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**Terms of Reference**

This Chapter has been prepared in response to Section 9.8 of the Terms of Reference (TOR) for the Saint Elmo Vanadium Project. Table 11.1 provides a cross-reference for Section 9.8 of the TOR and the relevant section in this Environmental Impact Statement (EIS).

**Table 11.1: TOR Cross-reference**

<table>
<thead>
<tr>
<th>TOR Requirements</th>
<th>Section of the EIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conduct the impact assessment in accordance with the department’s EIS information guidelines—Waste management and Applications for activities with waste impacts (ESR/2015/1836)</td>
<td>Chapter 11</td>
</tr>
<tr>
<td>Describe all the expected waste streams from the proposed project activities during the construction, operational, rehabilitation and decommissioning phases of the proposed project. Waste streams for resource projects would typically include: waste rock and coarse rejects from mining and mineral processing; salt from petroleum and gas projects; and brackish, saline or mine affected water from all types of resource projects.</td>
<td>Section 11.6</td>
</tr>
<tr>
<td>Describe the quantity, and physical and chemical characteristics of each significant waste, any attributes that may affect its dispersal in the environment, and its associated risk of causing environmental harm.</td>
<td>Section 11.6 Table 11.6</td>
</tr>
<tr>
<td>Define and describe objectives and practical measures for protecting or enhancing environmental values from impacts from wastes.</td>
<td>Section 11.4</td>
</tr>
<tr>
<td>Assess and describe the proposed management measures against the preferred waste management hierarchy, namely: avoid and reduce waste generation; cleaner production; reduce; recycle; reuse; reprocess and reclaim; waste to energy; treatment; disposal. This includes the generation and storage of waste.</td>
<td>Section 11.7</td>
</tr>
<tr>
<td>Describe how nominated quantitative standards and indicators may be achieved for waste management, and how the achievement of the objectives would be monitored, audited and managed.</td>
<td>Section 11.7</td>
</tr>
<tr>
<td>Detail waste management planning for the proposed project, in particular how measures have been applied to prevent or minimise environmental impacts due to waste at each stage of the proposed project.</td>
<td>Chapter 11</td>
</tr>
<tr>
<td>Use a material/energy flow analysis to provide details of natural resource use efficiency (such as energy and water), integrated processing design, and any co-generation of power and by-product reuse.</td>
<td>Section 11.7.4.1 in Chapter 3 – Project Description and Alternatives.</td>
</tr>
<tr>
<td>Detail the geochemistry of all waste rock, including spoil and rejects. Assess the potential risks associated with this waste stream and describe the management of progressive placement and any disposal strategy to minimise any potential impacts on environmental values of the proposed project area. Detail how high risk waste material will be managed in the rehabilitation plan.</td>
<td>Section 11.6.3; Part 2 Part 2 – Progressive Rehabilitation in Chapter 5 – Land; and Appendix A27 – Mine Material Management Plan</td>
</tr>
<tr>
<td>Identify the quantity, quality and location of all potential discharges of water and contaminants by the proposed project, including treated wastewater and sewage. Describe whether the discharges would be from point sources (whether uncontrolled and controlled discharges) or diffuse sources (such as irrigation to land of treated wastewater/sewage effluent), and describe the receiving environment (such as land or surface waters).</td>
<td>Section 6.9 in Chapter 6 – Water.</td>
</tr>
</tbody>
</table>
| Provide a risk assessment of the potential impacts on waters, in the near-field or far-field, resulting from controlled or uncontrolled discharges from the site. The EIS should address the following matters with regard to every potential discharge of contaminated water:  
  - Describe the circumstances in which controlled and uncontrolled discharges might occur.  
  - Provide stream flow data and information on discharge water quality, including any potential variation in discharge water quality that will be used in combination with proposed discharge rates to estimate in-stream dilution and water quality. Chemical and physical properties of any wastewater, including concentrations of constituents, at the point of entering natural surface waters | Sections 6.9 and 6.13 in Chapter 6 – Water. |
<table>
<thead>
<tr>
<th>TOR Requirements</th>
<th>Section of the EIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>should be discussed along with toxicity of effluent constituents to human health, flora and fauna.</td>
<td></td>
</tr>
<tr>
<td>▪ Provide an assessment of the available assimilative capacity of the receiving waters given existing water quality and other potential point source discharges in the catchment. Options for controlled discharge at times of natural stream flow should be investigated to ensure that adequate flushing of wastewater is achieved.</td>
<td></td>
</tr>
<tr>
<td>▪ Provide water quality limits that are appropriate to maintain background water quality, achieve local water quality objectives and protect other water uses as required by the Environmental Protection (Water) Policy 2009.</td>
<td></td>
</tr>
<tr>
<td>▪ Describe the necessary streamflow conditions in receiving waters under which controlled discharges will be allowed.</td>
<td></td>
</tr>
<tr>
<td>Provide relevant information on existing and proposed sewage infrastructure relevant to environmentally relevant activity (ERA) 63, by referring to the relevant department policies and guidelines, depending on the proposed sewage collection and treatment infrastructure proposed the reuse and/or disposal of treated wastewater and sewage wastes generated.</td>
<td>Section 11.7.3</td>
</tr>
<tr>
<td>Identify beneficial use options under the Waste Reduction and Recycling Act 2011 as per the relevant guidelines for irrigation, drilling mud, and associated water. The uses might include aquaculture, coal washing, dust suppression, construction, landscaping and revegetation, industrial and manufacturing operations, research and development and domestic, stock, stock intensive and incidental land management. Additional beneficial use guidelines are available on the department’s website.</td>
<td>Section 11.7.3</td>
</tr>
</tbody>
</table>

Source: DES 2018
11 Waste Management

This Chapter has been prepared to satisfy the requirements of Section 9.8 from the Terms of Reference and describes the expected waste streams, quantities, characteristics (physical and chemical) and management controls to be implemented for waste streams generated during the pre-construction, construction, operation and decommissioning phase of the Project.

In addition, this Chapter will outline the strategies proposed for protecting environmental values from the impacts of waste generated on the Project.

It should be noted that as part of the Project, Multicom proposes to establish an offsite Water Storage facility (OWSF) and associated pipeline to support the water demand for the Project. Impacts associated with waste management as a result of the OWSF have been assessed within a standalone chapter (Chapter 20 – Offsite Water Storage Facility and Associated Pipeline) and are excluded from the scope of this Chapter.

11.1 Project Overview

Multicom Resources Limited (Multicom) is seeking to develop the Saint Elmo Vanadium Project (the Project) for the purposes of mining and processing vanadium pentoxide and alternative vanadium-based products. The Project proposes to take advantage of the increasing supply gap associated with high-strength steel production, the growth market of vanadium batteries and the emergence of vanadium based compounds as a revolutionary metal in new technologies. There is an increasing global demand for lighter weight and higher strength steels as well as an increasing global demand for renewable and reliable energy, making vanadium a valuable resource.

The Project will consist of a shallow open cut mine, ranging in depth from 20 to 40 m (depending on depth of overburden), with associated dump and haul operations in order to obtain access to large known deposits of vanadium bearing sedimentary material. Strip mining is proposed to be carried out sequentially from mining panels along the north-south axis of Mining Lease Application (MLA) 100162, a greenfield site. Once the material is removed, the panel will be back filled with beneficiated gangue and overburden material, then contoured and sheeted with topsoil. Subsequently, revegetation with native species or as otherwise agreed with relevant stakeholders will take place.

The Project has an initial target production of 10,000 tonnes per annum (tpa) for the first two years with a maximum tonnage of up to 20,000 tpa (year 3 onwards) of vanadium pentoxide (V₂O₅) product over at least a 30 year mine life. Run of Mine (ROM) operations to produce the maximum 20,000 tpa will be up to 15 million tpa.
MLA100162 is located approximately 25 kilometres (km) east of Julia Creek in the priority North West Minerals Province of north western Queensland, within the McKinlay Local Government Area (LGA). The area of MLA100162 is approximately 8,882 hectares (ha).

11.2 Defining Waste

- Section 13 of the *Environmental Protection Act 1994* (EP Act) defines waste as anything, other than an end of waste resource, that is; Left over, or unwanted by-product, from an industrial, commercial, domestic or other activity; or
- Surplus to the industrial, commercial, domestic or other activity generating the waste.

Waste can be anything that is a gas, liquid, solid or energy, or a combination of any, whether or not is of value.

The *Environmental Protection Regulation 2019* (EP Regulation) defines specific waste types and for the purpose of this EIS, the following waste types have been identified as being applicable for the Project.

- General waste – generally, waste other than regulated waste and for chapter 6, part 2 of the EP Regulation any of the following—
  - Commercial waste other than regulated waste;
  - Domestic waste;
  - Recyclable waste.
- Commercial waste - means waste, other than green waste, recyclable waste, interceptor waste or waste discharged to a sewer, produced as a result of the ordinary use or occupation of commercial premises.
- Industrial waste – means interceptor waste e.g. waste such as oil and petroleum products that are held in an interceptor;
- Green waste – means grass cuttings, trees, bushes, shrubs, loppings of trees, bushes or shrubs, or similar matter produced as a result of the ordinary use or occupation of premises.
- Recyclable waste - means clean and inoffensive waste that is declared by the local government to be recyclable waste for the area e.g. glass bottles, newspapers, cardboard, aluminium.
- Regulated waste – is a waste that is commercial or industrial waste and is of a type, or contains a constituent of a type, mentioned in schedule 9, part 1, column 1 of the Regulation and includes—for an element—any chemical compound containing the element; and anything that contains residues of the waste, including, for example, a container contaminated with the waste.
11.2.1 Regulated Waste

Section 42 of the EP Regulation defines regulated waste as a waste that is commercial or industrial waste and is of a type, or contains a constituent of a type, mentioned in schedule 9, part 1, column 1 of the EP Regulation and includes—for an element—any chemical compound containing the element; and anything that contains residues of the waste, including, for example, a container contaminated with the waste.

Regulated wastes are classified as either category 1 or 2 under section 43 of the EP Regulation. Sampling and testing of commercial or industrial waste can be carried out in order to determine whether the waste is a general waste, a category 1 regulated waste or a category 2 regulated waste.

A category 1 regulated waste includes anything that contains residues of the waste, including, for example, a container contaminated with the waste and is either:

- a liquid waste; or
- solid waste that does not have current test results; and

where both of the following requirements apply –

- the waste is of a type, or contains a constituent of a type, mentioned in schedule 9, part 1, column 1; and
- the category mentioned in schedule 9, part 1, column 2 opposite the type is category 1.

In addition to the above, regulated waste can be a category 1 if test results for the waste state the pH of the waste is less than 2 or more than 12.5, or for a relevant substance, the concentration of the substance in the waste is more than the threshold mentioned in column 2 of the threshold table opposite the substance.

Category 2 regulated waste is regulated waste other than category 1 regulated waste.

11.3 Relevant Legislation, Guidelines, Policies and Strategies.

In Queensland, the key pieces of legislation relating to waste are:

- Environmental Protection Act 1994;
- Environmental Protection Regulation 2019;
- Waste Reduction and Recycling (Waste Levy) Amendment Regulation 2019;
- Environmental Protection (Regulated Waste) Amendment Regulation 2018;
- Environmental Protection (Waste ERA Framework) Amendment Regulation 2018;
- Waste Reduction and Recycling Act 2011 (WRR Act);
- Waste Reduction and Recycling Regulation 2011 (WRR Regulation);
- Public Health Act 2005; and
- Public Health Regulation 2018.

### 11.3.1 Amendments to Legislation

The Department of Environment and Science (DES) conducted a review of existing regulations and released a Decision Regulatory Impact Statement in June 2018. The review was aimed at developing a new contemporary risk-based approach to ensure they reflect current waste management standards, practices and technologies.

Following the review, the Environmental Protection (Regulated Waste) Amendment Regulation 2018 and the Environmental Protection (Waste ERA Framework) Amendment Regulation 2018 were made, which amend the existing Environmental Protection Regulation 2019 (EP Regulation). The new regulations came into effect on 04 February 2019.

The Environmental Protection (Regulated Waste) Amendment Regulation 2018 introduces a new risk-based waste classification framework whereby regulated waste will now be classified as either:

- Category 1 regulated waste (highest risk)
- Category 2 regulated waste (moderate risk); or
- Not-regulated waste /general waste (lowest risk).

In early 2018, the Queensland Government prepared a ‘waste management and resource recovery strategy’ that provides a strategic framework for Queensland to become a zero-waste society, where waste is avoided, reused and recycled to the greatest extent possible. This Strategy is underpinned by the waste levy which has been re-introduced in the Waste Reduction and Recycling (Waste Levy) Amendment Regulation 2019. This Regulation was approved on 21 March 2019 and incorporated into the existing Waste Reduction and Recycling Regulation 2011.

#### 11.3.2 Environmental Protection Act 1994

The EP Act is the key legislation framework for environmental management and protection in Queensland. In respect to the Project, the Act provides a definition for waste and outlines obligations to be met by individuals and corporations (e.g. general environmental duty of care, environmentally relevant activity requirements, notifiable activities and EIS requirements).

#### 11.3.3 Environmental Protection Regulation 2019

The EP Regulation sits under the EP Act and prescribes the requirements to be met for the management of waste and regulated wastes including its storage, disposal, transportation, tracking and treatment.
11.3.4 Waste Reduction and Recycling (Waste Levy) Amendment Regulation 2019

The Waste Reduction and Recycling (Waste Levy) Amendment Regulation 2019 provides more detail on requirements to implement the waste levy. As of the 1 July 2019, all waste going to landfill in Queensland will incur the relevant levy rate unless the waste is both generated and disposed of in the non-levy zone. The Project is located within McKinlay Shire Council, a non-levy zone however, some waste may be disposed of to areas located within the levy zone, such as Mount Isa and or Townsville, depending upon the quantities and waste stream types.

11.3.5 Environmental Protection (Regulated Waste) Amendment Regulation 2018

The Environmental Protection (Regulated Waste) Amendment Regulation 2018 introduces a new risk-based waste classification framework whereby regulated waste is now classified as either:

- Category 1 regulated waste (highest risk)
- Category 2 regulated waste (moderate risk); or
- Not-regulated waste /general waste (lowest risk).

The amendments outlined in this Regulation have been incorporated into the EP Regulation 2019.

Multicom will classify the expected regulated waste to be generated into a risk-based category at the pre-construction, construction, operation and decommissioning phases of the Project by either:

- Adopting a default waste category from Part 1 of Schedule 7 of the EP Regulation; or
- Organising sampling and testing of their waste by an appropriately qualified person to demonstrate an appropriate risk-based category in accordance with section 64A of the EP Regulation.

11.3.6 Environmental Protection (Waste ERA Framework) Amendment Regulation 2018

The Environmental Protection (Waste ERA Framework) Amendment Regulation 2018 introduces a new schedule of waste related Environmentally Relevant Activities (ERA). These are:

- ERA 53 Organic material processing;
- ERA 54 Mechanical waste reprocessing;
- ERA 55 Other waste reprocessing or treatment;
- ERA 57 Regulated waste transport;
- ERA 60 Waste disposal;
- ERA 61 Thermal waste reprocessing and treatment; and
- ERA 62 Resource recovery and transfer facility operation.
The amendments outlined in this Regulation have been incorporated into the EP Regulation 2019. It should be noted, that the Project does not intend on carrying out any of the activities listed above.

11.3.7 Waste Reduction and Recycling Act 2011

The *Waste Reduction and Recycling Act 2011* (WRR Act) contains a suite of measures to reduce waste generation, landfill disposal and encourage recycling. The purposes of the WRR Act are:

- To promote waste avoidance and reduction, and resource recovery and efficiency actions;
- To reduce the consumption of natural resources and minimise the disposal of waste by encouraging waste avoidance and the recovery, re-use and recycling of waste;
- To minimise the overall impact of waste generation and disposal;
- To ensure a shared responsibility between government, business and industry and the community in waste management and resource recovery; and
- To support and implement national frameworks, objectives and priorities for waste management and resource recovery.
The WRR Act provides for a waste management strategy, imposes obligations on waste disposal sites, product stewardship schemes, the plastic bag ban, the container refund scheme, and littering and provisions for end of waste. Additionally, the WRR Act enacts waste and resource management principles, which include:

- Outlining management strategy through the waste and resource management hierarchy (Avoid, Reduce, Reuse, Recycle, Recover, Treat, Dispose);
- The polluter pays principle (all costs associated with the management of waste should be borne by the persons who generated the waste);
- The user pays principle (all costs associated with the use of a resource should be included in the prices of the goods and services that result from the use);
- The proximity principle (waste and recovered resources should be managed as close to the source of generation as possible); and
- The product stewardship principle (there is a shared responsibility between all persons who are involved in the life cycle of a product for managing the environmental, social and economic impact of the product).

11.3.8 Waste Reduction and Recycling Regulation 2011

The Waste Reduction and Recycling Regulation 2011 (WRR Regulation) sits under the WRR Act and provides details about the new legislative framework. The key provisions of the WRR Regulation include:

- Fees for applications under the Waste Reduction and Recycling Act 2011;
- Management of used packaging materials; and
- Details about who is required to plan and report about waste management.

The WRR Regulation provides more details on the requirements to implement the waste levy.

11.3.9 Public Health Act 2005 and Public Health Regulation 2018

The Public Health Act 2005 (PH Act) aims to protect and promote the health of the Queensland public. The Public Health Regulation 2018 supports the PH Act by outlining specific measures to be implemented for managing an area of public interest e.g. asbestos, mosquitoes, rats and mice.

The Project intends on utilising treated wastewater and stormwater for irrigation (garden beds) and or dust suppression purposes and therefore, must meet the water quality criteria stipulated within this Regulation. The criteria set out in the regulation solely addressed public health requirements and does not address environmental requirements.
11.3.10 Guidelines, Policies and Strategies

The following guidelines, policies and/or strategies have been reviewed as part of this EIS process with specific elements being considered with the intention of incorporating these into the Construction Environmental Management Plan (CEMP) and the Operation Environmental Management Plan (OEMP) (refer Appendix A5 – Environmental Management Plan Framework).

11.3.10.1 Guideline – Application Requirements for Activities with Waste Impacts, Version 5.00

The Guideline – Application requirements for activities with waste impacts (ESR/2015/1836), Version 5.00 (2019) focuses on the types of waste produced and outlines the information to be provided to DES as part of the ERA application process (DES 2019). The applicable requirements of this Guideline have been carefully considered and incorporated into this Chapter.

11.3.10.2 Queensland Waste Management and Resource Recovery Strategy

The Queensland Waste Management and Resource Recovery Strategy provides a framework for Queensland to become a zero-waste society, where waste is avoided, reused and recycled. An example of some key priorities outlined within the strategy include recycle better, avoid waste, reduce waste, chose to reuse, avoid and minimise the long-distance transport of waste.

11.3.10.3 Queensland Waste Avoidance and Resource Productivity Strategy (2014 to 2024)

The Queensland Waste Avoidance and Resource Productivity Strategy (2014 to 2024) sets out progress measures for Queensland to reduce the rate of waste generated over the next 10 years. The strategy focuses on avoiding unnecessary consumption and waste generation, adopting innovative resource recovery approaches, and managing all products and materials as valuable and finite resources.

11.4 Proposed Project Activities

Waste generating activities are expected to occur at every stage (pre-construction, construction, operation and decommissioning) of the Project. This section of the Chapter will outline the expected waste streams associated with each stage and includes figures that show the Project site, the location of the proposed waste storage area, processing areas and onsite disposal locations (refer Figure 1 and Figure 11.2).

Figure 1
Figure 11.1
Project Site

MLA100162

Legend
- MLA100162
- 50m Buffer
- Cadastre (DCDB)
- Mining Footprint
- Unmined Area
- Mine Infrastructure Area
- Mine sequencing - Years 1 to 5
- Water Supply Dam
- Watercourse
- Access Roads
- Rail Line

Data Source:
©State of Queensland (Department of Natural Resources, Mines and Energy)
Multicom Resources Limited
Downer
Wave International

Multicom Resources Limited
Saint Elmo Vanadium Project

Scale: 1:60,000 @ A4
Datum: GDA94

BE180134.01 Rev 2 October 2019
**11.4.1 Pre-Construction Activities**

Pre-construction activities involve site preparation works which will include, but may not be limited to, the following:

- Installation of boundary and or survey pegs / markers;
- Agree re-routed stock route and access process with tenure owner;
- Establishment of site safety and security measures e.g. fencing, safety signage, contact signage;
- Establishment of temporary amenities e.g. portable toilets;
- Establishment of waste receptacles;
- Installation of erosion and sediment controls;
- Clearing and grubbing of site (vegetation and weeds);
- Topsoil and subsoil removal;
- **Earthworks for establishment of:**
  - Water management infrastructure e.g. clean water (pit protection levees), dirty water (sedimentation dams used to capture sediment laden stormwater runoff) and mine /process water (raw water dam, pit water used for mine processing);
  - Offsite water storage facility (OWSF) and associated pipeline (refer to Chapter 20);
  - Grading works for establishment of an access road off Old Nelia Road and internal access roads around the structure.
  - Fire water storage area (will be used for servicing the Mine Infrastructure Area (MIA) and process area);
  - Sewage treatment plant and effluent disposal area;
  - MIA, which includes administration offices, amenities, processing facilities, flammable and combustible liquid storage, waste storage area, power station, carpark, vehicle manoeuvre areas, plant /equipment workshop, sewage treatment plant, laboratory, washdown facilities;
  - On-site power facility infrastructure trenches; and
  - Rail spur line that will join onto the Northern Rail Line.
- **Grading works for establishment of:**
  - Site entrance and access road off Flinders Highway;
  - Internal site access roads;
  - Rail access into site from Northern Rail Line;
  - Water management infrastructure (listed above);
  - MIA (listed above);
  - Laydown and storage areas;
  - Site offices including crib hut and amenities;
  - Stormwater management infrastructure e.g. drainage lines /channels; and
  - Fire water storage area (will be used for servicing the MIA and process area).
- Establishment of site office: desks, chairs, power and water infrastructure, electrical goods (printers, photocopiers, computers etc.), stationery, storage cupboards.

Initial site preparation works will be concentrated in areas where key infrastructure will be located and where access roads, water storages and laydown areas will be required. All site preparation works will be undertaken in accordance with the Project’s Construction Environmental Management Plan (CEMP). Site preparation works will be staged to minimise the extent and duration of cleared areas at any one time. This staged approach will assist Multicom to manage their environmental requirements, such as minimising dust being generated and control of stormwater runoff.

Where possible, suitable soil resources for use in later rehabilitation activities will be stripped, handled and stored in a manner that aligns with industry best practice. Topsoil and subsoil will be separated during this stage as topsoil contains a higher nutrient content and must be kept separate so that it can be used to promote vegetative growth during rehabilitation. Topsoil can be stored as a berm around active worksites and utilised as an erosion and sediment control measure, provided adequate controls (for example; sediment fence and cover) are in place to manage the erosion risk of the topsoil or bund itself. The mine plan is designed to maximise the amount of topsoil that can be placed progressively, with limited stockpiling.

11.4.2 Construction Activities

Construction activities will include, but may not be limited to the following:

- Construction of processing plant including foundations and associated infrastructure e.g. electrical supply, lighting, security, water supply;
- Construction of sewage treatment plant, irrigation area and associated infrastructure e.g. diesel, electrical supply, pump station, alarm, foundations;
- Construction of the ROM, with area adequate to stockpile at least three days mine production to cover the mine shift and any plant shutdowns. The ROM will be oriented North-South to ensure safe operation when dumping;
- Excavation of shallow open cut pits for ore collection;
- Construction of MIA and associated infrastructure;
- Upgrade to the entrance and access road off Flinders Highway;
- Establishment of internal site access roads designed to accommodate semi-trailer and B-double vehicles;
- Construction of haulage roads into and out of pits and to ROM pad;
- Construction of rail spur line connected to the existing Northern Rail Line and associated infrastructure e.g. level crossing across Flinders Highway, electrical supply, loading yards.
- Construction of the tailings storage facility (TSF) and evaporation pond;
- Construction of water storage and stormwater management system infrastructure;
- Establishment of electrical power supply including electricity transmission infrastructure;
Diesel electricity generator located near to primary infrastructure with sufficient access for fuel delivery and storage or appropriate considerations for solar power generation; Operational gas demand will be supplied on-site through provision of 80 kl gas tanks. In total, a 5-day supply will be retained on-site. Gas will be supplied by road or rail; and

Trenching and laying of reticulated services e.g. potable water, fire water, raw water, sewage, electrical supply and communications.

OWSF construction activities will include:

- Construction of the four-cell, off-river OWSF with an average depth of 7.2 m (maximum depth of a cell is 7.8 m). Each cell would have an area of approximately 40 ha. Refer to Appendix A29, Table 3-2 for more details;
- Construction of a 1,375 m long and 10 m wide Diversion Channel to divert water at a rate of 1,400 ML/day from the Flinders River to the OWSF;
- Construction of a protective embankment alongside the river channel, 2 m above the riverbank;
- Construction of a Control Structure (embankment across Diversion Channel with two 2 m diameter pipelines beneath with a control gate on the upstream side to manage flow of water to the OWSF);
- Construction of 1 m diameter outlet Amalgamation Pipelines at Cells 2, 3 and 4 which report to the Amalgamation Channel that feeds back to the Diversion Channel, to be pumped to Cell 1;
- Construction of other infrastructure e.g. stormwater management infrastructure, diesel electrical power supply, and security;
- Establishment of site access road from Old Nelia Road and internal access roads around the structure;
- Construction of pipeline (approximately 24 km long) to the Project, trenched alongside Punchbowl Road within the road reserve;
- Establishment of gardens around site office.

It should be noted that no drilling or blasting activities will be required as part of the Project.

11.4.3 Operational Activities

Operational activities will be heavily focused on ore extraction, processing and transportation of final product. A summary of the mining sequence and activities to be undertaken is as follows:

- Clearing of vegetation (largely a weed management exercise) including removal and disposal;
- Excavation of shallow open cut pits (on average 20 m) whereby native grass-dominated vegetation communities, topsoil and subsoil will be removed and stockpiled adjacent to the void for future re-use (where practicable) during rehabilitation works and on the final landform;
• Overburden is removed and stockpiled for use during in-pit covering of reject material to final landform level;
• Ore is mined by utilising hydraulic excavators and off-roads trucks for mining and haulage via road networks to the ROM stockpile areas for processing;
• Reject material movement has been scheduled using 250 t excavators and D11 sized dozers. A single 250 t excavator can cover mining requirements to meet the 10,000 tpa production output. The additional equipment identified is required as the Project ramps up production to 20,000 tpa. These trucks (which are loaded with reject material from the ROM area) then back-haul to dump in the pit, before returning to load again with ore from the nearby active ore loading area;
• Ore is processed within the MIA until a high purity V₂O₅ flake is produced; and
• Product is transported to Townsville by rail to reach customer and/or export through the Port of Townsville.

For the OWSF and associated pipeline:

• Water would be diverted from the Flinders River along a Diversion Channel with a Control Structure to control flow;
• Fourteen 2 m control gates and pipelines would control flow to a 1,400 ML/day pump station.
• Water is pumped to Cell 1 and distributed to other cells using gravity via 2 m diameter pipelines and control gates on the upstream side, as required;
• To reduce evaporation, water would be selectively consolidated to reduce surface area, by transferring water from the Amalgamation Pipelines at cells 2, 3 and 4, via the Amalgamation Channel to the Diversion Channel where the water is then transferred using the River Pump to Cell 1; and
  Water is pumped to the Project from Cell 1, via the pipeline at a steady rate of 13 ML/day, based on 346 pumping days per year.

Refer to Chapter 20 – Offsite Water Storage Facility and Associated Pipeline for further details.

11.4.4 Decommissioning and Rehabilitation Activities

The Project, including the OWSF, will be decommissioned after approximately 30 years of mining or following depletion of the target resource. Progressive rehabilitation will be carried out as operations progress, in that each mining block or area will be progressively rehabilitated and compliance sought with the EA. Rehabilitation of the MIA and OWSF will take place once mining is completed and plant and structures decommissioned. The mine Plan of Operations will detail the final decommissioning and rehabilitation objectives. The OWSF will be returned to current landform, unless an agreement is reached with the landowner for it to remain.
Following the removal of vanadium, Multicom aims to return the Project area to a locally native ecological community that is progressing, credibly, towards a state resembling the vegetation that occurred onsite prior to mining. Where this cannot be achieved, Multicom will seek to return the mined area/s to a standard that resembles adjacent ecological communities. The final form of rehabilitation will be determined in conjunction with the landowners, local Council and other stakeholders.

The objectives of rehabilitation are to:

- Recreate a landscape safe for humans and wildlife into the foreseeable future;
- Create a stable landscape with natural rates of erosion;
- Establish vegetation communities that resemble those originally found onsite, which blend visually with the surrounding landscape and vegetation;
- Establish functional, self-sustaining vegetation communities;
- Establish ecosystems that resemble neighbouring unmined woodlands in their ability to respond to fire, termites, droughts and cyclones; and
- Ensure minimal post-mining impacts on surface catchments, water quality and volume.

The monitoring and accreditation of rehabilitation work undertaken throughout operations will be required as part of the Project’s Environmental Authority to sign off on rehabilitated areas. The Plan of Operations will set out the proposed program of actions to comply with the EA conditions, including a program to progressively rehabilitate disturbed land.

The rehabilitation and site closure methods are further outlined in Section 11.4.4 and, Sections 5.14 – 5.17 in Part 2 – PRCP, Chapter 5 – Land.

11.5 Assessment Methodology

The impact assessment has been conducted in accordance with the following:

- *EIS information guidelines – Waste Management*; and
- *Applications for activities with waste impacts* (ESR/2015/1836).

Waste streams expected to be generated during each stage of the Project, (pre-construction, construction, operation and decommissioning) have been quantified and characterised based on preliminary planning and design documentation. The primary methods used for the assessment of potential waste generation include:

- A review of the Commonwealth, State and Local regulatory framework relating to waste classification and management;
- Review of available design documentation;
- Review of the *Geochemical assessment of process waste 2019* report prepared by RGS Environmental (refer Appendix A27 – Mine Material Management Plan for further detail); and
- Investigations into local waste transport, treatment and disposal facilities and capacities.

### 11.6 Expected Waste Types

A summary of waste types expected to be generated during each phase of the Project (pre-construction, construction, operation, decommissioning) is provided in [Table 11.2](#) and includes the following information:

- **Waste type** - as defined in Schedule 12 of the *Environmental Protection Regulation 2019*; e.g. general, recyclable, regulated, limited regulated waste, liquid, industrial, chemical, green and commercial waste;
- **Source of the waste** - why and how waste has been generated e.g. food scraps from site personnel, toner cartridge from printer;
- **Project Phase** - outlines which phase of the Project the waste will be generated;
- **Nature of the waste** - e.g. solid, liquid, gas, combination;
- **Waste composition/characteristics** - e.g. geochemical (acid), chemical (sulphuric acid), physical (timber, metal, plastic);
- **Rate of waste production** - e.g. kg, tonnes per day/week/month/annum;
- **Regulated waste determination**;
- **Storage method** - e.g. general/recycling receptacles, tanks, drums, cabinets;
- **Collection/Transportation method** - e.g. licensed transporter, recycling and or re-use on site);
  and
- **Waste tracking requirement** - is tracking of waste required
Table 11.2: Expected Waste Summary

<table>
<thead>
<tr>
<th>Waste Type</th>
<th>Source</th>
<th>Project Phase</th>
<th>Nature (solid, liquid, gas, combination)</th>
<th>Waste Composition / Characteristic (geochemical, physical, chemical)</th>
<th>Approximate rate of production</th>
<th>Storage Method (licensed, recycled, re-use)</th>
<th>Collection Method (licensed, recycle, re-use)</th>
<th>Is the Waste a 'regulated waste'?</th>
<th>Waste Tracking Required?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Putrescible General waste</td>
<td>Food scraps from site personnel</td>
<td>All</td>
<td>Solid, liquid, combination</td>
<td>Organic compounds</td>
<td>400 tpa</td>
<td>Lined domestic bins, Commercial bin</td>
<td>Licensed transporter in general commercial bin</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>Cigarette Butts General waste</td>
<td>Site personnel</td>
<td>All</td>
<td>Solid</td>
<td>Physical, chemical</td>
<td>Unable to quantify</td>
<td>Lined domestic bins, Commercial bin</td>
<td>Licensed transporter in general commercial bin</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>Plastic – food and beverage related Recyclable waste</td>
<td>Milk and juice containers, soft drink bottles, water bottles</td>
<td>All</td>
<td>Solid</td>
<td>Polyethylene terephthalate (PETE) – water, soft drinks, High-density polyethylene (HDPE) – milk and juice bottles. All highly recyclable.</td>
<td>5 tpa</td>
<td>Recycling bins</td>
<td>Licensed transporter in recycling bins</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Plastic – food related General waste Recyclable waste</td>
<td>Plastic bags, food wrapping</td>
<td>All</td>
<td>Solid</td>
<td>Low-density polyethylene (LDPE) - most plastic bags and food wrap</td>
<td>5 tpa</td>
<td>Lined domestic bins, Commercial bin</td>
<td>Licensed transporter in general industrial bin</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Aluminium Recyclable waste</td>
<td>Drink cans, marker spray paint cans</td>
<td>All</td>
<td>Solid</td>
<td>Aluminium – extremely and infinitely recyclable.</td>
<td>2 tpa</td>
<td>Co-mingled recycling bins</td>
<td>Licensed transporter in recycling bins</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Paper / cardboard Recyclable waste</td>
<td>Paper from site office activities, numerous products to be used are generally packed in cardboard boxes.</td>
<td>All</td>
<td>Solid</td>
<td>Hemicellulose Lignin Organic carbon-based compounds</td>
<td>10 tpa</td>
<td>Co-mingled recycling bins</td>
<td>Licensed transporter in recycling bins</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Plastic General waste Recyclable waste</td>
<td>Product packaging (bubble wrap, cling wrap, films)</td>
<td>Pre-Construction, Construction, Operation</td>
<td>Solid</td>
<td>Polyethylene (LDPE) – non recyclable</td>
<td>5 tpa</td>
<td>Lined domestic bins, Commercial bin</td>
<td>Licensed transporter in general commercial bin</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Safety fencing, safety capping for reinforcing / steel bars</td>
<td>Pre-Construction, Construction</td>
<td>Solid</td>
<td>Polyvinyl chloride (PVC), Polypropylene (PP)</td>
<td>5 tpa</td>
<td>Commercial bin</td>
<td>Re-use</td>
<td>N</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>Builders film – multipurpose e.g. can be used as a moisture barrier under concrete slabs, drop sheet for protecting floors or as a tarpaulin.</td>
<td>Pre-Construction, Construction</td>
<td>Solid</td>
<td>Low or high density polyethylene</td>
<td>5 tpa</td>
<td>Commercial bin</td>
<td>Re-use</td>
<td>N</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>Plumbing materials e.g. PVC pipe, PVC junctions</td>
<td>Pre-Construction, Construction</td>
<td>Solid</td>
<td>Polyvinyl chloride (PVC)</td>
<td>5 tpa</td>
<td>Commercial bin</td>
<td>Licensed transporter in general commercial bin</td>
<td>N</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>Electrical supply materials e.g. PVC cable, insulation tape</td>
<td>Pre-Construction, Construction</td>
<td>Solid</td>
<td>Polyvinyl chloride (PVC)</td>
<td>5 tpa</td>
<td>Commercial bin</td>
<td>Licensed transporter in general commercial bin</td>
<td>N</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>Silt fencing, safety flagging, cement packaging bags</td>
<td>Pre-Construction, Construction</td>
<td>Solid</td>
<td>Polypropylene (PP) – silt fencing, cement bag lining Polyvinyl chloride (PVC) with nylon rope – safety flagging</td>
<td>5 tpa</td>
<td>Commercial bin</td>
<td>Licensed transporter in general commercial bin</td>
<td>N</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>Asphalt / bitumen Commercial waste</td>
<td>Roads, driveways</td>
<td>Pre-Construction, Construction</td>
<td>Viscous liquid / semi solid Crushed rock aggregates, gravel, sand and bitumen</td>
<td>Minor quantities expected as not all roads will be sealed</td>
<td>Commercial bin</td>
<td>Licensed transporter in general commercial bin</td>
<td>N</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>Timber Recyclable waste (if not treated)</td>
<td>Survey stakes, pallets received for delivery of products.</td>
<td>Pre-Construction, Construction, Operation</td>
<td>Solid</td>
<td>Primarily carbon</td>
<td>12 tpa</td>
<td>General industrial bin</td>
<td>To be recycled by resource recovery centre</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Metal (steel, copper) Commercial waste Recyclable waste</td>
<td>Off cuts from plumbing / electrical supply activities, construction of facilities, reinforcing bars / sheets, steel bars / rods used for demarcation purposes</td>
<td>All</td>
<td>Solid</td>
<td>Carbon, iron, copper</td>
<td>10 tpa</td>
<td>General industrial bin</td>
<td>Licensed transporter in general commercial bin</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Cement Commercial waste</td>
<td>May be used as a binding agent during construction of facilities and associated infrastructure</td>
<td>Pre-Construction, Construction</td>
<td>Solid</td>
<td>Limestone, clay, sand and/or shale</td>
<td>10 tpa</td>
<td>General industrial bin</td>
<td>Licensed transporter in general commercial bin</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Concrete Commercial waste</td>
<td>Pre-mixed (offsite) and used for construction of facilities and associated infrastructure.</td>
<td>All</td>
<td>Combination</td>
<td>Fine and coarse aggregate bound with liquid cement</td>
<td></td>
<td>General industrial bin</td>
<td>Licensed transporter in general commercial bin</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Waste Type</td>
<td>Source</td>
<td>Project Phase</td>
<td>Nature (solid, liquid, gas, combination)</td>
<td>Waste Composition / Characteristic (geochemical, physical, chemical)</td>
<td>Approximate rate of production</td>
<td>Storage Method</td>
<td>Collection Method (licensed, recycle, re-use)</td>
<td>Is the Waste a regulated waste? Y / N</td>
<td>Waste Tracking Required Y / N</td>
</tr>
<tr>
<td>------------</td>
<td>--------</td>
<td>---------------</td>
<td>----------------------------------------</td>
<td>---------------------------------------------------------------</td>
<td>-------------------------------</td>
<td>----------------</td>
<td>---------------------------------</td>
<td>-------------------------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td>Vegetation</td>
<td>Green waste</td>
<td>Site preparation clearing works includes grass, weeds, trees.</td>
<td>Pre-Construction, Construction, Operation</td>
<td>Solid</td>
<td>Water, carbon, potassium, nitrogen</td>
<td>Negligible</td>
<td>Weeds will be placed in bins. Vegetation will be mulched and stockpiled</td>
<td>Mulched material will be Re-used for rehabilitation purposes</td>
<td>N</td>
</tr>
<tr>
<td>Electronic waste</td>
<td>[E-waste] Commercial waste</td>
<td>Computers used in site offices, hand-held GPS devices used for site surveying, mobile phones, printers/photocopiers, telecommunications.</td>
<td>Operation, Decommissioning</td>
<td>Solid</td>
<td>Plastics, ferrous materials, lead, glass, aluminium, ceramics, rubber</td>
<td>General industrial bin</td>
<td>Licensed transporter in general commercial bin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sewage</td>
<td>Regulated waste</td>
<td>Portable toilets, sewage treatment plant and facilities.</td>
<td>All</td>
<td>Combination</td>
<td>Water, organic and inorganic matter, heavy metal salts</td>
<td></td>
<td>Onsite holding tanks as part of sewage treatment plant</td>
<td>Licensed waste transporter</td>
<td>Y</td>
</tr>
<tr>
<td>Tyres</td>
<td>Regulated waste</td>
<td>Site vehicles, plant and or equipment. Items will be stored in or near the workshop.</td>
<td>Pre-Construction, Construction, Operation</td>
<td>Solid</td>
<td>Elastomers, carbon black / silica, steel, textile, zinc oxide, sulphur</td>
<td>50 tpa</td>
<td>Stockpiled less than 3m high, with fire precautions and mosquito control.</td>
<td>To be transported to tyre take-back or recycling facility</td>
<td>Y</td>
</tr>
<tr>
<td>Batteries</td>
<td>Recyclable waste Regulated waste</td>
<td>Site vehicles, plant and or equipment. Vehicle batteries will be stored in or near the workshop and other types (e.g. dry cell batteries AAA, DD) will be stored in waste storage area.</td>
<td>Pre-Construction, Construction, Operation</td>
<td>Solid, Liquid</td>
<td>Zinc-carbon, nickel, cadmium, lithium, mercury</td>
<td>2 tpa</td>
<td>Stored for recycling</td>
<td>To be transported to nearest battery recycling facility</td>
<td>Y</td>
</tr>
<tr>
<td>Oils</td>
<td>Industrial waste</td>
<td>Site vehicles, plant and or equipment. Items will be stored in or near the workshop.</td>
<td>Pre-Construction, Construction, Operation</td>
<td>Liquid</td>
<td>Hydrocarbon</td>
<td>5 tpa</td>
<td>Store on site</td>
<td>Oil collected as per waste oil.</td>
<td>Y</td>
</tr>
<tr>
<td>Waste Oil Containers/Rags</td>
<td>General and or Recyclable waste</td>
<td>Site vehicles, plant and or equipment. Items will be stored in or near the workshop.</td>
<td>Pre-Construction, Construction, Operation</td>
<td>Liquid</td>
<td>Hydrocarbon</td>
<td></td>
<td>Store on site</td>
<td>Dispose offsite</td>
<td>Y</td>
</tr>
<tr>
<td>Diesel</td>
<td>Regulated waste</td>
<td>Fuel required for vehicles, generators, plant and or equipment. Fuel will be stored in self bunded storage tanks.</td>
<td>All</td>
<td>Liquid</td>
<td>Hydrocarbon</td>
<td>10 million litres per annum (based on 10,000 tpa V2O5 product yield)</td>
<td>10,000L double skinned, self-bunded above-ground tanks</td>
<td>No waste is expected to be generated</td>
<td>Y</td>
</tr>
<tr>
<td>Overburden</td>
<td>Overburden that overlays the mineral body and does not go through the processing stage.</td>
<td>Operation</td>
<td>Solid</td>
<td>Mineral aggregate</td>
<td>24 million tpa</td>
<td>Returned to ground</td>
<td>Returned to ground</td>
<td></td>
<td>N</td>
</tr>
<tr>
<td>Processing Waste</td>
<td>Beneficiation rejects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Washed rock post scrubbing</td>
<td></td>
<td>Oversized material from the scrubbing and screening process.</td>
<td>Operation</td>
<td>Solid</td>
<td>Washed rock</td>
<td>1,611,404 tpa</td>
<td>Stockpiled near screening plant. Will be re-used on site for placement back into the pit.</td>
<td>Mining fleet will transport onsite.</td>
<td>N</td>
</tr>
<tr>
<td>Processing tailings rejects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Includes floatation reject, sulphuric acid (H2SO4), filter cake.</td>
<td></td>
<td>Occurs during the floatation, filtration and desalination process.</td>
<td>Operation</td>
<td>Liquid</td>
<td>Tailings</td>
<td>1,279,644 tpa</td>
<td>Stored in clay lined impervious tailings storage facility (TSF)</td>
<td>Mining fleet will transport onsite and/or will be pumped (gravity fed) and/or pumped to TSF.</td>
<td>Y</td>
</tr>
<tr>
<td>Solvent extraction rejects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Includes silica gel, autoclave filtration cake, caustic soda (NaOH), sulphuric acid (H2SO4), aluminium sulphate (Al2(SO4))3, ammonia sulphate (NH4)2SO4, alamine 336.</td>
<td></td>
<td>Occurs during the desalination and refining process.</td>
<td>Operation</td>
<td>Combination (material will be dewatered)</td>
<td>Silicon dioxide (SiO2)</td>
<td>98,809 tpa</td>
<td>Evaporation Pond. Rejets will be dewatered, removed and disposed of in the TSF.</td>
<td>Mining fleet will transport onsite and/or will be pumped (gravity fed) and/or pumped to TSF.</td>
<td>Y</td>
</tr>
</tbody>
</table>

11-20
11.6.1 Construction

Waste types expected to be generated during the pre-construction and construction phase of the Project were identified following a review of the activities to be undertaken and have been outlined in Table 11.2. Prior to the commencement of works, a Construction Environmental Management Plan (CEMP) will be prepared and will include management strategies and mitigation measures for waste streams generated during this phase of the Project (refer Appendix A5-Environmental Management Plan Framework for further detail).

11.6.2 Operation

Waste types expected to be generated during the operation phase of the Project were identified, following a review of the activities to be undertaken. Mineral processing activities will generate the greatest amount of waste during the Project and have been outlined in Table 11.2.

Processing of mineral ore will be conducted using the atmospheric leaching method and comprises of the 4 stages (refer Figure 11.3). The processing plant is mainly a hydrometallurgical plant and there are a significant number of reagents required to run the flotation, leaching and downstream processing units of solvent extraction, desilication, AMV precipitation and deammoniation. Table 11.3 outlines the processing stages and reagents used in each stage.

Table 11.3: Processing Stages (General Overview)

<table>
<thead>
<tr>
<th>Processing Stages</th>
<th>Atmospheric Leaching Method</th>
<th>Reagents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage 1: Beneficiation</td>
<td>Scrubbing</td>
<td>Floatation Reagents</td>
</tr>
<tr>
<td></td>
<td>Screening</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cyclone</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Centrifuge</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Floatation</td>
<td></td>
</tr>
<tr>
<td>Stage 2: Leach</td>
<td>Roasting</td>
<td>Sulphuric Acid</td>
</tr>
<tr>
<td></td>
<td>Atmospheric Leaching</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Filtration</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Concentration Option 1:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Solvent Extraction or</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Concentration Option 2:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ionic Exchange</td>
<td></td>
</tr>
<tr>
<td>Stage 3: Purification</td>
<td>Desilication</td>
<td>Nil</td>
</tr>
<tr>
<td></td>
<td>AMV Precipitation</td>
<td></td>
</tr>
<tr>
<td>Stage 4: Refining</td>
<td>Deammoniation</td>
<td>Caustic soda</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Aluminium Sulphate</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ammonia Sulphate</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sulphuric Acid</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Alamine</td>
</tr>
</tbody>
</table>

For a detailed description of the atmospheric leaching process, refer to Chapter 3 – Project Description and Alternatives.
11.6.3 Processing Waste and Disposal

Geology
The Project area contains sediments of the Eromanga Basin, a marine basin that formed between the Late Triassic to Early Late Cretaceous. MLA100162 contains sediments deposited in the Late Early Cretaceous, comprising the Toolebuc Formation, and the overlying Allaru Mudstone (Resolve 2018).

Underlying the Toolebuc Formation is the Wallumbilla Formation, the most widespread marine unit within the Eromanga Basin. The Allaru Mudstone is generally 200 – 300 m thick and formed in a shallow to basinal marine setting. The Toolebuc Formation is a widespread cocquinite and underlying oil shale, varying between 6 to 45 m thick basin wide. The unit presents as a vanadium enriched 6 m cocquinite with an average 12 m thick underlying vanadium enriched calcareous oil shale unit within the tenement area.

The vanadium is found within organic compounds (kerogen and vanadyl porphyrins), within clays, and also within pyrites (within the fresh portion of the unit) and associated goethite within the oxidised units (Resolve 2018). In the oxidised rocks, vanadium within the organic compounds is unbound, which typically enhances metalliferous recovery and mining / beneficiation properties of the ore (Resolve 2018). The structural geology within the tenement is benign, with a gentle anticlinal structure on both an east west and north south axis, known as the Saint Elmo Anticline (Resolve 2018).

11.6.3.1 Waste

The principal objective of processing minerals extracted is to maximise vanadium ($V_2O_5$) from native ores. Waste will be produced as a by-product of the processing loop. The expected waste types and quantities generated during processing is summarised in Table 11.4. These quantities have been based on an average production of 10,000 tpa of saleable product. The management of these wastes are addressed in Table 11.7.

<table>
<thead>
<tr>
<th>Extracted Material</th>
<th>Annual Weight (tonnes per annum)</th>
<th>Annual Volume (m$^3$)</th>
<th>Disposal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Topsoil and subsoil</td>
<td>1,000,000</td>
<td>670,000</td>
<td>▪ Temporarily stockpiled adjacent to the pit; and ▪ Will be used for rehabilitation once the pit has been backfilled.</td>
</tr>
<tr>
<td>Overburden</td>
<td>24,000,000</td>
<td>16,000,000</td>
<td>▪ Temporarily stockpiled adjacent to the previous mined pit; and ▪ Will be used to back fill the previously mined pit.</td>
</tr>
<tr>
<td>Ore (total)</td>
<td>2,989,857</td>
<td>2,114,369</td>
<td>▪ Transported for processing in the MIA.</td>
</tr>
</tbody>
</table>

Processed Ore

Table 11.4: Processing Waste
<table>
<thead>
<tr>
<th>Extracted Material</th>
<th>Annual Weight (tonnes per annum)</th>
<th>Annual Volume (m³)</th>
<th>Disposal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beneficiation rejects (washed rock post scrubbing).</td>
<td>1,611,404</td>
<td>1,074,269</td>
<td>Returned to the mine pit and used for backfill.</td>
</tr>
<tr>
<td>Processing tailings rejects (includes floatation reject, sulphuric acid (H₂SO₄), filter cake).</td>
<td>1,279,644</td>
<td>947,885</td>
<td>Transferred to tailing storage facility.</td>
</tr>
<tr>
<td>Solvent extraction rejects (includes silica gel, autoclave filtration cake, caustic soda (NaOH), sulphuric acid (H₂SO₄), aluminium sulphate (Al₂(SO₄)₃), ammonia sulphate (NH₄)₂SO₄, amamine 336.</td>
<td>98,809</td>
<td>959</td>
<td>Transferred to the evaporation pond; and Solids will remain in-situ.</td>
</tr>
</tbody>
</table>

11.6.3.2 Waste Geochemistry Characterisation

**Block Modelling**

For the purpose of conducting block modelling for the Project, historic data and collection of bulk samples totalling 100 tonnes of material from and adjacent to the Toolebuc Formation for metallurgical was undertaken.

Drill holes were imported into Micromine geological modelling software, including a header (collar) file, a geology file and an assay file. Standard checks were carried out on the data, including cross section review, production of thickness and grade isopaches to test for anomalies, and database checks including collar height checks, identifying duplicate holes and depth overlaps.

A reference surface was constructed and extrapolated to the limits of the tenement to reflect the interpreted local geology. Thickness models for the coquina and the Allura Mudstone were built on a 50 m grid spacing (inverse distance squared (IVD²) interpolation method was used), stacked on top of the reference surface and then cut by the soil and the topography, for which a 1 arc second (SRTM) dataset was used.

Resolve acknowledged that these datasets are inaccurate by comparison to a LiDAR survey, however given the extremely flat nature of the terrain over EPM 26410, it was not thought that the use of a lesser quality topographic model would be a material detriment to the reported confidence levels.

All drill hole collars were registered to the topography before modelling proceeded. The basal shale unit of the Toolebuc Formation is not commonly drilled through into the unit below. A 15m thickness was assumed. Grades of key elements were estimated into the block model using an inverse distance...
The model was then cut by a base of weathering wireframe before resources were extracted from the oxide layer and the limited fresh coquina.

The Project will develop a Geo-environmental Block Model (GBM) to differentiate this environmental model from the geology, ore and resource block model(s). The GBM will include the overburden in the regolith units such as topsoil, sub-soil, and the underlying extremely weathered to partially weathered geological units above the groundwater table down to the deepest mined surface. If interburden occurs between ore bodies, then this would also be included in the GBM.

The goal of the GBM is to achieve stable and safe constructed mined landforms that have self-sustaining vegetation and rehabilitation outcomes that are non-polluting. To achieve this goal a mine must identify, mine and place material that requires active management into the most appropriate location and reinstate a soil profile on the mined landforms that has the biogeochemical properties and functions of the pre-mined land.

The detail and level of reliability in the GBM is dependent on the geological and geochemical data that has been compiled and will continue to be compiled from Q4 2019 to end of Q2 2020 and then beyond that over the life of mine (refer to Appendix 27 – Mine Material Management Plan).

Tailings static and kinetic geochemical testing

In 2019 Wave International Pty Ltd (Wave) engaged RGS Environmental Pty Ltd (RGS) to supervise the static geochemical analysis of the following (five) samples. These samples were used to provide the two samples that are being subjected to kinetic leach column (KLC) testing.

- 3 x fractions of bulk calcite rejects Coquina Comp 1 (received by ALS 1st April 2019) that included:
  - Coquina Comp 2 +4mm
  - Coquina Comp 2 -4+0.3mm
  - Coquina Comp 2 -0.3mm Cyc #1 52 UF;
- 1 x bulk Calcite Rejects Coquina Comp 2 (sent to ALS 12 June 2019); and
- 1 x Bulk Calcite Rejects 2 Roasted - H₂SO₄ Leach Residue – Neutralisation (sent to ALS 24th June 2019).

RGS has completed 3 x weekly leach cycles and 2 x monthly leach cycles on 2 x KLC samples that include:

- KLC#1: Composite of the 3 x fractions of the bulk calcite rejects Coquina Comp 1; and
- KLC#2: bulk calcite rejects Coquina Comp 2.

RGS (2019) state all samples are classified as acid consuming and will leach mildly alkaline to neutral pH water. The static testing results also verified that the potential for acid drainage from the tested samples
is very low (improbable) (RGS, 2019). RGS conclusions are based on their supervision the static geochemical analysis of the five samples, including two samples that are being subjected to kinetic leach column (KLC) testing.

A summary of results from this testing are provided below:

- The hydrogen ion concentration (pH) of all samples are mildly alkaline at pH 7.8 to 8.5;
- The sulfide concentrations of all samples are very low ranging from < 0.005 to 0.01 percent verifying the materials have a very low potential to oxidise and produce acid;
- All samples have very high acid neutralising capacity (ANC) ranging from 825 to 942 kg H2SO4/t;
- All samples are classified as Acid Consuming (AC) and are determined to leach mildly alkaline to neutral pH water. This is a positive finding for the tailings assessment;
- The EC of the samples are very low ranging from 102 to 183 μS/cm. Furthermore, the TS concentrations of 0.02 to 0.05 percent verify the potential for saline drainage dominated by SO42- is also very low;
- The total elemental content was measured using the ALS MEMS41 method (2 acid aqua regia digest). The total elemental content can be compared to the soil concentrations to evaluate if the enrichment has the potential to adversely affect soils in the receiving environment or water resources;
- The concentration of elements of environmental concern such as arsenic, cadmium, cobalt, copper, lead, and zinc are all in the same range of concentrations as the median values of Australian soils;
- The concentration of elements of environmental concern such as arsenic, cadmium, copper, manganese, molybdenum selenium and zinc are all elevated above the median values of Australian soils, suggesting there may be some potential for water quality issues associated with the mining and placement of these materials;
- The 1:3 (solid to water) 16-hour water soluble leach test is a selective leaching procedure that is used to quantify the concentration of each element that may be susceptible to being leached from the sample by water for a single leach event;
- The pH and EC results verify the samples are circum-neutral and have very low salinity (102 to 183 us/cm);
- The results also verify that the water-soluble elemental content is very low for the major cations (Ca, Mg, K and Na), major anions (Cl, F and P) and major, minor and trace elements (metal(loids));
- Static geochemical testing on the 4 Coquina samples verifies the following:
  - Total sulfur in the 4 Coquina Comp and Calcite Rejects samples is 0.02 to 0.05 percent
  - The ANC is very high > 825 kg/tonne
  - The samples are AC and should not produce acid
  - Total elemental assay concentrations are low/very low; and
The kinetic leach column results for the two KLC samples verify the materials are AC and produce leachate that is mildly alkaline, with low salinity and low metalloid concentrations. RGS (2019) note that the results of their analyses are limited to the samples tested and cannot be used to infer if there may be adverse environmental impacts from the mining and placement of the materials into shallow pits or tailings dams (see Appendix A27 – Mine Material Management Plan, for further information). RGS (2019) states this uncertainty will be addressed through the design and implementation of a geochemical and physical sampling and analysis program that achieves the following:

- Prior to mining to:
  - Characterise the potential for acid, neutral or alkaline pH and saline and metalliferous drainage (collectively referred to as AMD) in mine impacted water or natural water sources
  - Predict under the proposed placement and disposal strategy the quality of runoff and seepage generated concerning potentially environmentally significant effects including salinity, acidity, alkalinity and dissolved metals, metalloids and non-metallic inorganic substances
  - Identify dispersive and non-dispersive spoil and the salinity, acid and alkali producing potential and metal/metalloid concentrations of waste rock and tailings;

- Following material extraction to:
  - Verify encapsulation and/or placement of potentially acid-forming and acid-forming waste rock and tailings has been done in a manner that can limit the potential for adverse environmental harm
  - Verify the requirements and methods for decommissioning and final rehabilitation of the placed materials, including the prevention and management of AMD, erosion minimisation and establishment of vegetation cover has been done in a manner that can limit the potential for adverse environmental harm; and

- Following rehabilitated to:
  - Comply with Contaminated Land legislation under the EP Act and provide a Site Investigation Report prior to applying for progressive rehabilitation certification; and
  - To ensure that the land is suitable for its final land use.

RGS have prepared a Mine Material Management Plan (MMMP) that outlines the geochemical and physical characterisation, classification and management over the life of mine for the Project. The MMMP stipulates what actions are to be undertaken by Multicom during all phases of the Project i.e. pre-construction, during construction, decommissioning and rehabilitation. Refer to Appendix 27 – Mine Material Management Plan for further detail.
11.6.3.3 Waste Characterisation Sampling Program

An ongoing geochemical and physical sampling and analysis program will be carried out by Multicom Resources to further define and characterise the reject materials as mining progresses. The physical sampling and analysis program will be completed prior to the commencement of mining activities:

- Characterise the potential for acid, neutral or alkaline pH and saline and metalliferous drainage (collectively referred to as AMD) in mine impacted water or natural water sources;
- Predict (using robust conceptual and numerical modelling methods) under the proposed placement and disposal strategy the quality of runoff and seepage generated concerning potentially environmentally significant effects including salinity, acidity, alkalinity and dissolved metals, metalloids and non-metallic inorganic substances; and
- Identify dispersive and non-dispersive spoil and the salinity, acid and alkali producing potential and metal/metalloid concentrations of waste rock and tailings.

In addition, the geochemical and physical sampling and analysis program will continue to be completed after material is mined and placed into storage areas to:

- Verify encapsulation and/or placement of potentially acid-forming and acid-forming waste rock and tailings has been done in a manner that will limit the potential for adverse environmental harm; and
- Verify the requirements and methods for decommissioning and final rehabilitation of the placed materials, including the prevention and management of AMD, erosion minimisation and establishment of vegetation cover has been done in a manner that will limit the potential for adverse environmental harm.

Finally, the geochemical and physical sampling and analysis program will be completed after material is rehabilitated to:

- Comply with Contaminated Land legislation under the EP Act and provide a Site Investigation Report prior to applying for progressive rehabilitation certification; and

To ensure that the land is suitable for its final land use.

11.6.3.4 Disposal

Tailings Storage Facility

A tailings storage facility (TSF) will be constructed within the MIA to contain reject material generated during the mineral processing phase. Reject material that is not used for backfilling of voids, will be dewatered and deposited in the tailings storage facility.
To minimise the risk of potential seepage, the TSF will be constructed with a compacted clay liner that has a hydraulic permeability of less than $1.0 \times 10^{-9}$ m/sec.

The sizing of the TSF is based on annual estimated production rates provided in Table 11.4. These volumes and a 25-year life of mine, the maximum storage volume required in the TSF is calculated as follows:

$$947,885 \text{ m}^3 \times 25 \text{ years} = 23,697,125 \text{ m}^3$$

The TSF will be sized to accommodate this volume of material. To facilitate progressive rehabilitation and minimise the footprint of the facility, the TSF will comprise of five individual cells, as shown in Figure 11.4. Each individual TSF cell will have the following minimum dimensions:

- Surface area of 29 ha;
- Depth of 25 m;
- Side wall slopes of 1V to 3H (19 percent gradient); and
- Volume of 4,739,425 m$^3$ (excluding volume for compacted clay liner and clay capping)

The anticipated characteristics of the reject material are that they will be fine, being classified as a medium plasticity silty clay. The TSF will be encapsulated with a compacted clay layer that achieves a hydraulic conductivity of less than $1.0 \times 10^{-9}$ m/s. Therefore, the tailings and liner are effectively acting as a low permeability barrier. The clay used for lining the TSF will be sourced from the shale that is underlying the coquina. Once a TSF cell has been filled with reject material, it will be capped and rehabilitated, and the subsequent TSF cell will commence receiving reject material.
Figure 11.4
Tailings Storage Facility and Evaporation Pond Layout and Cross Section

Legend
- MLA100162
- 50m Buffer
- Mining Footprint
- Mine Infrastructure Area
- Evaporation Pond HDPE Liner
- TSF Compated Clay Liner

Cross Section A-A through Evaporation Pond and Tailings Storage Areas

Data Source:
Multicom Resources Limited
Evaporation Pond

An engineered evaporation pond will be constructed within the MIA to capture decanted liquor produced in tailings storage facility. The evaporation pond sizing has been based on the annual estimated production rates (refer to Table 11.4) and will have the following minimum dimensions:

- Surface area of 12 ha;
- Depth of 3 m;
- Side wall slopes of 1H to 3V (19 percent gradient); and
- Volume of 313,555 m³.

In addition to the above dimensions, the pond will be designed and constructed to achieve a 95 percent compaction and will be vegetated to help bind soil. Evaporation ponds have very large surface areas that are designed to efficiently evaporate water by sunlight and exposure to the ambient temperatures.

Solvent extraction rejects will be transferred to the evaporation pond once dewatered solids have been removed and disposed of to the TSF. The pond will be lined with a geomembrane (HDPE) to allow for storage of highly saline solvent extraction rejects. The geomembrane liner will have an equivalent hydraulic conductivity to compacted clay (1.0 x 10⁻⁹ m/sec). Importantly, the permeability of the geomembrane liner will not be impacted by the salinity of the reject material.

11.7 Waste Management Strategy

Waste management strategies will be outlined in the Project’s CEMP and OEMP and will be prepared using the waste and resource management hierarchy principles as outlined in the WRR Act:

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

The following waste management principles will be incorporated into the Project’s Environmental Management Plans however, a review will be conducted prior to the commencement of works to identify additional principle that may need to be added:

- The waste storage area will be allocated within the Mine Infrastructure Area (MIA) and will include a dedicated section for general waste, recyclable waste and regulated wastes;
- Waste storage areas will be clearly labelled designating what wastes are to be deposited into the storage area and any specific directions / hazards;
- To assist in the collection and transfer of regulated wastes, designated regulated waste bins, drums and skips will be used. Where possible these regulated waste storage containers will be located at the location where the waste is being generated (i.e. workshop) and then returned to the designated regulated waste storage areas for storage prior to offsite disposal and/or recycling;
- Dedicated regulated waste storage areas will be provided to prevent the mixing of regulated wastes with other stored material or with incompatible hazard classes. A dangerous goods segregation chart will be made available in every storage area containing dangerous goods;
- An inventory will be kept and maintained of all regulated waste stored;
- Where bunding is required, this will be designed in accordance with AS 1940-2017 (Storage and Handling of Flammable and Combustible Liquids) or appropriate Australian Standard;
- Loading and unloading of waste will take place within the waste storage area;
- Where vehicular access is required to a bunded area, such as load in and load out areas, the bund will be designed to prevent damage by vehicles accessing these areas as required;
- Sufficient and appropriate clean-up equipment (spill kit) will be provided together with appropriate instructions and training;
- Cleared vegetation must be stockpiled for re-use. Weed material must be kept separate from stockpiles and stored in a way that prevents the spread of weeds e.g. bagged and binned and removed off site; and
Waste that cannot be reused on site, will be collected by a licensed waste transporter and records of transportation and disposal methods will be retained on site.

11.7.2 Waste Avoidance / Minimisation

To avoid and or minimise the production of waste streams, Project planning will be undertaken to:

- Substitute inputs for activities that generate waste;
- Increase the efficiency in the use of raw material, energy, water or land;
- Redesign processes or products;
- Improve the maintenance and operation of equipment;
- Minimise the amount of material brought onsite to satisfy the waste management objectives and reduce costs associated with the Project;
- Purchase in bulk where appropriate and practicable to reduce the amount of packaging waste and costs; and
- Return excess materials such as drums, buckets and used chemical containers to the supplier or other local users for reuse where possible.

11.7.3 Waste Reuse

The Waste Reuse Principles to be adopted on the Project include, but are not limited to the following:

- Identifying materials for reuse purpose (e.g. green waste = mulching, treated effluent = irrigation, dust suppression);
- Segregating materials at the source of generation to facilitate reuse;
- Storing, or reusing those items, either onsite or offsite, during the process if economical to do so; and
- Consideration will be given, during supplier selection as to the type of materials used for packaging by the supplier for products needed on the Project.

A Sewage Treatment Plant (STP) will be constructed within the MIA to treat effluent from amenities onsite. The STP will be sized to cater for the estimated peak construction and operational workforce of 250 persons. In accordance with the management direction within the Queensland Model Mining Conditions, treated effluent will be trickle and spray irrigated over designated landscape areas within the MIA or used for dust suppression in the overburden dump areas when water quality requirements are met.
11.7.4 Waste Recycling

Recycling is a process involving the collection and separation of waste materials that are transformed into useable products. The management measures to be implemented for general and recyclable waste will be to:

- Identify materials for a recycle purpose development and implementation of a waste recycling program;
- Implement and maintain a waste stream inventory identifying the type, classification, storage, transport and disposal requirements for the waste;
- Erecting signage to encourage the reuse and recycling of recovered waste material;
- Regular inspect waste storage area to ensure waste management measures are being adhered to; and
- Regularly provide training in the principles of the waste hierarchy to all personnel handling wastes.

Current market demands for recyclable waste products and opportunities to minimise the waste to landfill are discussed in Table 11.5.

### Table 11.5: Market Demand for Waste

<table>
<thead>
<tr>
<th>Waste</th>
<th>Marketability</th>
<th>Potential Customers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scrap metal</td>
<td>Scrap metal industry</td>
<td>Scrap metal recycling companies</td>
</tr>
<tr>
<td>Paper and cardboard waste</td>
<td>Paper and cardboard can be recycled into other products such as packaging, toilet paper and egg cartons.</td>
<td>Numerous waste recycling operators</td>
</tr>
<tr>
<td>Waste oils</td>
<td>The Gladstone oil re-refinery is the only plant in Queensland and expected to process 100 per cent of Queensland waste lube oil (Southern Oil 2015).</td>
<td>Southern Oil – Gladstone Facility.</td>
</tr>
<tr>
<td>Lead acid batteries</td>
<td>Recycling is the only safe solution for lead acid batteries.</td>
<td>Numerous battery recyclers throughout Queensland.</td>
</tr>
<tr>
<td>Decommissioned equipment</td>
<td>Demand will differ depending on the pricing cycle of the resource sector and needs of other operations. Scrapping and recycling opportunities would be considered for non-operating equipment or equipment with little resale opportunity.</td>
<td>Other mining operations and supporting services. Scrap material merchants throughout Queensland and broader Australia.</td>
</tr>
</tbody>
</table>

The Project will contract a principal waste service provider who will be licensed to remove all non-processing/non-mining waste streams, the fate of the material will be discussed with the contractor to ensure recycling opportunities are being embraced within the current market.

11.7.4.1 Natural Resource Use Efficiency

To maximise natural resource use efficiency and minimise waste production the following will be implemented within the Project area where feasible:

- Cleared vegetation (weed-free green waste) during construction will be stored and used for rehabilitation;
- Water demand to be minimised through onsite treatment and recycling of water from sewage treatment plant, oil water separator and overland flow that has been treated to meet water quality objectives;
- Overburden and reject material to be reused in land stability and contouring to minimise landscape and visual amenity impacts; and
- Disturbed areas will be progressively rehabilitated as soon as practicable.

11.7.5 Waste Storage

To efficiently manage waste streams, solid waste will be separated before transportation to the appropriate facility. Co-mingled recycle and general waste bins will be strategically located around site to enable easy segregation and recycling at the point of use or waste stream generation. The locations for waste separation and storage include the:

- Designated waste storage area within the MIA;
- Site workshop;
- Crib rooms; and
- Administration buildings.

Commercial waste receptacles (skip bins, wheelie bins) will be provided by the licensed waste contractor and will have appropriate colouring and labelling to identify the waste stream for the container. It is anticipated that the following receptacles and vehicles may be used for waste storage and transportation:

- Liquid wastes (effluent, grease trap, oily water) – will be removed using liquid vacuum tankers;
- Co-mingled recycling – front lift commercial bins and the loose waste removed using a front lift truck;
- Scrap metals – skip bin removed by truck;
- Timber – skip bin removed by truck;
- General waste – front lift commercial bins and the loose waste removed using a front lift truck; and
- Construction, demolition, industrial and mining wastes – skip bin removed by truck.

Separate waste bins for general waste, cardboard, scrap metal and co-mingled recycling will be provided in the waste storage area.

11.7.6 Waste Removal

Wastes that cannot be reused or recycled, will be transported by a licensed waste transport contractor to facilities that have the capacity and capability to accept the material. Such arrangements will be
established prior to the commencement of construction, under commercial agreements with the facility operators.

Waste removal principles for the Project will include:

- Preparation of a schedule for the collection or emptying of waste receptacles will be established prior to the commencement of works e.g. standard weekly collection by licensed waste contractor;
- Wastes will be removed from by licensed contractors for reuse, recycling and or disposal to a licenced facility e.g. landfill;
- Local truck routes will be chosen for environmental acceptability and to minimise disruption to the residents along the routes; and
- All trucks are to be covered and have their wheels cleaned before departing the work site, to ensure that no waste residue is deposited on public roads.

McKinlay Shire Council have four waste facilities listed on the Queensland Government website and are provided in Table 11.6.

### Table 11.6: McKinlay Shire Council Landfills

<table>
<thead>
<tr>
<th>Name and Address</th>
<th>Phone</th>
<th>Coordinates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Julia Creek Recycling and Waste Management Facility</td>
<td>(07) 4756 7166</td>
<td>-20.647954, 141.732667</td>
</tr>
<tr>
<td>Old Normanton Road, Julia Creek 4825</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kynuna Landfill</td>
<td>(07) 4756 7166</td>
<td>-21.580861, 141.906969</td>
</tr>
<tr>
<td>Landsborough Highway, Kynuna 4823</td>
<td></td>
<td></td>
</tr>
<tr>
<td>McKinlay Landfill</td>
<td>(07) 4756 7166</td>
<td>-21.281551, 141.307464</td>
</tr>
<tr>
<td>Landsborough Highway, McKinlay 4823</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nelia Landfill</td>
<td>(07) 4756 7166</td>
<td>-20.663408, 142.208559</td>
</tr>
<tr>
<td>Nelia-Bunda Road, Nelia 4823</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The waste contractor will hold appropriate licences/permits for the transport of waste and with appropriately designed vehicles, tanks and containers.

#### 11.7.6.1 Trackable Wastes

The EP Regulation requires the tracking of ‘trackable wastes’ listed in Schedule 11. Trackable waste produced by the Project are identified in Table 11.2.

All identified trackable wastes are required to be accompanied by a Waste Transport Certificate and there is a requirement for a licensed waste transporter to collect and dispose of the waste utilising the appropriate DES procedures. A register will be developed and maintained for all regulated wastes generated on site. It will include the following details:

- Source of waste;
- Type of waste;
• Quantity of waste;
• Storage location and details;
• Dates of collection;
• Date of disposal/recycling; and
• Name and details (including licencing details) of transporter and facility used to dispose the waste.

The relevant DES forms will be completed in line with the requirement under EP Regulation. The nominated waste contractor will be required to provide a report outlining all the previous with the end disposal details.

11.7.7 Regulated Waste

Regulated waste is defined under section 42 and 43 of the EP Regs as waste that:

• Is commercial or industrial waste; and
• Is of a type, or contains a constituent of a type, mentioned in Schedule 9, part 1, column 1.

A review of activities to be undertaken on the Project was conducted against Schedule 9, part 1, column 1 of the EP Regulation. Regulated waste produced by the Project are identified in Table 11.2.

The management strategies to be implemented are, but not limited to the following:

• Use of biodegradable and nonhazardous materials where options are available;
• Efficient use of consumables, including chemicals, oils and lubricants;
• Separation and storage of regulated waste will be within the MIA, in facilities designed to meet the Australian Standard (AS) 1940-2017 *The Storage and Handling of Flammable and Combustible Liquids* Guideline;
• Service and maintain equipment to increase operational efficiency;
• Consider and anticipate ‘end of life’ for Project materials and return excess materials such as drums, buckets and used chemical containers to the supplier or other local users for reuse where possible;
• Spill containment material and spill kits will be in areas where liquid waste is stored and handled;
• Training in spill response will be conducted for all relevant employees; and
• Portable toilet facilities will be used until the permanent facilities are constructed. Once the permanent facilities are operational, all sewage and septic effluent waste will be treated onsite and any residual removed by a licensed contractor. A detailed sewage treatment system design will be prepared prior to construction commencing on the Project. Effluent management will be detailed in the Project’s CEMP and OEMP.
### 11.7.8 Training and Education

Multicom will work toward creating a culture of waste minimisation throughout all Project phases, through education and regular monitoring of waste management practices. All site personnel will be trained in the following areas via the site induction and on-going training sessions:

- Waste management principles and waste hierarchy;
- Waste streams produced from Project activities;
- Ways to minimise wastes;
- Recognise which types of materials are recyclable;
- Waste segregation;
- Spill response procedures; and
- Awareness of their obligations to use recycling facilities provided on site including impacts of poor waste management.

To increase waste management awareness onsite, information promoting good waste management principles will be displayed throughout the Project site offices and waste storage area.

### 11.7.9 Social Responsibility

Multicom will carry out waste management in a manner that will have the most benefit to minimising impacts on local community resources. This includes:

- Liaison with the waste contractors, local councils and other relevant groups to determine existing and future capacities and accepted waste types of landfills, and where required assist with the planning of expansion and upgrade of landfills to ensure wastes generated from the Project can be accommodated;
- When sourcing waste contractors, some preference will be given to businesses employing sustainable waste management practices, amongst other selection criteria; and
- Multicom will work with local businesses so that they can take advantage of opportunities for reuse and recycling.

### 11.8 Qualitative Risk Assessment

To ensure that potential impacts on land values are managed, a qualitative risk assessment has been included in Table 11.7. The assessment considers the relative frequency and magnitude of impacts discussed in previous sections together with the risk they pose to the construction, operation and decommissioning of the Project, as well as the rehabilitation of the site. The residual risk following application of proposed mitigation measures has been identified and described. The risk assessment method used is provided in Chapter 19 – Risk Assessment.
### Table 11.7: Qualitative Risk Assessment – Waste Management

<table>
<thead>
<tr>
<th>Hazard</th>
<th>Potential Impacts</th>
<th>Risk Rating</th>
<th>Mitigation Measures</th>
<th>Residual Risk Rating</th>
</tr>
</thead>
</table>
| Storage and disposal of general waste (e.g. putrescible, recyclable) | • Increased pressure on existing waste infrastructure. Reduction in landfill capacity and increased use of resources;  
• Cross-contamination of waste streams;  
• Increase in pest (mosquito, mice) numbers resulting in potential human health issues (e.g. mosquito borne illnesses);  
• Inappropriate storage and disposal of wastes, messy and unkept storage area, uncontrolled ignition sources, intentional ignition; and  
• A fire in the waste storage area could result in health impacts from the emission of toxic gases, damage to surrounding infrastructure and place the safety of workers in danger from smoke inhalation or burns. | Moderate (6) | • Waste disposed at local facilities will be subject to the disposal fees to assist Council or private operators managing infrastructure capacity;  
• Dedicated waste storage area within the Mine Infrastructure Area;  
• General housekeeping maintained and regular collection service to assure there is no overflow of bins;  
• Training and education on litter and waste management;  
• Regular checks surrounding work sites and main trafficable roads for levels of litter and clean ups if required;  
• Regular inspection of waste storage areas;  
• Waste segregation and dedicated bunded waste storage areas; and  
• Smoking areas will be provided with specific butt bins. | Low (2) |
| Fuel Storage | • Spills resulting in the contamination of soil; and  
• Injury. | Moderate (6) | • Fuels will be stored in accordance with AS 1940:2017;  
• Emergency Response Plan will be developed in consultation with emergency services;  
• Where possible, firefighting equipment will be placed near any flammable or combustible waste material; and  
• Safety signage (e.g. NO SMOKING) will be placed on and or near fuel containers. | Low (3) |
| Storage of regulated wastes | • Spills resulting in the contamination of soil. | High (12) | • Specific waste bins and bunding will be used to isolate waste liquids, chemicals and hazardous wastes;  
• Minimal quantities will be kept on site;  
• Empty drums and other storage containers will be stored sealed and in bunded areas; | Moderate (9) |
<table>
<thead>
<tr>
<th>Hazard</th>
<th>Potential Impacts</th>
<th>Risk Rating</th>
<th>Mitigation Measures</th>
<th>Residual Risk Rating</th>
</tr>
</thead>
</table>
| Disposal of regulated waste                     | Breach of legislative requirements for incorrect disposal.                       | Moderate (6)| - Containers will be reused or recycled where possible;  
- An inventory of safety data sheets for hazards substances will be maintained;  
- Licenced contracts will be engaged to regularly remove waste to the appropriate facility; and  
- Spill kits will be available close to areas where chemicals are being used or kept. | Low (4)             |
| In-pit disposal of reject material (processed and not processed) | Chemical residue in material resulting in contamination of soil.                   | Moderate (6)| - Reject material that has not been through processing will be re-used for filling of voids;  
- Reject material that has been through processing will be stored in the Tailings Storage Facility (TSF) and tested prior to its re-use so the correct disposal method can be confirmed;  
- Training and education on the disposal methods for various waste streams to be utilised across the Project;  
- Labelling and strategic placement of bins to be carried out across the site;  
- Using vehicles that are fit for purpose; and  
- Enforce speed limits;                                      | Low (4)             |
| In-pit disposal of reject material (processed and not processed) | Groundwater contamination from interaction with in-pit disposed reflect.           | Low (2)     | - Impervious clay lining in the TSF; and  
- Regular monitoring of onsite bores to confirm if changes in parameters being measured has occurred.                                                                                                        | Very Low (1)         |
11.9 Conclusion

Waste will be generated during the construction, operation and decommissioning phases of the Project. The waste management hierarchy for the Project follows a framework for prioritising waste management practices to achieve the best environmental outcomes possible.

The waste streams have been characterised based on preliminary planning and design documentation during the Construction and Operational phases of the Project, with appropriate management measures determined. Based on these waste management measures it is anticipated the majority of waste generated will be beneficially reused within the various functions of the Project. Where outputs cannot be reused, opportunities to recycle will be maximised, with sufficient facilities located within the region able to accept wastes that will need to be disposed of offsite. It is therefore unlikely waste generated as a result of the construction and operational phases of the Project will create a significant impact on the existing environmental values.

11.10 Commitments

Multicom’s commitments, in relation to Project waste are provided in Table 11.8.

<table>
<thead>
<tr>
<th>Commitments – Waste Management</th>
<th>How Commitment will be Implemented</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preparation of Project Environmental Management Plans e.g. Construction Environmental Management Plan (CEMP) and Operational Environmental Management Plan (OEMP) prior to commencement of works.</td>
<td>Management plans will be prepared by Multicom and provided to their contractors for implementation. A compliance auditing and inspection program will be undertaken to confirm the requirements of the plan are being met.</td>
<td>▪ Reduced risk of environmental harm occurring; and ▪ Compliance with statutory approvals.</td>
</tr>
<tr>
<td>RGS have prepared a Mine Material Management Plan (MMMP) that outlines the geochemical and physical characterisation, classification and management over the life of mine for the Project.</td>
<td>Requirements outlined in the MMMP will be incorporated into the projects CEMP prior to commencement of works. The MMMP will be reviewed prior to commencement of Operation. Amendments will be incorporated into the projects OEMP.</td>
<td>▪ The MMMP provides Multicom with strategies for the management of mined material and waste streams so that the potential for adverse environmental effects is minimised to a tolerable and agreed level.</td>
</tr>
<tr>
<td>Waste characterisation sampling program will be prepared and implemented.</td>
<td>An ongoing geochemical and physical sampling and analysis program will be carried out by Multicom to further define and characterise the reject materials as mining progresses.</td>
<td>▪ Better management of waste streams produced during mineral processing phases; and ▪ Correct storage of these waste streams i.e. TSF and or Evaporation Pond.</td>
</tr>
<tr>
<td>A geochemical and physical sampling and analysis program will be carried out on mined material.</td>
<td>Samples of rock will be obtained directly from the mined rock / ore following placement in the stockpile area.</td>
<td>▪ Verify encapsulation and/or placement of potentially acid-forming and acid-forming waste rock and tailings has been done in a manner that will limit the potential for adverse environmental harm; and ▪ Verify the requirements and methods for decommissioning and disposal.</td>
</tr>
<tr>
<td>Commitments – Waste Management</td>
<td>How Commitment will be Implemented</td>
<td>Outcome</td>
</tr>
<tr>
<td>------------------------------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Waste management strategies will include the waste and resource management hierarchy principles as outlined in the WRR Act 2011.</td>
<td>A waste management program will be prepared and implemented by site personnel. Regular training will be provided to site personnel.</td>
<td>Reduction in waste being generated and disposed to landfill.</td>
</tr>
<tr>
<td>Flammable and or combustible liquids will be stored in accordance with AS 1940:2017.</td>
<td>During all phases of the Project, compliance audits will be conducted to confirm integrity of storage equipment is adequate and complies with AS 1940:2017.</td>
<td>To minimise the potential for contamination to land as a result of a spill.</td>
</tr>
<tr>
<td>Wastewater will be treated and re-used for irrigation and or dust suppression.</td>
<td>A suitably qualified person will prepare the sewage treatment plant design.</td>
<td>Reduced volume of waste going to local council sewage treatment plants.</td>
</tr>
</tbody>
</table>
| Identify waste operators in the McKinlay and Mount Isa to allow for the offsite disposal of waste from the site. | Prior to commencement of works, commercial agreements (where applicable) will be established with McKinlay Shire Council, Mount Isa City Council and licensed waste transporters for the collection and disposal of waste from the Project site. | - Correct disposal of waste to licensed facilities; and  
- Compliance with applicable components of waste legislation.                                                                       |
| Implement a recycling program with the aim of recycling all waste materials that have some value and where recycling options are available. | Implement a recycling program.                                                                                         | Reduced volume of waste going to landfill.                                                                                              |
| Waste management training for Project personnel.                                               | Waste management training will form part of site inductions.                                                            | Create a culture of waste minimisation through education.                                                                               |
11.11 References


DES 2019, Guideline – Application Requirements for Activities with Waste Impacts (ESR/2015/1836), Version 5.00, Department of Environment and Science.

RGS 2019, Waste Characterisation Report, RGS Environmental Pty Ltd.