. | Landfill will be designed and constructed in accordance with EcoAccess Guideline *Landfill Siting, Design, Operation and Rehabilitation* (EHP 2012). |
| Sewerage and Grey Water | A total of 13 ML/year or 420 ML for the life of the mine | n/a | n/a | Sewerage and grey water will be treated onsite at a packaged STP | Treated sewerage will be evaporated via irrigation in a designated disposal area. | The STP has been designed to produce Class A effluent in accordance with the *Planning Guidelines for Water Supply and Sewerage* (DERM 2010) and the *Queensland Water Recycling Guidelines* (EPA 2005). |
| Site Water | Quantities of all waste water generated at site are detailed in the Site Water Balance within Section 3.5.3 | Separation of clean and dirty water catchments to minimise contaminated water. | Waste water is reused and recycled around the Project site in accordance with mine water demands | n/a | Excess mine water will be evaporated as required. | The site is a zero-discharge site with all water re-used or recycled on site. |

| Waste Type | Approx. Quantity Total | Waste Management Strategy | | | | |
|---|---|---|---|---|---|---|
| | | Avoidance | Reuse/ Recycle | Treatment/ Destruction | Disposal/ Storage Sites | Comments |
| Waste oil, waste solvents, grease, batteries, scrap steel | A total of 50-100 tpa or approximately 2,400 t for the life of the mine | n/a | All scrap steel will be collected by a licensed contractor and taken to an appropriate facility for recycling | n/a | Regulated waste will be collected by a licensed contractor and disposed of to an appropriate facility. | Solvents/oils are stored and management in accordance with Australian Standards in order to minimise contamination and/or hazards. |
| Tyres | A total of 439 tpa or 14,035 t for the life of mine | Regular maintenance of vehicles and equipment for optimum efficiency | n/a | n/a | Tyres will be collected by a licensed contractor and disposed of to an appropriate facility. Alternatively, tyres may be buried within spoil dumps in a manner that maintains long term dump stability. | Management of waste tyres may be reconsidered should a viable recycling facility become available. |