ENVIRONMENTAL IMPACT ASSESSMENT

KENMARE MOMA
TITANIUM MINERALS
PROJECT IN MOZAMBIQUE

FRAMEWORK
ENVIRONMENTAL
MANAGEMENT PLAN

Prepared by:
Coastal & Environmental Services
P.O. Box 934
Grahamstown
6140
South Africa

Prepared for:
Kenmare Resources P.L.C.
Chatham House
Chatham Street
Dublin 2
Ireland

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1. INTRODUCTION

1.1 LEGAL REQUIREMENTS

This document meets the requirements of the Environmental Law of Mozambique (Decree 76/98 of 29 December 1998) and the principal recommendation of the Environmental Impact Assessment (EIA) undertaken for the Kenmare Moma Titanium Minerals Project.

Chapter V of the Environmental Law of Mozambique (Decree no 76/98 of 29 December 1998) states that an environmental license is required for new projects, and a condition thereof involves an evaluation of the impacts of the development on the environment by means of an EIA, as well as the management of these impacts in an Environmental Management Plan (EMP).

This document describes the strategy for the environmental management of the Kenmare Moma Titanium Minerals Project. It should be noted that a separate EIA process is currently underway assessing a transmission line from Nampula to the mine site.

1.2 PURPOSE AND SCOPE

This EMP represents a statement of intent by Kenmare Resources plc (hereafter “Kenmare”) and outlines the company’s commitment to reduce the significance of potential negative impacts and enhance the significance of potential positive impacts associated with the proposed Kenmare Moma Titanium Minerals Project. The majority of the mitigatory measures or recommendations required to address these impacts are presented in the Environmental Impact Report (EIR).

This EMP addresses the activities associated with the design, construction and operation of:

- Dredging;
- Process plants;
- Tailings dam;
- Operational support infrastructure; and
- Materials handling (including conveyor, jetty, barge and shipping).

1.3 BACKGROUND TO THE PROJECT

Kenmare, an exploration and mining company based in Dublin, Ireland, has been involved in developing a titanium mineral sands project in north-eastern Mozambique for over 10 years. In the 1990s Kenmare identified and explored further deposits in the coastal regions from Moma town to Mogincual. One of the sites showed significant mineralisation and is located north-east of the town of Moma, at 16°30’S, 39°40’E, hereafter referred to as the Moma titanium minerals deposit.

Kenmare is proposing to develop a heavy mineral sands mine and processing operation in the Moma district of Nampula Province in northern Mozambique. Final products will consist of ilmenite, a titanium mineral used in the pigment industry, with co-products zircon and rutile, all of which are expected to be sold to overseas markets.

The proposal recommends that mining be carried out using a dredge to mine relatively low grade sandy material to a maximum depth of 40m below current land surface. The sands will...
be treated firstly through a spiral concentrator plant to reject the bulk of the waste (sand, silt and clay) and produce a heavy mineral concentrate (HMC). Thereafter, the HMC is transferred to a mineral separation plant where the individual ilmenite, rutile and zircon products are separated. Roasting will be necessary for upgrading of one of the ilmenite products stream to meet market specifications. The products will be stored on site and then transferred by conveyer to a jetty for loading into a barge and subsequent transhipment to ocean-going vessels. Markets for the products are situated in the USA, Europe and Asia. The proposed process is summarised in Figure 1.3a.

**Figure 1.3a:** Mining process diagram.

Kenmare previously completed a pre-feasibility study into developing a mining and processing operation, with a positive economic outcome. Subsequently, it commissioned a Definitive Feasibility Study (DFS), which covers all aspects of the project, including a detailed assessment of the impact the operation would have on the local environment and people. The DFS was completed in February 2001, and indicated a positive economic outcome. DFS addendum work was subsequently commissioned in three separate areas, namely waste disposal optimisation, resizing of the roaster and provision of a power line to link with the national electricity grid. The addendum was completed in July 2002 and ongoing work continues for detailed design.

Kenmare envisages commencement of project construction early 2003, following completion of financing and product market negotiations. It is anticipated that operations would commence towards the end of 2004. The project is described in more detail in Chapter 3.
2. PROCESS AND STRUCTURE OF THE ENVIRONMENTAL MANAGEMENT PLAN

2.1 ENVIRONMENTAL MANAGEMENT PROCESS

The generally accepted world best practice sequence for implementation of environmental management processes associated with large projects is:

1. **Pre-feasibility Environmental Assessments:** These are undertaken to identify critical environmental issues that could be regarded as fatal flaws.

2. **Environmental Impact Assessments (EIAs):** These are traditionally carried out at project level and are used to identify and assess potential impacts and mitigation measures.

3. **Environmental Management Plans (EMPs):** These are traditionally used to identify, implement, maintain and monitor detailed mitigation measures aimed at reducing/managing the potential impacts during all phases of a project (*viz* design, construction and operation).

4. **Environmental Management System (EMS):** This is aimed at ensuring that the environmental aspects associated with the operational phase of a project are effectively managed and monitored.

5. **Closure and Rehabilitation Plans (CRPs):** These outline the procedures required to close and rehabilitate an operation once activities have ceased.

The following environmental studies have been undertaken for the Kenmare Moma Titanium Minerals Project:

- Pre-feasibility Environmental Assessment (March 1999)
- Environmental Impact Assessment (Submitted to MICOA in November 2001)
  - Volume 1 - Scoping and Terms of Reference Report
  - Volume 2 – Specialist studies Report
  - Volume 3 – Environmental Impact Report
  - Volume 4 – Summary Report
  - Volume 5 – Comments Report and associated specialist studies
- Environmental Management Plan (this document)

2.2 ENVIRONMENTAL MANAGEMENT PLAN DEVELOPMENT

This EMP is based on an approved format and builds on the findings of the EIA undertaken for the Kenmare Moma Titanium Minerals Project, and provides a framework to ensure that:

- Recommendations contained in the EIA are put into effect timeously in order to manage impacts (e.g. during the design, construction and operation of the project).
- Outstanding issues from the EIA are addressed and resolved.
- Assumptions contained in the EIA are tested and verified.

Therefore this EMP identifies the required mitigation measures that are needed in order to reduce negative impacts and enhance positive ones. It ensures that all mitigatory measures and recommendations identified during the EIA, and post-EIA, are incorporated into a single

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1 Operational EMPS are commonly known as Environmental Management Systems.
document so that they can be considered during the various phases of the project (i.e. design, construction, operation and decommission). These mitigatory measures will be the responsibility of a number of people, for example the proponent and their consultants, authorities, contractors and environmental consultants.

This EMP is designed to ensure that Kenmare and their contractors are aware of the environmental responsibilities that they have, and that MICOA has a clear record of the standards and intentions of Kenmare’s environmental programme, against which they can be held accountable. Specifically this EMP is designed to ensure that:

- During project design, all mitigatory measures identified during the EIA, that could be incorporated into the design of the project, are considered during the detailed design phase.
- During construction, all constraints, restrictions and actions required to minimise construction impacts are implemented.
- During commissioning and operation, detailed operating procedures are developed so that all constraints, restrictions and actions required to minimise impacts caused by commissioning and operation are developed, implemented and monitored for all areas. These will form part of an operational EMS based on the ISO\textsuperscript{2} 14001 framework.
- During the life of the project Kenmare will continue to enhance positive impacts and ensure mitigation for negative impacts. An important component of this is the monitoring, evaluation and communication of findings and adherence to the principle that Kenmare through the EMPs and EMS will strive for continued improvement.

An important point to note is that the project is continually developing and therefore the specific and detailed technical and procedural requirements for achieving the proposed mitigation measures outlined in the EMP will also continue to be developed. Therefore provision is made for the evolving nature of the project without compromising its environmental management requirements. The EMP described in this document is therefore part of a larger environmental management programme, which will continue to evolve as the project develops, and will be reviewed internally, updated periodically and audited externally.

Part of this ongoing environmental programme (see Figure 2.2a) will be to produce a specific construction EMP which will contains the specific directives to Kenmare and their contractors in the form of Environmental Action Plans (EAPs). These EAPs provide the specific detail for managing construction issues and can only be concluded during final design of the project. During the construction phase an operational EMP (also termed an EMS) will be finalised for the operational phase. Finally during the operational phase a Closure and Rehabilitation Plan (CRP) will be finalised and submitted to MICOA for approval.

\textsuperscript{2} The International Organisation of Standards (ISO) developed the ISO 14001 framework in order to certify Environmental Management Systems and standardise their application.

\textsuperscript{3} It should be noted that rehabilitation is an ongoing activity and is therefore covered in the Construction EMP and Operational EMS as well as the Closure and Rehabilitation Plan.
Figure 2.2a: Outline of Kenmare ongoing environmental programme\(^4\).

\(^4\) It must be noted that while there are specific deliverables the programme should be seen as a dynamic process with ongoing liaison between the environmental and technical managers.
3. PROPOSAL FOR MINING

3.1 MINING OPERATION

3.1.1 MINERAL RESOURCES

The Moma deposit forms part of a sequence of near-coastal sand dunes extending from Kenya to the Richards Bay area in South Africa. The geology of the area has been clearly defined, based on extensive drilling, and consists of a series of unconsolidated fine to medium grained sands and silty sands, with local clay units. Potentially economically valuable heavy mineral (VHM) grades occur on the surface of specific sand units in two adjacent areas, Namalope Flats and Tupuito High Dunes. Mineralisation above 2% is of potential economic interest, although the typical grade range is 3-6% HM. The HM assemblage consists primarily of the valuable heavy minerals ilmenite, minor zircon and rutile (roughly 85%, 5% and 2%, respectively), and exhibits little variation within and between the units.

The area of the Namalope Flats and High Dunes deposits is approximately 25km². Total resources within this area were estimated at nearly 700 million tonnes averaging 4.5% HM above a 3% HM cut-off grade. Reconnaissance drilling has shown that potential exists for additional deposits to the south-west.

Total proved and probable reserves within the dredge path design were estimated at: 407.46 million tonnes @ 4.33% HM, 6.63% slimes and 1.04% oversize. This is sufficient to produce approximately 615 000 t/a (tonnes per annum) of ilmenite, 24 000 t/a zircon and 12 500 t/a rutile for 20 years, from an average of 22 million t/a of ore.

3.1.2 DREDGE MINING

Geotechnical and hydrological studies have demonstrated that the Moma deposits can be mined using a bucket wheel suction dredge operating in a mining pond. Pond sizes of 400m wide x 700m long are proposed, with a minimum mining depth of 5.5m and a maximum of 10m below pond water level. The dredge operates by cutting sand at the working face and transferring this sand by means of a suction pump and pipe to the concentrator floating behind the dredge. Mining will average 3 000 tonnes per hour of ore.

3.1.3 VEGETATION CLEARING AND REHABILITATION

Prior to mining, vegetation will be cleared and topsoil removed to a depth of 200mm and stored adjacent to the mine path to assist in subsequent rehabilitation. The amount of clearing will be limited to no more than the area required for mining in the following year, and will vary from 0.5km² to 2.5km², depending on the thickness of the deposit in different areas.

Following mining of a particular dredge pond, the pond will be filled with tailings from the floating concentrator to a level at or slightly above the pre-existing land surface. Thereafter, the tailings will be contoured, covered with a layer of slimes material (clay rich <45 micron material), and the top layer mixed with previously stored topsoil to produce a better water-retaining, more fertile substrate for vegetation than existed previously. The rehabilitation will be completed by fertilising and seeding with a variety of native species.

Trials are required to determine the combination of plants most suitable for rehabilitation of the mining area, which will include both native fauna and food crops. Kenmare intends to
establish a nursery area to investigate the optimum conditions and plants for rehabilitation of the area.

The total area to be affected by the mine, processing plant and associated infrastructure is approximately 2,748 hectares, as shown in Table 3.1a and Figure 3.1a, of which the mine path is 2,500 hectares. Given that clearing, mining, tailings disposal and land rehabilitation can be completed in a 5 to 6-year cycle, approximately one-third of the mining area or 800 hectares will not be available for agricultural purposes at any one time. However, infrastructure areas can be rehabilitated only after closure of the operation. Note that a second slimes dam, occupying 300 ha, lies within the boundary of the mine area.

Table 3.1a: Disturbed areas over the life of the mine.

<table>
<thead>
<tr>
<th>Item</th>
<th>Area (Hectares)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mine – Dredge</td>
<td>2,500</td>
</tr>
<tr>
<td>Initial slimes dam</td>
<td>200</td>
</tr>
<tr>
<td>Dry plant/shed</td>
<td>10</td>
</tr>
<tr>
<td>Overland conveyor/road</td>
<td>2.2</td>
</tr>
<tr>
<td>Accommodation village</td>
<td>7</td>
</tr>
<tr>
<td>Red silty sand quarry</td>
<td>3</td>
</tr>
<tr>
<td>New access roads</td>
<td>20</td>
</tr>
<tr>
<td>Borefield</td>
<td>3</td>
</tr>
<tr>
<td>Jetty head</td>
<td>0.25</td>
</tr>
<tr>
<td>Landing area</td>
<td>0.5</td>
</tr>
<tr>
<td>Other infrastructure</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2,747.95</strong></td>
</tr>
</tbody>
</table>

3.2 **PROCESSING**

3.2.1 **CONCENTRATOR**

The concentrator will receive all mined material from the dredge as a slurry. This material is directed through a pair of trommels where oversize particles are rejected back to the pond. The undersized material passes through an agitated surge tank, where the majority of the slimes-sized (<45 microns) material is separated, before being treated at an average rate of 2,810 t/h over a series of six stages of spirals. These spirals separate HM from lighter waste particles due to the contrast in densities between heavy minerals (density generally >4) and typical sand and slimes particles with densities <3. The series of spirals allows for preparation of high grade concentrate with minimal waste particles.

The product, which contains approximately 95% HM, will be pumped to stockpiles at the dry plant, where it is dewatered prior to subsequent treatment. The water is then pumped back to the dredge pond. The waste product slurry from the spirals is treated as described in Section 3.5.

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5 Included in the mine area are the second slimes dams.
**Figure 3.1a**: General layout of the mine site and associated infrastructure.

### 3.2.2 MINERAL SEPARATION PLANT

At the mineral separation plant, stockpiled HM is fed to a dryer at a rate of up to 120 t/h. After drying, the HMC stream is treated through a complex series of stages to separate the saleable products, namely ilmenite, zircon and rutile, from the remaining waste. Essentially, this is accomplished by magnetic separation (to recover ilmenite), with the non-magnetic fraction undergoing further treatment by electrostatic separation to produce rutile (a non-conductor). The conductor fraction is further treated by size classification and density separation to yield zircon, and the remainder being considered as a waste product, is returned to the dredge pond or tailings area along with other reject streams. The zircon product will be put through a hot acid leach circuit to enhance the marketability of the product.

A portion of the ilmenite stream contains unacceptably high levels of chromite. This material, possibly as much as 330 000 t/a, will be retreated by heating to >500°C for a short period,
after which it will be cooled and then it will pass through another magnetic circuit to complete the separation.

3.2.3 PRODUCT STORAGE

All products are transferred by conveyors to a shed adjacent to the dry plant, where they are stored in separate compartments to await shipping. Total capacity of the storage shed will be 145,000t, equivalent to about 12 weeks of production.

3.3 TAILINGS DISPOSAL AND REHABILITATION

Tailings disposal
The great majority of the waste material comprises sand, silt and clay particles removed in the concentrator stage. Essentially these can be sub-divided into sand tailings (>45 microns) and slimes (<45 microns), which are collected in a series of hoppers at the back of the floating concentrator.

Disposal of sand sized particles is straightforward, these being pumped either to a floating boom stacker towed behind the concentrator or land lined, and deposited by means of cyclones and high pressure sprays at the rear of the dredge pond. Minor quantities of sand are piped ashore and utilised in construction of slimes dam walls and water retaining berms.

Disposal of slimes material is more difficult, given the propensity for this size fraction to remain in suspension for a long period. A minor proportion of slimes can be incorporated between sand grains within the sand tailings, although this quantity seldom exceeds 1.5%. Consequently, the bulk of the slimes will be pumped to one of two thickeners where partial dewatering will be undertaken, with addition of very minor quantities of reagents to promote thickening. The slimes will be thickened to 25% by weight of solids and then the majority pumped from the thickeners to slimes dams for final deposition. A proportion of the thickened slimes product will be pumped to shallow paddocks on top of the sand tailings, where it will be dried to assist in rehabilitation.

A slimes dam will be constructed off the deposit to accept slimes from the early years of mining, while allowance has been made for a second slimes dam in rehabilitated ground in the mining area, closer to the operation. The footprint of the initial dam will be 2,000 x 950m, and will be designed and built by a professional engineers and contractors to meet international standards. The footprint of the second slimes dam has been conservatively estimated to be 2,150 x 1,750m. (The second dam comprised 2 dams. The initial dam will be incorporated into the second dam once the area has been mined out) However, experience gained in the initial years of operation should allow waste handling methods to be refined, which may lead to a reduction in the size of the second slimes dam.

Rehabilitation
The tailings deposition is required to have a 500mm cap of well mixed clay rich material to favourably assist the revegetation process. A sand/slimes/topsoil rehabilitation layer is to be formed on top of the sand deposition after levelling and contouring. The rehabilitation layer slimes material will be sourced from thickener underflow slimes, while the sand will be primarily from the stacked sand tailings. The topsoil will be sourced from previously removed and stockpiled material.
Step 1 – Dry cell formation
A sequence of shallow drying cells will be designed and constructed on the mine tailings deposition area. The drying cell design details are yet to be finalised and each area will need to take into account the specific area topography. Wall sizes and placement will vary according to the specific landform of the local area. The slimes will be pumped directly from the underflow of either thickener and deposited into the drying cells.

Step 2 – Initial mix
After drying, ~135mm slime deposition in the cells is plough mixed into the underlying 165 mm of sand with a dual row articulated deep disc to a depth of 300 mm towed by a D8 dozer. After some further natural drying, a 200mm layer of topsoil is deposited with scrapers onto the initial rehabilitation mixture.

Step 3 – Fertilising
A dose of ground conditioning fertiliser as well as lime and/or gypsum will be applied where required. The conditioner is to be applied with a spreader on top of the topsoil prior to the secondary mix occurring.

Step 4 – Secondary mix
A D8 dozer and dual disc plough is also used for this secondary mix. The secondary mix will plough to a depth of ~400mm in a one pass operation that will mix the topsoil with the initial sand / slime material. This surface thus prepared will form the seedbed ready for normal revegetation processes to proceed.

The target for the rehabilitation layer is 15% clay in the solids.

3.4 PRODUCT TRANSPORT AND SHIPMENT

The mineral products will be conveyed overland for nearly 3km to the head of a jetty where they will be loaded onto a custom-designed barge for transhipment to an ocean-going vessel.

The conveyor system will cross an area of both temporary and permanent wetland on a raised roadway, which will also provide access between the beach and the dry plant. This roadway will follow relatively high ground as far as possible and will include extensive culverting to permit natural water flows. It will initially be 12m wide to accommodate movement of large items from the beach during construction. The conveyors will be fully enclosed to contain any spillage.

The jetty will extend for approximately 720m out to sea to access minimum water depths of 7m at lowest astronomical tide for safe movement of a barge. Product is transferred to a custom-built 4 000 DWT self-propelled, self-unloading barge which motors 10km to an off-shore mooring, where product is transhipped to ocean-going vessels.

Ships are expected to include 20 000 DWT and 40 000 DWT vessels. Continuous loading of a 20 000 DWT vessel is expected to be completed in 2.4 days, but some down-time will occur due to high seas, strong winds or rain.

Mineral products are expected to be sold under long term contracts and shipped to customers located in Europe, Asia and the USA.
3.5 WATER SUPPLY

A hydrological investigation has identified a major aquifer lying beneath the site. At the base of this aquifer over the southeastern portion of the site is a coarse grained sand and gravel horizon that exhibits a high transmissivity. The groundwater flow is from the north across the site to the sea in the south, and it is proposed to locate the borefield between the dredge mining area in the north and the sea which lies some 3 kms to the south.

The groundwater surface across the site is very flat beneath the Namalope Flats and rises in elevation up into the Tupuito Uplands. While the plan area of direct recharge to the borefield area is approximately 12 km$^2$, it is evident that any drawdown in the borefield area will cause recharge to occur from well outside the limits of the 12 km$^2$ area and the effective area of recharge to the borefield to increase very significantly.

A conservative estimate of 26 000 m$^3$ per day of recharge will be available under average rainfall conditions in the 12 km$^2$ area for abstraction in the borefield area without affecting groundwater “in storage”. The estimated water balance for the groundwater system has largely been based on the make-up water requirement for the mining operation and the natural recharge to the groundwater system that flows directly through the borefield area. The groundwater system will, however, also be recharged by water losses from the sand tailings placement and seepage from the pond. Thus a significant portion of the daily mining make-up water will, in fact, be recycled in the groundwater system.

The hydrologists are confident that the groundwater system will support the mining operation. Ongoing investigations in the form of the development of a full groundwater model will however be used to further increase the confidence of the existing data set.

3.6 INFRASTRUCTURE

3.6.1 INTRODUCTION

A large number of on-site support facilities are required for the operation of the project, ranging from a workshop and administration office to the accommodation village and waste treatment and disposal facilities. Key areas are summarised in the following sub-sections.

3.6.2 ROADS

The main access road to Pilivili village will be realigned and upgraded to support significantly increased traffic. In addition, a substantial road will be constructed across the wetlands to the beach, both to allow movement of equipment and materials during the construction phase and to allow continued access to the jetty thereafter. Other roads will be constructed for access to the accommodation village, borefield and airstrip, while semi-permanent roads will be built to allow access to the mining areas, tailings disposal sites and other infrastructure.

Roads will be constructed of silty sands and gravel found in several parts of the licence area, with an initial borrow pit identified close to the dry plant site.

3.6.3 FUEL SUPPLIES AND STORAGE

At this stage, heavy fuel oil is the primary fuel being considered for use in HMC drying and roasting. Diesel will be used for heating, mobile plant and back-up power supply etc. Both
fuels will be delivered by small tanker direct to the jetty and will be pumped to fuel storage tanks in the mineral separation plant compound, for distribution to the various operating areas. Anti-pollution equipment will be kept on hand to contain and recover any spillages at the jetty, in accordance with best operating practices.

Three fuel storage tanks will each carry a maximum of 3 000t, which will be sufficient to meet the operation’s needs for up to 4 months of continuous operation of the roaster and the back-up power station depending on tank configuration. These tanks will be bunded to retain all fluids in the event of tank failure.

3.6.4 AIRSTRIP

An airstrip has been established near the project site, but upgrading and equipping will be required during project implementation. The airstrip is 100m wide and 1 100m long at an elevation of 57 A.M.A.L. It will cater for day navigation of small aircraft used for transport of operations personnel.

3.6.5 ADMINISTRATION AND SUPPORT FACILITIES

The administration and support facilities will be located close to the dry mill and product storage shed. The facilities will consist of the following buildings:

**Administration Office**

The administration office of approximately 500m$^2$ will be located within the dry mill perimeter fence line just inside the main gates. The building will be sub-divided into individual self-contained offices to house administration, technical and management personnel, as well as computers and communications facilities. The office will be provided with fully ducted air-conditioning and will be fully furnished and equipped.

**Amenity Building and Training Centre**

This building will provide a training/instruction room, showers and change/locker room and dining area.

**Medical centre**

This building will comprise a treatment room and a small sick bay for those confined to bed. The office will house the duty medical officer plus records and other equipment. It will be air-conditioned and fully equipped with furniture, medical equipment and teaching aids.

**Laboratory**

A laboratory will be located in close proximity to the dry mill and administration building. The building will be approximately 290m$^2$, and will be fully equipped for day to day operation of the plant with provision for X-ray fluorescence, heavy media, slimes and wet chemical assay facilities.

**Workshop/Store**

The workshop will be located near the dry mill with easy access to vehicles. The building will be approximately 1 250 m$^2$ and will be used to undertake routine maintenance of vehicles, process plant equipment and other infrastructure. Dividing bays will be provided for heavy vehicles, light vehicles, welding and machining, and electrical works. An overhead crane will be included for the boiler making and maintenance area.

A lockable store will be accessible from front and rear and will provide storage space for wear parts and insurance spares, inclusive of high maintenance parts and consumables.
the covered store will be an open air storage yard that will be used for heavy parts. The workshop will be fully equipped with hand and machine tools, rigging equipment, vehicle hoists, storage shelving and consumables such as cutting tools, welding rods, etc.

**Gatehouse**

All access to the dry mill area, administration office and other infrastructure buildings at the plant will be via the gatehouse. This will afford a single entry point to the project area for directing workers and visitors and maintaining security. This building will contain amenities and offices for security personnel, and will be attached to a plant entry/exit turnstile and boom gate.

**Communications**

A satellite system will be implemented at the project site for telephone, data and facsimile communications to service mining operations and infrastructure support services.

### 3.6.6 ACCOMMODATION VILLAGE

All senior administrative, technical staff and skilled labour will require permanent housing. A new housing development will be established near the project site. Unskilled project employees will be recruited from the surrounding villages. These employees will live in their respective villages.

In addition to staff housing, there will be a recreation complex and a meals area for local employees. Access to the housing development will be by roads formed with clayey gravels.

### 3.6.7 SEWAGE AND WASTE HANDLING FACILITIES

Self-contained sewage treatment systems will be provided for the process plant and accommodation village. The plant will comprise a below ground FRP tank and pumping station, aerobic treatment unit, agitated aeration tank and sludge disposal to a sludge digestion pond. Waste liquid will be piped to the tailings pond.

Solid wastes will include materials from the workshop, laboratory and domestic sources. A solid waste disposal facility will be provided, including a lined area for non-inert material.

Liquid wastes such as laboratory effluent and surface run-off from the plant and workshop areas may contain potential pollutants. Such effluents will be collected in sumps and treated in the appropriate fashion to avoid release to the general environment.

### 3.6.8 POWER SUPPLY

Power requirements for the project total some 20 megawatts, principally to power the dredge, concentrator, waste disposal pumps and mineral separation plant. It is intended that this will be sourced from the national grid by means of a 110 kV overhead transmission line from the existing sub-station at Nampula. An on-site diesel fuelled power station will be constructed to supply back-up power to the project in the event of power outages. This will be sited in the vicinity of the mineral separation plant.

Power will be distributed to the mining operation, borefield, accommodation village, slimes dam and tailings areas by overhead transmission line, and by underground cabling to the dry plant and administration area.
3.6.9 EMPLOYMENT

During operations, the project initially expects to employ a workforce of 426 people, including 43 expatriates, 124 skilled Mozambicans from outside the Moma area (security people be will recruited from outside and are not considered skilled), and 259 local semi-skilled and unskilled people. A training programme will be implemented aimed at improving the skills of Mozambican personnel who are expected to replace as many as 27 expatriates after the first two years of operations.

The establishment of local small businesses and co-operatives to supply essential needs of the project will be encouraged through the formation of a semi-autonomous Development Foundation, which will also identify opportunities to develop local infrastructure on a sustainable basis.

3.7 CHANGES TO THE PROJECT DESIGN SINCE THE EIA

3.7.1 RATIONALE AND REASONS FOR CHANGES

Good environmental practice dictates that the environment should be considered in the project design from its inception. The Kenmare Moma Titanium Minerals Project is an example of this philosophy being implemented successfully. The first environmental studies were conducted at the pre-feasibility stage and were subsequently built on in the scoping and full EIA phases. This approach ensured that cognisance of the environment was taken at the start of the process and resulted in important recommendations being implemented early on, e.g. the Icuri Evergreen Forest was excluded from the mine path and the transhipping point was moved away from the island. While this interactive approach between the proponents and environmental consultants allows for the development of a more sensitive development, it does mean that the design will change slightly from time to time.

Since the EIA was completed, additional test work has resulted in modifications to the preferred mining method, tailings disposal and power supply. The EIA identified these possible changes and evaluated a range of scenarios in terms of mining method and tailings disposal, viz. dry and dredge mining and the traditional slimes handling approach versus a co-disposal option. The addendum to the Detailed Feasibility Phase has been completed and this has resulted in a number of changes to the project description. The sections below outline the changes and the possible implications they will have on the biophysical, economic and social environments.

3.7.2 DREDGE VERSUS DRY MINING

Section 3.3 of Volume 3 of the Kenmare Moma Titanium Minerals Project EIA outlined the proposed combined dredge mining and dry mining scenarios as they were envisaged at that stage of the project. Subsequent technical and financial investigations established that dry mining is not a suitable mining method and the entire area will now be dredge mined.

Environmentally the implications of this operation are slight and can be summarised as follows:

1. There will be less heavy machinery in the area, resulting in less risk in terms of accidents involving the local population and mine workforce.
2. There will be a reduction in the generation of dust as dredge mining results in less dust in comparison to dry mining.
3. There will be a reduction in the level of noise and vehicle emissions as the number of large vehicles will be greatly reduced.

In synopsis, the change in design from a combination of dry and dredge mining to only dredge mining is unlikely to have any additional adverse impacts on the environment and may result in the reduction of the severity of some of the negative impacts.

3.7.3 TAILINGS DISPOSAL

Section 3.5 of Volume 3 of the Kenmare Moma Titanium Minerals Project EIA outlined the two principal options initially assessed, viz. co-disposal and traditional disposal. A technical review of the two options proposed has resulted in a traditional disposal method being selected. While the co-disposal scenario has the benefit of returning all the slimes to the tailings, it would have been restricted to areas with a fines fraction of less than 6%. It was also felt that the risk of slimes re-entering the pond was too great.

The new tailings disposal option should not have a significant effect on the rehabilitation of the land as the 500m rehabilitation layer stipulated in the EIA will still be implemented. The new option will, however, result in a substantial increase in the size of the proposed tailings dams which are expected to be 2 000 x 1 000 x 10m and 2 000 x 2 000 x 10m. The impact that these tailings dams will have on the environment is negative and is primarily orientated around the following issues.

1. **Loss of productive land beneath the slimes dams** – The area beneath these dams is effectively lost to the local populous. The initial slimes dam is however located on an area which was not suitable for agriculture, and the second is within the mine area and located on a traditionally unfertile area on the Namalope Flats. While this impact has increased since the initial EIA, it is not regarded as being significant.

2. **Loss of groundwater recharge** – The slimes dams will result in an impermeable layer of the footprint of the dams, which will result in a localised decrease in the recharge of the aquifer. In terms of the size of the aquifer, this impact is not considered to be significant.

3. **Impact on wetlands and surface water bodies** – The Moma deposit is surrounded by the Larde floodplain, edaphic coastal wetlands and a vegetated high dune area. These parameters leave little space for the placement of slimes dams. The larger slimes dam will be on the Namalope Flats within the mine area but the initial slimes dam will be off the mine path. The slimes dam location is on an area covered by secondary savannah and moist grassland. However the foot of the slimes dam will be close to the wetland that runs parallel with the frontal dune system. The loss of secondary savannah is of low significance as it has already been impacted upon and is plentiful in Nampula Province. The impact on the wetlands is of greater significance due to the important ecological activities which occur in these ecosystems and the high conservation profile they enjoy. A number of mitigatory measures have been implemented to reduce any impacts, e.g. any scour produced by the spill way will be obviated by chutes, reno mattresses and energy dissipating structures. While impacts on wetlands in terms of water quality may be significant, locally the habitat is very common from Angoche all the way to Quelimane, and is therefore of less regional significance. While this impact is of significance, it does not warrant jeopardising the entire project. Rigorous design mitigation, monitoring protocols and rehabilitation must, however, be undertaken.

4. **Impact on local people** – Slimes dams, if incorrectly managed, can result in significant impacts on people through high levels of dust, visual impacts and
catastrophic failure. The dams have been designed by Davies Lynn and Partners, who are practised engineers with experience in this field. In addition, the entire project was reviewed by SRK (UK) Limited as part of a due diligence process. The dams have been designed to stringent safety regulations and have taken into consideration local environmental factors such as slope angle, reinforcement of walls, geotechnics, precipitation levels and flooding etc.

The issue of dust can be significant if not managed, but if dust levels are regularly monitored and standard mitigatory actions such as wet suppression and re-vegetating are implemented, dust can be controlled. Specific mitigatory actions are contained in the EMP tables (see Appendix A). While this impact is of high significance, it is still felt that the overall benefits of the project outweigh the negatives. Rigorous design mitigation, monitoring protocols and rehabilitation must however be undertaken.

3.7.4 POWER SUPPLY

In section 3.8.8 of Volume 3 of the Kenmare Moma Titanium Minerals Project EIA it was initially thought that power from the main grid would only become available at the end of the second year of operations. The original mine design had diesel as the primary fuel being considered for use in power supply, heating, mobile plant etc, and heavy fuel oil for drying and roasting. This would be delivered by small tankers direct to the jetty and would be pumped to fuel storage tanks in the mineral separation plant compound, for distribution to the various operating areas.

The EIA conducted on the Moma Titanium Minerals Project (CES 2000) indicated that there would be a number of possibly significant impacts associated with the use of diesel for the mining operation. The most significant impacts were:

- Possible shipwreck and consequent damage of important coral reefs and other nearshore habitats.
- Terrestrial soil and ground water contamination through leaking storage facilities.
- Production of air emissions by the diesel generators.

Further financial and technical investigations, post-2000, indicated that the use of diesel powered generators for the initial 2 years of operations as the only power source posed too much of a risk to the project. These risks are around the cost of the power and possible downtime due to diesel supply and ongoing generator maintenance.

The industry norm for power supply for this type of operation is from a national or provincial power grid. The environmental risks in conjunction with the financial and technical constraints associated with diesel generators has resulted in this option being discarded as being viable at this stage. A separate EIA and EMP is currently being undertaken on the power line and this is due to be completed in early 2003.

It should be noted that while the main power source will be from the national grid, there would still be back-up generators. However, as these generators will only be for back-up purposes, significantly less diesel than originally planned will be required.
4. THE AFFECTED ENVIRONMENT AT MOMA

4.1 BRIEF DESCRIPTION OF THE BIOPHYSICAL ENVIRONMENT

4.1.1 CLIMATE

The climate is sub-tropical with hot summers and warm to hot winters, and is influenced by the warm Mozambique current. Two distinct seasons are distinguishable, the rainy season and the warm dry season. The rainy season usually commences abruptly in December and extends to April. About 75% of the total annual rainfall occurs during this period, causing hot, humid conditions. Annual rainfall at Quelimane (about 300km south-east of Moma) is almost 1400mm, but in the project area is likely to be about 200mm less. The warm dry season at the coast extends from May to November. Only the months September and October are truly “dry” at the coast. Periodic cyclones sweep the Mozambique Channel during this period, occasionally reaching the coast and bringing very heavy rainfall.

4.1.2 GEOLOGY AND GEOMORPHOLOGY

The area is characterised by a prograding coastline with numerous geological and geomorphological features. These features include a Pleistocene weathered ancient dune deposit that forms a prominent topographic ridge (The High Dunes), coastal plain and alluvial/paralic deposits, migratory dunes and accreted beach/dune complexes.

The study area is divided into four geomorphological features, viz. the Frontal or Beach Dunes, the Coastal and Estuarine Flats, the Namalope Flats and the Tupuito and Tebani High Dunes.

4.1.3 GROUND AND SURFACE WATER

Groundwater is essentially contained in a single aquifer, and has a high recharge rate as the sands are highly permeable and there is relatively little surface runoff. The groundwater resource is large enough to supply the needs of both the remaining local population and the mining operation. The Coastal and Estuarine Flats are normally completely flooded during the second half of the wet season. The valleys have eroded down to the normal groundwater level, forming bogs and wetlands, which are primarily freshwater systems. Running water is only encountered close to the outlet of the rivers onto the Coastal and Estuarine Flats.

The groundwater is acidic with a pH of between 5 and 6, and has a low hardness. Together these factors imply that the water can be expected to be corrosive. The water has a low electrical conductivity, and low absolute concentrations of sodium (Na⁺) and chloride (Cl⁻), and therefore there is no evidence of brackish or saline conditions. The groundwater facies is Sodium-Chloride-Bicarbonate.

The surface water bodies contain acidic water with a low electrical conductivity. Acidity in some bogs in spring areas of rivers arising in the High Dunes is as low as pH 4.5.

4.1.4 SOILS AND LAND USE

A limited range of soil occurs in the area, because the parent material is exclusively arenaceous sediment with little weatherable mineral material. The dominant soil forms in the project area are Fernwood (the grey and pale brown sands), Hutton (red sands) and Clovelly (the brown sands with yellow subsoil).
The soils of the area are generally very infertile. However, most of the Moma area has been cultivated in the traditional shifting cultivation pattern of rural Africa, resulting in a mosaic of exotic and indigenous fruit trees and crops with little of the original indigenous woodland and forest remaining. The high temperatures limit the potential for livestock in the area.

4.1.5 VEGETATION

The vegetation within the study area is generally widespread in Nampula Province, and has been classified into eleven different plant communities. These are Dune scrub, Wetlands, Moist grasslands, Swamp, Open secondary savannah, Secondary savannah, Dry thicket, Cashew woodland, Miombo woodland/forest, Coastal evergreen forest and the Wetland mosaic. The slash-and-burn agriculture has had a great impact on the natural vegetation and much of the important flora and vegetation of the region has been lost due to human population pressures in the region.

4.1.6 MARINE AND ESTUARINE ECOSYSTEMS

The immediate area around the concession area has one large estuary (Larde Estuary), which has a low species diversity in comparison to other mangrove estuaries in tropical regions and contained no species of special concern. The fish fauna in the freshwater wetlands is relatively depauperate and lacks threatened or endemic species. The nearshore and beach environment has a diverse ichthyofauna. The coral reefs associated with Caldeira and Nojovo islands are located 10 km off shore and have a rich biodiversity.

4.1.7 FAUNA

The fauna of northern Mozambique is one of the most poorly studied in Africa and there are limited conservation areas for the protection of the fauna. None of the amphibian species which occur in the area are on international lists of threatened species, but five sea turtle species are listed as threatened in the Red List and four additional reptiles are listed in CITES legislation. Four species of birds which are listed as ‘Locally Threatened’ in southern Mozambique due to habitat destruction or hunting occur in the Moma region and appear to face similar threats. Local subsistence hunting and habitat destruction has over a long period of time caused an almost total loss of large mammals and a substantial loss of overall mammalian diversity.

4.1.8 NATURAL RESOURCES

The Pilipi (Miombo) woodland and the Icuri area (Coastal Evergreen Forest) were considered important resources for the communities due to the provision of large trees for housing construction, the large variety of medicinal plants and for the provision of food including fruits and edible mushrooms. Sea turtles, birds, monkeys, porcupines, squirrels and bush pigs, as well as scrub hare and African civet are commonly hunted for food.

The nearshore and coral island fisheries are diverse multi-species fisheries and form a large aspect of resource utilisation. The catches are generally small, but when conditions are right, catches can be very large. The catch from the Larde Estuary is seen as an important source of food to the villages, while the bulk of the catch of the nearshore fishery is sold.
4.2 **BRIEF DESCRIPTION OF THE SOCIAL ENVIRONMENT**

### 4.2.1 HISTORICAL AND CURRENT SETTING – ECONOMIC INDICATORS

Mozambique ended its 18-year post-independence war in 1992 with the signing of the Rome Peace Accord. Prior to this accord the country had been subjected to a violent and protracted war between the armies of Frelimo and Renamo. Thousands of Mozambicans lost their lives, many more fled their homesteads and fields and the country’s economy was devastated. Despite recent growth, the country continues to depend on foreign assistance to balance the budget. The Kenmare project is a major investment into the country. It is anticipated that the project will generate significant export revenues once full production is reached. In addition to the direct returns from the tax base, there will be additional indirect as well as induced economic benefits.

### 4.2.2 PROVINCIAL AND DISTRICT BASELINE DESCRIPTION

The study area for the Kenmare project falls under the administrative authority of the Larde Locality, one of seven localities within the district of Moma, which is the largest of the 21 districts within Nampula Province. Villages in the area are characterised by low levels of service, extremely limited infrastructure and high levels of unemployment. Literacy and skills levels are low. Major activities in the area revolve around subsistence in both agriculture and fisheries.

### 4.2.3 LOCAL BASELINE DESCRIPTION

Larde Locality has five primary schools and no post-primary education facilities. The only health facilities in the local area are at Moma, Larde and Tebani. Moma and Larde both have a hospital and Tebani has a small primary health care clinic. Medical supplies are collected monthly from Moma but generally last only two weeks. Larde hospital has inadequate capacity for the population.

People access drinking water from either hand pumps or open wells. Sanitation comprises of pit latrines located in each homestead. The main road running through the study area joins the Moma/Nampula road; access is generally restricted to 4x4 vehicles and is therefore limited. There are no public or other forms of road transport within and between local villages. No communication infrastructure (postal or telecommunications) exists at the village level and there is also no bulk electricity supply. People rely on natural resources (wood from surrounding areas) for energy. The land within the study area is not supported by a title deed, but rather by traditionally recognised criteria such as historical settlement, familial inheritance, current occupation and cultivation of land.

There is a high dependence on local resources with limited influence from natural resources from further a field. Agriculture consists of slash-and-burn cultivation, with cassava being the dominant crop. Fishing in the Moma district is an important aspect of securing a livelihood. The ownership of boats and nets is seen as a particular status symbol and as the only viable way of making money. There is an intricate trading network between the five villages in the study area, which is dependent on social networks. Fish is exported locally and other goods traded include those that are locally produced, like furniture, mats and baskets.

There are no formal employment opportunities for local residents apart from those employed by Kenmare. Some people are self-employed in the informal market sector, but the majority of the population is unemployed and involved solely in subsistence activities. The roles and responsibilities within the village are clearly defined along gender lines. Women are...
responsible for the reproduction of the household through agriculture, child-rearing and domestic activities. Men remain dominant in the organisation of civil society and are seen to be the breadwinners. Men are almost exclusively involved in fishing and trade.
5. POLICIES, LEGISLATION AND STANDARDS

5.1 CORPORATE POLICIES

Kenmare will develop detailed company policies that ensure sustainable development and operation, and will to strive to develop the project in a way that meets the needs of the present generation without compromising the ability of future generations to meet their needs.

Corporate policies will include Health, Safety, Environment and Community responsibilities, which will ensure continual improvement in their performance, efficient use of natural resources and avoid or mitigate potentially adverse effects on local communities and the environment. Kenmare’s approach will based on the requirements of internationally recognised standards, and will take into account the policies of the World Bank and the International Finance Corporation.

5.1.1 HEALTH AND SAFETY POLICY

Kenmare’s Health and Safety Policy will seek to ensure the health and safety of the local community, employees and contractors. To fulfil this commitment Kenmare will:

1. Strive to identify and assess potential risks and hazards early and manage them in a way that avoids or mitigates adverse effects.
2. Set targets and objectives that seek to reduce the risk of harm to the community, employees and contractors.
3. Monitor risks and reassess risk, thereby aiming to improve results continuously.
4. Train employees to ensure that they have the right skills and competencies.
5. Develop an emergency response programme / preparedness plan to deal with potential risks.

5.1.2 ENVIRONMENT POLICY

The conservation of the environment is essential for long term sustainable development. Kenmare recognise that their activities have the potential to cause environmental harm, and their aim will be to reduce the impact on the environment over time. To fulfil this commitment Kenmare will:

1. Comply with all current laws, regulations, international conventions and specific license conditions.
2. Apply the precautionary principle approach to environmental management in order to ensure opportunities for environmentally sustainable development.
3. Set environmental standards and targets to assess performance.
4. Assess potential impacts and ensure continual improvement by monitoring performance and reassessing targets.
5. Integrate environmental factors into design, construction, operation and decommission.
6. Ensure the protection, maintenance and rehabilitation of the environment.
7. Promote environmental awareness of employees and contractors through training.
8. Develop an emergency response programme / preparedness plan to deal with potential risks.
5.1.3  COMMUNITY POLICY

Kenmare’s community policy will aim to ensure that the local community will benefit from development projects, and that potentially adverse effects on the local populous are prevented or mitigated. Kenmare will ensure that:

1. The project fosters full respect for the community’s dignity, human rights and cultural uniqueness.
2. Employees and contractors act sensitively and respectfully.
3. The local communities do not suffer adverse effects during the project, and that they receive culturally compatible social and economic benefits from the proposed project.
4. Communities are incorporated into the project development process by identifying and addressing their preferences and concerns through consultation and the incorporation of local knowledge into the development.
5. Community development is encouraged and supported.
6. There is no discrimination in employment practices and no forced or child labour.
7. Communities that are unavoidably resettled are compensated.
8. Alternative economies that attract investment and employment are encouraged, so that the post-mining economy is sustainable.

5.2  LEGISLATIVE FRAMEWORK

The legislation applicable to the Kenmare Project is summarised in Table 5.2a and includes:

- The Environmental Act (Law 20/97, October 1, 1997)
- The Land Act (Law 19/97 of October 1, 1997)
- The Water Rights Act (Law 16/91, August 3, 1991)
- The Labour Act (Law 8/98 of July 20, 1998)

As in most countries, environmental law in Mozambique is not integrated in such a way that rights and associated procedures are simplified and rationalised. Separate licensing is required for each of:

- Environmental;
- Mining;
- Land; and
- Water use purposes.

Two legal instruments form the main legislation directly applicable to safety in mining operations:

- The legislative diploma 48/73 of July 5, 1973 on health and safety in working places.
- The ministerial diploma 96/81 of December 16, 1981 on technical safety in underground and surface mining works.

These legal instruments provide details on: the minimum internal safety control; safety of workers and equipment; health protection; uniform and equipment for workers; first aid and other measures in the case of accidents; and labour inspections.
The legal framework for environmental protection in Mozambique is based on policy instruments and internal instructions from MICOA. Currently the granting of an environmental licence is dependent on the completion of an Environmental Impact Assessment and the preparation of an Environmental Management Plan. Accordingly, this EMP meets all legal obligations.

**Table 5.2 a: Legislation applicable to the environmental management of the Kenmare Moma Project.**

<table>
<thead>
<tr>
<th>Mining</th>
<th>Safety</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mining Act Regulation (Decree 13/87 of February 24, 1987 as amended by Decree 53/94 of November 9, 1994 and Decree 21/95 of July 25, 1995)</td>
<td>Decree on labour inspection offices regulations (Decree 32/89 of November 8, 1989)</td>
</tr>
<tr>
<td></td>
<td>Legislative Diploma on health and safety in working places (Legislative Diploma 48/73 of July 5, 1973)</td>
</tr>
<tr>
<td></td>
<td>Ministerial Diploma on technical safety in underground and surface mining works (Ministerial Diploma 96/81 of December 16, 1981)</td>
</tr>
<tr>
<td></td>
<td>Legislative Diploma on professional accidents and diseases (Legislative Diploma 1706 of October 19, 1957)</td>
</tr>
<tr>
<td>Environment</td>
<td></td>
</tr>
<tr>
<td>Environment Act (Law 20/97 of October 1, 1997)</td>
<td></td>
</tr>
<tr>
<td>Regulation on the Process of Environment Impact Assessment Study (approved by Decree Nº 76/98 of December 29, 1998)</td>
<td></td>
</tr>
<tr>
<td>Land Act (Law 19/97 of October 1, 1997)</td>
<td></td>
</tr>
<tr>
<td>Land Act Regulation (approved by Decree 66/98 of December 8, 1998)</td>
<td></td>
</tr>
<tr>
<td>The National Environmental Policy (approved by Resolution of the Council of Ministers 5/95 of August 3, 1995)</td>
<td></td>
</tr>
<tr>
<td>Water Resources Act (Law 16/91 of August 3, 1991)</td>
<td></td>
</tr>
<tr>
<td>Ministerial Diploma on technical safety in underground and surface mining works (Ministerial Diploma 96/81 of December 16, 1981)</td>
<td>Decree on protection against pollution of waters, beaches and coastline in Mozambique (Decree 495/73 of September 20, 1973)</td>
</tr>
<tr>
<td>Decree on protection against pollution of waters, beaches and coastline in Mozambique (Decree 495/73 of September 20, 1973)</td>
<td>Portaria establishing the regulations on the transportation, handling and transit of dangerous cargo in the ports of Mozambique (Portaria 18 891 of September 27, 1965)</td>
</tr>
<tr>
<td>Portaria establishing the regulations on the transportation, handling and transit of dangerous cargo in the ports of Mozambique (Portaria 18 891 of September 27, 1965)</td>
<td>Legislative Diploma on Forests Regulations (Legislative Diploma 2642 of September 20, 1965)</td>
</tr>
<tr>
<td>Legislative Diploma on forests regulations (Legislative Diploma 2642 of September 20, 1965)</td>
<td>Decree establishing rules to protect the soil, flora and fauna in the overseas provinces (Decree 40040 of February 24, 1955)</td>
</tr>
<tr>
<td>Decree establishing rules to protect the soil, flora and fauna in the overseas provinces (Decree 40040 of February 24, 1955)</td>
<td>Draft Internal Administrative Regulations from MICOA named Environmental Regulations on Mining Exploitation and Development of Mineral Deposits in Mozambique (“Regulamento Ambiental sobre Extracção Mineira e Desenvolvimento de Depósitos Minerais em Moçambique”)</td>
</tr>
</tbody>
</table>
The release of effluent requires a licence from ARA-Sul. The Water Act states that it is only permitted if the effluent meets certain water quality standards as set out in the water regulations, but government must also approve any release.

This EMP recognises all legal instruments presently in force in Mozambique. This preliminary legal review will be updated during the annual reviews of the Environmental Management System so as to ensure that it remains compliant with Mozambican legislation.

5.3 ENVIRONMENTAL STANDARDS

Kenmare has adopted the following standards to ensure that the Kenmare Moma Titanium Minerals Project operates to best international standards and practice:

1. Emission standards
2. Sewage treatment standards
3. Noise standards
4. Tailings storage facility safety and design standards
5. Radiation standards

5.3.1 EMISSIONS

The project will comply with South African standards for ambient\(^6\) air quality, and will be designed to meet the ambient air quality levels presented in Table 5.3a.

Table 5.3a: Ambient air quality standards\(^7\).

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Annual Ave (μg/m(^3))</th>
<th>Max. 1 month average (μg/m(^3))</th>
<th>Max. 24 hr average (μg/m(^3))</th>
<th>Instantaneous peak (μg/m(^3))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inhalable particulates</td>
<td>60</td>
<td>-</td>
<td>180 not exceeded more than three times per year</td>
<td>-</td>
</tr>
<tr>
<td>Total Particulate Matter</td>
<td>180</td>
<td>-</td>
<td>300</td>
<td>-</td>
</tr>
<tr>
<td>Sulphur dioxide</td>
<td>79 (0.03ppm)</td>
<td>130 (0.05ppm)</td>
<td>262 (0.1ppm) not exceeded more than once per year</td>
<td>1 571 (0.6ppm)</td>
</tr>
<tr>
<td>Nitrogen oxides</td>
<td>278 (0.2ppm)</td>
<td>416 (0.3ppm)</td>
<td>556 (0.4ppm)</td>
<td>1 946 (1.4ppm)</td>
</tr>
<tr>
<td>Carbon monoxide</td>
<td>-</td>
<td>-</td>
<td>10 000 (9 ppm) (8 hr period only)</td>
<td>40 000 (35ppm)</td>
</tr>
</tbody>
</table>

The project will comply with occupational exposure limits taken from the South African Occupational Health and Safety Act 1993, for H\(_2\)S, SO\(_2\), and NO\(_x\) as given in Table 5.3b below:

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\(^6\) Emissions levels are measured at source (e.g. the stack), whereas ambient levels are measured at various places where the pollutant is deposited (e.g. surrounding vegetation).

\(^7\) Air quality guidelines vary between the World Bank, US EPA and WHO. The suggested standards are the South African standards which in general comply with World Bank Standards.
5.3.2 SEWAGE TREATMENT STANDARDS

The design of the sewage treatment plant will comply with the effluent discharge standards presented in Table 5.3c. These effluent quality limits apply to treated industrial and sanitary effluents discharged to watercourses or which may contact groundwater used for drinking water.

Table 5.3c: Effluent discharge standards.

<table>
<thead>
<tr>
<th>Effluent discharge standards (Max value mg/l)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FACTOR</td>
</tr>
<tr>
<td>---------------------------------</td>
</tr>
<tr>
<td>pH</td>
</tr>
<tr>
<td>BOD₅</td>
</tr>
<tr>
<td>COD</td>
</tr>
<tr>
<td>Total Suspended Solids (TSS)</td>
</tr>
<tr>
<td>Temperature increase</td>
</tr>
<tr>
<td>Soaps, oils &amp; greases</td>
</tr>
<tr>
<td>Residual Chlorine</td>
</tr>
<tr>
<td>Phenol</td>
</tr>
<tr>
<td>PO₄ (as Phosphate)</td>
</tr>
<tr>
<td>Free and saline ammonia (as Nitrogen)</td>
</tr>
<tr>
<td>Sulphide</td>
</tr>
<tr>
<td>Ammonia</td>
</tr>
<tr>
<td>Total toxic metals</td>
</tr>
<tr>
<td>Floatable</td>
</tr>
<tr>
<td>Total Coliforms</td>
</tr>
</tbody>
</table>

5.3.3 NOISE STANDARDS

The World Bank noise standards will be applied for ambient noise levels. Noise abatement measures should achieve either the levels presented in Table 5.3d, or a maximum increase in

Table 5.3b: Occupational exposure limits.

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>24 Hour Mean Normal Operating Limits (mg/Nm³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>H₂S</td>
<td>0.15</td>
</tr>
<tr>
<td>SO₂</td>
<td>0.105</td>
</tr>
<tr>
<td>NO₂</td>
<td>0.15</td>
</tr>
</tbody>
</table>
background levels of 3 dB(A). Measurements are to be taken at noise receptors located outside the project property boundary.

Table 5.3d: Ambient noise limits.

<table>
<thead>
<tr>
<th>Receptor</th>
<th>Maximum Allowable Log (hourly), in dB(A)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Daytime 07:00 to 22:00</td>
</tr>
<tr>
<td>Residential</td>
<td>55</td>
</tr>
<tr>
<td>Industrial</td>
<td>70</td>
</tr>
</tbody>
</table>

The Project will comply with the following Industry Best Practice for occupational noise exposure:

- A maximum of 8 hours exposure to 85 dB(A), 2 hours exposure to 91 dB(A), and 1 hours exposure to 94 dB(A). A maximum limit of 115 dB(A).

5.3.4 TAILINGS STORAGE FACILITY SAFETY AND DESIGN STANDARDS

Safety
1. For the life of any dam, the owner has full responsibility for the safety of the dam, irrespective of its funding sources or construction status.
2. The dam is to be designed and its construction supervised by experienced and competent professionals.
3. Certain dam safety measures for the design, bid tendering, construction, operation and maintenance of the dam and associated works will be adopted and implemented.
4. Review by an independent expert, throughout investigation, of the design, construction of the dam and the start-up of operations.
5. Preparation and implementation of detailed plans: a plan for construction supervision and quality assurance; a plan for instrumentation; an operation and maintenance plan; and an emergency preparedness plan.
6. Pre-qualification of bidders during procurement and bid tendering.
7. Periodic safety inspections of the dam after completion.

Design
The dimensions of the initial dam will be 2 000 x 1 000 x 10m, and will be designed by professional engineers and constructed by competent and qualified contractors independent engineer to meet international standards. Experience gained in the initial years of operation should allow waste handling methods to be refined, leading to a reduction in the size of the second slimes dam. However, conservative estimates indicate that this dam will be 2 000 x 2 000 x 10m.

5.3.5 RADIATION STANDARDS

Radioactivity occurs naturally within heavy minerals, resulting in an existing level of radioactivity in the region. The extraction and processing of the heavy minerals merely concentrates this natural radioactivity, but it must be noted that no radioactive substances will be created by mining or processing. Radiation is a standard issue in heavy mineral sands mining and there are industry proven techniques for dealing with this issue. The Kenmare Moma Titanium Minerals project will be required to implement an industry standard radiation management programme.
The International Commission on Radiological Protection (ICRP) and the International Atomic Energy Agency (IAEA) provide guidance on radiation protection issues worldwide. The ICRP recommends dose limits and provides a general outline of the way in which its radiation protection philosophy may be implemented.

The IAEA develops nuclear safety standards, guides and technical documents and based on these standards, promotes the achievement and maintenance of high levels of safety in applications of nuclear energy as well as the protection of human health and the environment against ionising radiation.

The ICRP has formulated three basic principles for radiation protection, which are:

1) The justification of a practice: No practice should be adopted unless it produces sufficient benefit to the exposed individuals or to society to offset the radiation detriment it causes.
2) Individual dose and risk limitation: The dose equivalent to individuals from all practices should be less than the appropriate dose limits.
3) The optimisation of protection: All exposures will be kept as low as reasonably achievable, economic and social factors being taken into account.

The main aims of radiation protection are to prevent all detrimental deterministic effects (organ damage) and limit the probability of stochastic effects (e.g. cancers) to levels deemed by society to be acceptable.

**Annual dose limits**
The exposure of individuals should be restricted so that both the total effective dose and the total equivalent dose to relevant organs or tissues does not exceed any relevant dose limit specified below:

1. **Occupational exposure**
   - An effective dose of 20 mSv\(^8\) per annum averaged over a period of five years
   - An effective dose of 50 mSv in any one year
2. **Visitors to the mine and persons not classified as occupationally exposed**
   - An effective dose of 1 mSv in a year
3. **Public exposure (arising only from operations at or effluent discharges from the mine)**
   - An effective dose of less than 1 mSv in a year

Public limits are far more stringent than for workers, the main reasons being that large numbers of people may be exposed, populations include children who are more radiosensitive and the risk factors deemed acceptable for the public are lower.

The standards to be used for radiation protection for the Kenmare Moma Titanium Minerals Project will be the international standards recommended in the Basic Safety Standards of the International Atomic Energy Association. These are summarised in *IAEA, International Basic Safety Standards for Protection against Ionizing Radiation and the Safety of Radiation Sources, Safety Series No. 115. IAEA, Vienna, 1996*, and the recommendations of the

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\(^8\) Sievert: The Sv is a measure of radiation dose equivalent received by a person or living tissue in units of J/kg which describes the biological effects (damage) of radiation. Equal exposure to different types of radiation does not necessarily have the same biological effect and the Sv allows these effects to be quantified. One Sv is a large dose, thus dosages are normally expressed as millisieverts (mSv).
6. FORMAT OF THE ENVIRONMENTAL MANAGEMENT PLAN

This EMP is structured so that the key environmental components are directly linked to the activity areas of the project. The key environmental components include:

1. Terrestrial ecological issues (Appendix 1);
2. Marine ecological issues (Appendix 2);
3. Social issues (Appendix 3);
4. Waste Disposal issues (Appendix 4); and
5. Emission issues (Appendix 5).

These environmental components are linked to the following project activities:

1. Dredging: dredging and associated activities, as well as backfilling pond with tailings;
2. Process plants: the concentrator and mineral separation plant;
3. Tailings dam: the tailings dam and associated activities;
4. Operational support: Administration and support buildings (e.g. administration office, amenity building and training centre, medical centre, laboratory, workshop/store, gatehouse and communications); accommodation village; waste and sewage disposal facilities; chemical and fuel storage facilities; roads; airstrip; and power and telephone lines; and
5. Materials handling: storage shed, conveyor, jetty, barging and shipping.

Actions to overcome the identified possible negative environmental impacts or to enhance positive impacts are presented in five tables (Appendices 1 to 5), one for each of the environmental components identified above.

These actions represent Kenmare’s commitment to good environmental practice. The tables set out specific “management statements” as to how impacts will be managed during all phases (i.e. design, construction, operation and decommission) of the project.

Impacts relating to a specific environmental component are grouped together, so that all the mitigation measures required to manage specific activities of the project are clearly identified. This will ensure that causes of possible non-compliance during monitoring can be traced, and ensure that all environmental requirements of a project activity have been or are being met.

The tables, which are located in Appendices 1 to 5, have six column headings, which are explained below.

a. **EMP Reference Number:** This column is used to give each proposed mitigation measure or "management statement" a unique number for ease of reference.
b. **EIA Reference:** This column provides a reference to the EIA documentation in which the environmental impact and related mitigation measures were identified and explained. This ensures easy cross-referencing.
c. **Impact:** This column lists the impacts identified for a particular project activity.
d. **Management Statement:** This column specifies the proposed mitigation measures for the impacts,
e. **Responsibility:** This column suggests the appropriate professionals in the project team or authority responsible for managing the specific mitigation measures. Shared
responsibility indicates the importance of interaction between the different professional
groups on the project team and authorities during all phases of the project.

f. **Phase:** This column depicts the phase of the project (Design, Construction or Operation) when the mitigation measure must be addressed or implemented:

- *Design* is the phase when final design for construction must be undertaken.
- *Construction* implies the completion of design and the start of construction, which extends until the completion of the commissioning of the various facilities.
- *Operations* begin after commissioning and extend for the life of the project.
7. ENVIRONMENTAL MONITORING

The objectives of monitoring will be to:

- Demonstrate that Kenmare operates in accordance with all of the conditions in the EIA and that control structures and programmes operate in a manner consistent with these conditions.
- Provide timely, relevant and appropriately presented information within the company, to the regulatory authorities and the general public on the environmental performance of the project.

The monitoring requirements will be refined as information becomes available during the design and construction stage. The following monitoring programmes will be implemented:

7.1 METEOROLOGICAL MONITORING

A meteorological station will be operational and will be capable of continuously monitoring the following parameters:

- Ambient temperature
- Rainfall
- Wind speed
- Relative humidity
- Barometric pressure
- Solar radiation

During the operational phase, vessels employed for transhipment and fuel supply will be equipped with modern, long-range weather monitoring equipment for the early detection of inclement weather. The vessels will be capable of receiving regular meteorological updates by satellite.

7.2 WATER QUALITY MONITORING

A system of monitoring both ground and surface water quality on a quarterly basis will be implemented. The groundwater quality will be monitored using samples drawn from wells or groundwater-monitoring boreholes, which will be drilled for this purpose. In addition, surface water samples will be drawn from selected points in the Larde River and estuary. The quality factors monitored will include:

- pH, Turbidity
- Electro-conductivity (EC)
- Chemistry – nitrate, chloride, sulphate, ammonia, sodium, potassium
- Water hardness – Total and Permanent Hardness
- Solids – Total, Dissolved and Suspended
7.3 ENVIRONMENTAL RADIATION

A baseline survey will be undertaken to determine baseline environmental radiation. The radioactivity levels of various processes, waste and product streams will be determined, so that mitigation for the handling, storage and disposal of waste streams can be implemented. During operation, ongoing annual surveys will also be undertaken.

7.4 EMISSIONS AND NOISE

Emissions will be monitored to ensure that the project does not exceed the standards presented in Tables 5.3a & b. A monitoring unit, probably as part of the meteorological station, will be installed and will monitor ambient meteorological conditions, as well as the primary anticipated pollutants (Inhalable particulates, Total Particulate Matter, Sulphur dioxide, Nitrogen oxides, Carbon monoxide, H2S, SO2, and NO2). Data will be presented in wind roses, pollution roses and average concentrations per measured parameter.

Monitoring equipment will be installed to ensure that operations do not exceed the noise standards presented in Table 5.3d.

7.5 RESETTLEMENT

A Resettlement and Compensation Plan (RCP) is currently being developed for the Kenmare Moma Titanium Minerals Project. The implementation and success of the RCP will be assessed through an on-going monitoring, evaluation and review programme. Annually there will be a site self-assessment carried out by Kenmare, and an audit carried out by a credible independent agency. Initially these activities will focus, among other things, on ensuring:

- Project affected households timeously receive the compensation and assistance to which they are entitled.
- Disputes and grievances are dealt with promptly and efficiently.
- Project affected households receive assistance to acquire equivalent land in resettled areas for cropping.
- The effectiveness of the resettlement.

7.6 REHABILITATION

A rehabilitation programme will be developed for the project, and monitoring the success of rehabilitation and invasion of aliens will form part of this programme.

The survival rate of plants will be monitored, and if regression of vegetation is noted, the underlying causes will be identified and addressed. Strategies will be developed to eradicate alien vegetation that establishes itself in the post-mining environment, along roadsides, etc.

7.7 WASTES AND WASTE SITES

7.7.1 TAILINGS DAM

The tailings dam will be designed, constructed and operated according to international standards (see Section 5.3.4). This will entail undertaking periodic safety inspections of the dam after completion, and monitoring local surface water and dust.
7.7.2 SEWAGE TREATMENT SYSTEM

The sewage treatment plant will be designed to comply with the effluent discharge standards presented in Table 5.3c, and will be regularly monitored to ensure that the system is operating as designed and is not exceeding the standards.

7.7.3 LABORATORY WASTE STREAM

The laboratory waste stream will be monitored for eco-toxicity.

7.7.4 NEUTRALISED ACID PRECIPITATE

Neutralised acid precipitate will be placed in a sealed area that will be specifically designed and constructed with an impermeable liner. This facility will be monitored to ensure that no leakage occurs.

7.7.5 BALLAST WATER

The pumping of ballast water into the nearshore zone has been recognised as a potential problem. The ballast water plan designed in the EIA phase (see CES 2000) Volume 2 will be implemented and monitored.

7.8 SUBTIDAL MARINE HABITAT

The marine habitats in and around the jetty and transfer site will be monitored for pollution and ore build-up. Annual surveys will also be conducted on the coral reefs on Nojovo and Caldeira islands. The surveys will concentrate on the closest reefs which are approx 5 km from the barge to ship transfer site. These surveys will monitor the health of the reefs and a thorough base case survey will be undertaken prior to implementation of the marine transport option.

7.9 OBJECTIVES AND TARGETS

Environmental performance objectives and targets will be developed, against which the performance of the project can be measured and monitored.
8. IMPLEMENTATION OF THE ENVIRONMENTAL MANAGEMENT PLAN

This section outlines the suggested organisational structures and other activities that will be required to implement the EMP.

8.1 ORGANISATIONAL STRUCTURE

The generic key management positions to manage the EMP are discussed below. The actual titles used for each position may change once the project is implemented but the responsibilities will remain unchanged:

Mine General Manager (GM)
The role of the GM will be to ensure that all personnel on site abide by the requirements of the EMP and that all areas of the project are constructed and operated in such a manner that it meets all specified legal and contractual environmental requirements.

Technical Services Manager (TSM)
The role of the Technical Manager will be to ensure that all areas of the project are designed, constructed and operated to meet the specified environmental parameters and contractual and legal requirements. The TSM will report to the GM.

Environmental, Health, Safety & Community Manager (EHSC)
The EHSC Manager will report directly to the TSM and his/her role will be to:

1. **Ensure the successful implementation of the Environmental Management System, which includes this EMP, by:**
   - Continuously reviewing the suitability and effectiveness of the activities described in the EMP.
   - Overseeing the execution and management of the activities described in the Resettlement and Compensation Plan (RCP).
   - Overseeing liaison activities with local stakeholders.
   - Ongoing liaison with appropriate project personnel.
   - Maintenance and management of the monitoring programme.
   - Ongoing reporting.
   - Ongoing liaison with National and Provincial Government agencies and regulatory authorities.
   - Monitoring contractors’ compliance with the EMP and EMS.
   - Recommending actions to the Technical Manager in the event of non-compliance.

2. **Ensure the successful on-site implementation and supervision of the RCP and Public Consultation and Disclosure Plan (PCDP). Responsibilities will include:**
   - Management of the RCP and PCDP.
   - Financial responsibility for payment of compensation and resettlement costs.
   - Liaison with local Government agencies and regulatory authorities.
   - Formulation of a detailed community liaison plan.
   - Provide technical and managerial support for implementation of the Resettlement Guidelines where the Government of Mozambique is not able to make this available.
   - On-site liaison with the contractors responsible for resettlement infrastructure development.
• Holding regular meetings with the affected community as part of the PCDP, and attend Resettlement Working Group (RWG) meetings.
• Managing and responding to grievances raised by the community.
• Executing specific communication procedures for the different stakeholders.
• Managing the Labour Desk (LD).
• Formulating a Social Responsibility Programme and disburse funds.
• Implementing the mine’s Social Development Plan.
• Establish and maintain a socio-economic monitoring programme for the affected households.
• Ongoing reporting.

3. **Manage personnel on site and ensure that the environmental considerations are implemented during all phases. Responsibilities will include:**

• Monitoring and regulating compliance by all personnel.
• Execution of the environmental monitoring programme.
• Continued and ongoing liaison with contractors.
• Environmental awareness training.
• Ensuring that all sites disturbed during all phases of the operation are effectively rehabilitated as soon as possible.

**Resettlement Working Group**

A Resettlement Working Group (RWG) will be the primary channel of communication between the developer and the Government of Mozambique, on the one hand, and the affected populace on the other. The RWG will be established during the detailed design phase and will meet at least monthly. The composition profile will probably be as follows:

• District Administrator
• **Chef de Poste** (Larde)
• Department of Physical Planning representative (Nampula Province)
• Representatives from other Government line departments (District level)
• Secretaries of the affected villages
• Elected representatives of the affected population in the mine project area
• Traditional authorities
• Kenmare and its nominated agents
• Interested NGOs.

In addition to acting as a conduit of information, the RWG has the following key responsibilities:

• Ensure that the terms of the Resettlement Guidelines are adhered to.
• Monitor the implementation of the Resettlement Guidelines programme and suggest modification, if and when necessary.
• Identify issues or areas of concern that may have been overlooked or under-emphasised in the Social Impact Assessment or Resettlement Guidelines, and suggest ameliorative and/or mitigation measures.
• Assist in the finalisation of the Land Use Plan for the resettlement areas.
• Facilitate land acquisition in areas under its control, i.e. both in the mine site area and in the host resettlement area.
• Agree to the principles of a means test to determine which households qualify for extended transitional support.
• Determine the length of time that transitional support shall run.
• Assist the Department of Physical Planning to identify development opportunities that can enhance productivity, sustainability and viable economic opportunities in Larde, the affected area, and the host resettlement areas.
• Assist in recruitment of fieldworkers to help with the resettlement process.
• Hold regular meetings with the affected constituencies to explain the process of compensation and resettlement, and advise about progress.
• Monitor the project area to prevent illegal encroachers and squatters.

Development Foundation
As part of the Social Responsibility Programme, a Development Foundation (DF) will be established and will be a joint initiative between Kenmare and the local villagers and authorities. While Kenmare will be a member of the DF and will provide the majority of financial and logistical support, the DF will not be a Kenmare controlled body. Specific details on the functioning and mandate of the DF are outlined in the Resettlement and Compensation Plan (RCP).

The DF will be established in the early phases of mine implementation and will be responsible for identifying areas for development, including assistance in establishing and operating small businesses, which will contribute greatly to the long term prosperity of the area.

The benefits of the DF will include:
• The ability to raise funds as a single entity and co-ordinate development inputs.
• Co-ordinate local participation in development initiatives.
• The potential to monitor and evaluate the efficiency of development interventions.
• The potential to develop and empower local capacity.

8.2 TRAINING AND AWARENESS PROGRAMMES

General training
All personnel involved in the construction and operation of the project will undergo a training and awareness programme on environmental management prior to commencing activities. A procedure for environmental training will be developed, which will lay out in detail the methodology used to present environmental awareness and induction training. The range of topics that will be covered in environmental training will include:

• Kenmare’s Environment policy.
• Kenmare’s Health and Safety policy.
• Kenmare’s Community policy.
• Kenmare’s Environmental Objectives and Targets.
• Organisational structure and responsibilities.
• Aspects of routine or day-to-day operational activities, which can have environmental impacts.
• Environmental hazards, which could arise from non-routine situations and corrective actions.
• The importance of Environmental Hazard Incident reporting and completion of appropriate reports.
• Channels of communication for discussing and reporting environmental issues.
• Documentation systems so that appropriate records of environmental matters are maintained.
• Responsibilities under the applicable legislation.
Information will be transferred in an appropriate manner. Training courses will take language and cultural and education levels into consideration. A site Environmental Handbook will be developed and distributed to all literate personnel. This handbook will cover some of the information presented in the Environmental Awareness and Induction Training.

**Specific training**
Employees will be trained to ensure that they have the right skills and competencies to undertake their particular activities, and what environmental management is specific to their activities, to prevent possible impacts.

### 8.3 PERFORMANCE OBJECTIVES AND TARGETS

Environmental performance objectives and measurable indicators against which the performance of the project can be measured and monitored will be developed for all phases of the project. Objectives and targets will be reviewed on a regular basis.

### 8.4 ENVIRONMENTAL INCIDENT MANAGEMENT

A procedure for managing environmental incidents will be developed, which will follow specific Hazard and Incident Reporting Protocols. A report will be completed for all incidents, and appropriate action taken where necessary to minimise any potential impacts. MICOA will be informed of any environmental incident, in accordance with legislative requirements.

Notification of an incident or emergency will include the following:
- A description of the incident.
- The location of the emergency or incident.
- The relevant environmental authority.
- The name and telephone number of the designated contact person.
- The time of the emergency or incident.
- The suspected cause of the emergency or incident.
- The environmental harm and/or environmental nuisance caused, or suspected to be caused, by the emergency or incident.
- The action taken to prevent future occurrence of the incident and mitigate any harm and/or environmental nuisance caused by the emergency or incident.

A procedure for reporting environmental complaints from the affected community and employees will be developed.

### 8.5 EMERGENCY PREPAREDNESS

An emergency response programme / preparedness plan will be finalised before any major site activities take place. This will be developed in accordance with industry best practice. Individual Emergency Preparedness Plans will be required for various aspects of the operation, and the approach to reporting and responding to emergencies will be based on the ISO 14001 requirements.
8.6 REPORTING AND DOCUMENTATION

The EMP reporting and documentation requirements will be based on the ISO 14001 requirements. Annual reports will be made available to authorities and to interested and affected parties.

8.7 CONTINUOUS IMPROVEMENT

Continuous improvement will form a key component of the Environmental Management System. Documents associated with the EMP will be regularly reviewed and updated. Research on certain aspects will be undertaken to refine environmental management, so as to ensure that the levels of environmental protection outlined in the EMP are achieved.

8.8 AUDITING AND REVIEW

Audits of the environmental performance of the project will be undertaken on an annual basis by accredited institutions that are vetted by MICOA. The purpose of the audits will be to assess compliance with the conditions of the Environmental Licence, and objectives and targets outlined in the EMP.

The findings of external, internal and informal environmental reviews will be recorded and items requiring action will be identified from the recommendations made. The implementation of these actions will be assessed in the following audit.
9. BIBLIOGRAPHY

Coastal and Environmental Services 1999. Moma Pre Feasability Environmental Study. Coastal and Environmental Services, Grahamstown.


IAEA, International Basic Safety Standards for Protection against Ionizing Radiation and the Safety of Radiation Sources, Safety Series No. 115. IAEA, Vienna, 1996,

# 10. GLOSSARY OF ACRONYMS

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>CES</td>
<td>Coastal and Environmental Services</td>
</tr>
<tr>
<td>CITES</td>
<td>Convention on International Trade in Endangered Species</td>
</tr>
<tr>
<td>CRO</td>
<td>Community and Resettlement Officer</td>
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<tr>
<td>CRP</td>
<td>Closure and Rehabilitation Plan</td>
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<tr>
<td>DF</td>
<td>Development Foundation</td>
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<tr>
<td>DWT</td>
<td>Dead Weight Tonne</td>
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<tr>
<td>EHSC</td>
<td>Environmental, Health, Safety and Community Manager</td>
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<tr>
<td>EIA</td>
<td>Environmental Impact Assessment</td>
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<td>EMP</td>
<td>Environmental Management Plan</td>
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<tr>
<td>EMS</td>
<td>Environmental Management System</td>
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<tr>
<td>ESO</td>
<td>Environmental Site Officer</td>
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<tr>
<td>GM</td>
<td>General Manager</td>
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<tr>
<td>GOV</td>
<td>Mozambican authorities</td>
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<tr>
<td>HMC</td>
<td>Heavy Mineral Concentrate</td>
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<tr>
<td>ISO</td>
<td>International Organisation of Standards</td>
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<tr>
<td>MICOA</td>
<td>Ministry for the Co-ordination of Environmental Affairs</td>
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<tr>
<td>MIREME</td>
<td>Ministry of Mineral Resources and Energy</td>
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<tr>
<td>MSP</td>
<td>Mineral Separation Plant</td>
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<tr>
<td>PCDP</td>
<td>Public Consultation and Disclosure Plan</td>
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<td>PCP</td>
<td>Primary Concentrator Plant</td>
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<td>RCP</td>
<td>Resettlement and Compensation Plan</td>
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<tr>
<td>THM</td>
<td>Total heavy mineral</td>
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<td>TSM</td>
<td>Technical Manager</td>
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<td>VHM</td>
<td>Valuable Heavy Minerals</td>
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### APPENDIX 1 – TERRESTRIAL ECOLOGICAL ISSUES

#### SECTION 1 - ALL PROJECT COMPONENTS

|--------------|-------------------------------------|--------------------------|----------------------|---------------|-------|
| V2 S3.6.7    | V3 S4.6.2                            | Oil pollution of the groundwater | • Good maintenance, operating and quality control procedures will be developed and implemented on all machinery and petroleum storage sites.  
• Groundwater quality will be monitored as part of a long term monitoring programme. Baseline groundwater monitoring will be undertaken. | TM EHSC | All |
| V3 S9.5.2    |                                     |                          |                      |               |       |
| V2 S3.7      | V3 S9.5.2                            | Impact on surface water resources | • Surface water quality will be monitored as part of a long term monitoring programme.  
• Monitoring measures for surface water resources will be developed.  
• Baseline water monitoring on the Rio Larde and selected tributaries will be undertaken. | TM EHSC | All |
| V3 S9.5.2    |                                     |                          |                      |               |       |
| V2 S6.3.8    |                                     | Increased turbidity in surface water bodies due to runoff | • Runoff and stormwater controls will be developed. | TM | All |
| V2 S7.12.1   | V3 S6.4.7                            | Potential impact on Larde Estuary if water is extracted from the Larde River | • An estuarine freshwater flow-requirement (EFR) will be commissioned on the Larde Estuary if freshwater is to be extracted. | EHSC | Design |
| V3 S6.4.7    |                                     |                          |                      |               |       |
| V2 S5.21.2   |                                     | Impacts on vegetation and role of rehabilitation | • Roads and infrastructure will be carefully sited, to avoid damage to sensitive vegetation types as well as to the ecotones between them.  
• Mining activities will be carried out and planned so as not to impact on rehabilitation sites.  
• Rehabilitation of the mine site will be undertaken by Kenmare.  
- Meetings will be held with affected communities to determine how the post-mining environment will be rehabilitated (e.g. cultivation, natural vegetation, or a combination).  
- A rehabilitation programme will be developed to ensure that disturbed areas are rehabilitated. The following will form part of the programme:  
1. Rehabilitation trials will be undertaken, which will | TM EHSC RWG GOV | All |
| V3 S6.4.7    |                                     |                          |                      |               |       |

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1 V = Volume; S = Section
## APPENDIX 1 - TERRESTRIAL ECOLOGICAL ISSUES

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<td></td>
<td></td>
<td></td>
<td><strong>Involves different slimes mixes, topsoil depth, mixing depths, mixing methods, cover crops, etc.</strong></td>
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<td>2. A nursery will be established.</td>
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<td>3. Topsoil will be stockpiled and used for rehabilitation.</td>
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<td>4. The seed mixtures will be balanced and every effort will be made to use seeds and plants from the area to be rehabilitated.</td>
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<td>5. Rare, endangered and economically important plant populations will be rescued from the mine path and used in rehabilitation areas.</td>
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<td>6. Tree species will be established as isolated saplings in the rehabilitation regions.</td>
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<td><strong>Rehabilitation will be initiated in areas where mining is completed, concurrent to mining in subsequent areas.</strong></td>
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<td><strong>The rehabilitation process will be monitored closely, so that the process can be enhanced or corrected should regression of vegetation occur or crop security not be attained.</strong></td>
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<td></td>
<td><strong>The return of the local communities to rehabilitated areas will be controlled and only allowed when rehabilitation has been satisfactorily achieved.</strong></td>
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<td>• The establishment of conservation areas will be considered by the DF in conjunction with the Government of Mozambique.</td>
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<tr>
<td>1.1.6</td>
<td>V2 S5.20.3 V3 S6.4.4</td>
<td>The invasion of alien plant species into disturbed areas or areas that have been cleared of vegetation</td>
<td>• No alien vegetation (not occurring in the area) will be used in the rehabilitation of disturbed areas.</td>
<td>TM EHSC</td>
<td>All</td>
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<td></td>
<td>• A monitoring and alien eradication programme will form part of the rehabilitation programme.</td>
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<tr>
<td>1.1.7</td>
<td>V2 S6.8.6 V3 S6.4.5</td>
<td>Introduction of faunal alien species</td>
<td>• Employees and contractor will be prohibited to release exotic species into local water systems.</td>
<td>EHSC</td>
<td>Construction Operation</td>
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<td></td>
<td>• An environmental awareness programme will be developed and implemented.</td>
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<td>1.1.8</td>
<td>V2 S5.20.3 V3 S6.4.4</td>
<td>Change or destruction of vegetation communities due to pollution</td>
<td>• Best practice standards will be adhered to and quality control measures will be implemented.</td>
<td>TM EHSC</td>
<td>Construction Operation</td>
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<td></td>
<td>• An emergency preparedness/response plan will be developed.</td>
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<td></td>
<td>• Environmentally sound clean up and disposal procedures will be implemented.</td>
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### APPENDIX 1 – TERRESTRIAL ECOLOGICAL ISSUES

#### SECTION 1 - ALL PROJECT COMPONENTS

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<tr>
<td>V2 S6.8.1</td>
<td></td>
<td>Loss of habitats (forest, grassland, wetlands, foredune, shore and mangrove)</td>
<td>The rehabilitation programme will include all disturbed areas. The programme will rehabilitate selected areas of all disturbed habitats (forest, grassland, wetlands, foredune and shore).</td>
<td>TM EHSC DF</td>
<td>All</td>
</tr>
<tr>
<td>V2 S6.8.2</td>
<td></td>
<td>Habitat fragmentation (forests, wetlands and grasslands)</td>
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<td>V2 S6.8.3</td>
<td></td>
<td>Loss of species of special concern</td>
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<td>V2 S6.8.4</td>
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<td>V3 S6.4.5</td>
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<td>V2 S6.8.7</td>
<td></td>
<td>Impact of increased light pollution on fauna</td>
<td>The use of high light intensities for long periods at night will be controlled, especially in the sensitive shore and foredune regions.</td>
<td>TM EHSC</td>
<td>Construction Operation</td>
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<td>V2 S6.4.5</td>
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<td>V2 S6.8.7</td>
<td></td>
<td>Impact of increased noise on the fauna</td>
<td>Where possible, activity will be reduced in certain areas at certain times (e.g. in the foredune and shore environment during turtle breeding season).</td>
<td>EHSC</td>
<td>Construction Operation</td>
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<td>V2 S6.4.5</td>
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<tr>
<td>V2 S6.8.3</td>
<td></td>
<td>Increased hunting</td>
<td>Kenmare will promote environmental awareness of employees and contractors through training.</td>
<td>EHSC</td>
<td>Construction Operation</td>
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<tr>
<td>V2 S7.12.2</td>
<td></td>
<td>A decline in the availability of faunal resources due to destruction of the animal habitats (especially the woodland vegetation) as a result of clearing land for the mining operation</td>
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<td>V3 S6.4.7</td>
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<tr>
<td>Post EIA</td>
<td></td>
<td>Impact on the terrestrial biophysical environment</td>
<td>Environmental performance objectives and measurable indicators against which the performance of the project can be measured and monitored will be developed for all phases of the project and corrective actions implemented where practical and achievable.</td>
<td>EHSC</td>
<td>All</td>
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### APPENDIX 1 – TERRESTRIAL ECOLOGICAL ISSUES

<table>
<thead>
<tr>
<th>EMP Ref. No.</th>
<th>Abbreviated Impact/Issue</th>
<th>Management Statement</th>
<th>Responsibility</th>
<th>Phase</th>
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<tbody>
<tr>
<td>1.2.1 V3 S9.5.2</td>
<td>Change to landform</td>
<td>The placement of tailings in the mined out area will attempt to re-establish a similar topography to that existing prior to mining. Erosion berms and other temporary changes to the topography will be levelled, and no small holes and other distinctive small topographical features will remain after mining.</td>
<td>TM EHSC</td>
<td>Operation</td>
</tr>
<tr>
<td>1.2.2 V2 S2.7.2 V2 S5.20.4 V3 S6.4.1 V3 S6.4.4</td>
<td>Change in the nature of the surface and near-surface sands within the mine path areas</td>
<td>A slimes cap will be placed over the final layer of coarser underflow material to achieve a 15% silt plus clay content. This fines layer will be mixed into the tailings before replacement of the topsoil material. Fertilisers and agricultural additives, e.g. lime and gypsum, will be used to enhance fertility.</td>
<td>TM EHSC</td>
<td>Operation</td>
</tr>
<tr>
<td>1.2.3 V2 S2.7.4 V3 S6.4.1</td>
<td>Damage to wetlands and other habitats while dredging</td>
<td>The topography, landform and vegetation will be reinstated during tailings disposal and rehabilitation. The rehabilitation process will link into the needs of the local communities as well as the biophysical environment.</td>
<td>TM EHSC</td>
<td>Operation</td>
</tr>
<tr>
<td>1.2.4 V2 S3.6.1 V2 S3.6.2 V2 S3.6.4 V2 S3.6.3 V2 S5.20.3 V2 S6.8.7 V3 S6.4.2 V3 S6.4.4 V3 S6.4.5</td>
<td>Lowering of the groundwater table</td>
<td>A monitoring programme will be developed, which will include the monitoring of groundwater levels to ensure that over-abstraction does not occur and to map groundwater flows. Kenmare will undertake corrective action to rectify any over-abstraction.</td>
<td>EHSC</td>
<td>All</td>
</tr>
<tr>
<td>1.2.5 V2 S3.6.4 V3 S6.4.2</td>
<td>Depletion of potable water resources</td>
<td>Alternative points of access to groundwater will be provided.</td>
<td>TM EHSC RWG</td>
<td>Construction</td>
</tr>
<tr>
<td>1.2.6 V2 S3.6.8</td>
<td>Destruction of portions of the Rio</td>
<td>The affected areas will be landscaped to re-establish the form and function of</td>
<td>TM EHSC</td>
<td>Operation</td>
</tr>
</tbody>
</table>

1 V = Volume; S = Section
2 GM = General Manager; TM = Technical Manager; EHSC = Environmental, Health, Safety & Community Manager; RWG = Resettlement Working Group; DF = Development Foundation; GOV = Mozambican authorities
|-------------|-------------------------------------|--------------------------|----------------------|---------------|-------|
| 1.2.7       | V2 S4.8.1, V2 S4.9.3, V3 S6.4.3     | Loss of land use (arable and grazing land) | • A rehabilitation programme will be developed to ensure that disturbed areas are rehabilitated.  
• Field trials will be set up to conduct experiments on levels of lime and N, P and K fertilisation; suitability of different cultivars of commonly grown crops and ground covers. | EHSC | Design Construction |
| 1.2.8       | V2 S4.8.2; V2 S5.20.4, V3 S6.4.3, V3 S6.4.4 | Increased wind erosion because areas are more exposed | • A rehabilitation programme will be developed to ensure that disturbed areas are stabilised during construction and operation, and then rehabilitated. | EHSC | Design Operation |
| 1.2.9       | V2 S6.8.2, V3 S6.4.5                | Changes in fire regimes | • Fire control measures will be developed and implemented. | TM, EHSC | All |
### APPENDIX 1 – TERRESTRIAL ECOLOGICAL ISSUES

#### SECTION 3 - PROCESS PLANT

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<tr>
<td>1.3.1</td>
<td>V2 S3.7</td>
<td>• Impact of groundwater on technical processes and equipment due to its properties</td>
<td>• The technical impacts of using groundwater will be determined and designed for.</td>
<td>TM</td>
<td>Design</td>
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## APPENDIX 1 – TERRESTRIAL ECOLOGICAL ISSUES

### SECTION 4 - TAILINGS DAM

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<tr>
<td>1.4.1</td>
<td>V2 S2.7.2 V3 S6.4.1</td>
<td>Alteration of landscape and landform due to the construction of tailings dams</td>
<td>It will be determined if an alternative means of waste disposal to reduce the volume of slimes entering the tailings dam can be implemented.</td>
<td>TM</td>
<td>Design Construction</td>
</tr>
<tr>
<td>1.4.2</td>
<td>V2 S3.610 V3 S6.4.2</td>
<td>Local change in the groundwater levels and flow as a result of the tailings dams</td>
<td>The tailings dams will be carefully placed, constructed and managed.</td>
<td>TM EHSC</td>
<td>Design Construction</td>
</tr>
<tr>
<td>1.4.3</td>
<td>Post EIA</td>
<td>Impact on environment due to tailings dam failure</td>
<td>The tailings dam will comply with international standards: 1. The dam is to be designed and its construction supervised by experienced and competent professionals. 2. An independent expert will review tailings dam design, construction and start-up of operations. 3. An emergency preparedness / response plan will be developed and implemented. 4. Periodic safety inspections of the dam will be undertaken after completion.</td>
<td>TM EHSC</td>
<td>Design Construction Operation</td>
</tr>
<tr>
<td>1.4.4</td>
<td>V3 S9.5.2</td>
<td>Pollution of ground and surface water</td>
<td>Surface water in and groundwater quality below the slimes dams will be monitored and appropriate remedial actions implemented where required.</td>
<td>EHSC TM</td>
<td>Design Operation</td>
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## APPENDIX 1 - TERRESTRIAL ECOLOGICAL ISSUES

### SECTION 5 - OPERATIONAL SUPPORT

|-------------|-------------------------------------|--------------------------|----------------------|---------------|-------
| 1.5.1       | V3 S6.3                             | Clearing of vegetation for the infrastructure associated with the mine | A rehabilitation programme will be developed to ensure that disturbed areas are rehabilitated. | TM EHSC       | Operation |
| 1.5.2       | V2 S8.4.6 V3 S6.4.6 V3 S6.3        | Removal/loss of wetland  | Roads will be designed to have as little impact as possible on water flow (e.g. extensive culverting will be incorporated into the design of the roads). Culverts will be maintained to prevent blockages. A rehabilitation programme will be developed to ensure that disturbed areas are rehabilitated. | TM EHSC       | Design Operation |
| 1.5.3       | V2 S6.8.7 V3 S6.4.5                 | Increased animal mortalities on roads | Vehicle traffic will be controlled around sensitive areas at specific times. Controls will include speed limits, speed ramps etc | EHSC          | Construction Operation |
| 1.5.4       | V2 S6.8.7 V3 S6.4.5                 | Oil spillages and chemical pollution | Oil traps, cut-off drains, sumps and settling ponds will be installed at all vehicle servicing areas, areas with hydraulic and transformer oils and other areas where needed. All machinery and equipment will be maintained. Routine services will occur in approved areas. Fuel and chemical storage tanks will be designed, located, constructed and managed in suitably bunded areas and in accordance with the accepted international standards. An emergency response / preparedness plan for chemical spills and related incidents will be developed and implemented. A training and awareness programme for handling chemical products will be developed and implemented. | TM EHSC       | All |
| 1.5.5       | V2 S6.9.4 V3 S6.3                   | Increased erosion and silting up of water courses | Access roads and paths will be carefully contoured. | TM EHSC       | Design Construction |

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### APPENDIX 1 – TERRESTRIAL ECOLOGICAL ISSUES

#### SECTION 6 - MATERIALS HANDLING

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<tr>
<td>1.6.1</td>
<td>V2 S4</td>
<td>Impact on vegetation foredune area</td>
<td>• Impact on the sensitive foredune area should be kept to a minimum and rehabilitated after construction and at mine closure. During construction erosive areas must be stabilised to prevent blow-outs.</td>
<td>EHSC</td>
<td>Design Construction</td>
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## Appendix 2: Marine Ecological Issues

### APPENDIX 2 – MARINE ECOLOGICAL ISSUES

#### SECTION 1 - ALL PROJECT COMPONENTS

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**THE MANAGEMENT OF MARINE ECOLOGICAL ISSUES FOR ALL PROJECT COMPONENTS IS NOT APPLICABLE**

#### SECTION 2 - DREDGING

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**THE MANAGEMENT OF MARINE ECOLOGICAL ISSUES FOR DREDGING IS NOT APPLICABLE**

#### SECTION 3 - PROCESS PLANT

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**THE MANAGEMENT OF MARINE ECOLOGICAL ISSUES FOR THE PROCESS PLANT IS NOT APPLICABLE**

#### SECTION 4 - TAILINGS DAM

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**THE MANAGEMENT OF MARINE ECOLOGICAL ISSUES FOR THE TAILINGS DAM IS NOT APPLICABLE**

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### APPENDIX 2 – MARINE ECOLOGICAL ISSUES

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<td><strong>THE MANAGEMENT OF MARINE ECOLOGICAL ISSUES FOR OPERATIONAL SUPPORT FACILITIES IS NOT APPLICABLE</strong></td>
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### SECTION 6 - MATERIALS HANDLING

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<tr>
<td>2.6.1</td>
<td>V3 S6.3</td>
<td>• The construction of a 0.5 hectare hard top area on the beach next to the pier</td>
<td>• All structures will be removed after all the large equipment has been landed and the area rehabilitated after the construction period.</td>
<td>EHSC</td>
<td>Construction</td>
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</tbody>
</table>
| 2.6.2        | V2 S8.4.1 V3 S6.4.6                  | • Pollution of coral and nearshore ecosystems by antifoulants | • A monitoring programme will be developed, which will include the monitoring of reefs for the effects of pollution.  
• Shipping will be restricted to prescribed traffic ways.  
• Barges will be moored outside the transhipment operational area when not in use.  
• Kenmare will keep abreast of antifouling technology and less toxic antifoulants will be used as soon as they are the industry norm. | EHSC TM        | Design Operation |
| 2.6.3        | V2 S8.4.1 V3 S6.4.6                  | • Pollution of coral and nearshore ecosystems by fuel spillages | • Fuel transfer facilities at the jetty will be designed and operated to international standards, with facilities for containing and handling oil and fuel spills.  
• A contingency plan will be developed and implemented for oil pollution. | TM EHSC        | Design Operation |
| 2.6.4        | V2 S8.4.1 V3 S6.4.6                  | • Pollution of the beach and nearshore region around the pier | • An environmental operating plan for the pier will be developed and implemented. This plan will cover aspects such as transfer of fuel, plastic pollution, wastewater dumping, etc. | TM             | Construction Operation |
| 2.6.5        | V2 S8.4.2 V3 S6.4.6                  | • Pollution of coral and nearshore ecosystems by mineral spillages | • Ore handling equipment will be designed to minimise loss, and retrievable spillages swept up and bagged for reprocessing. | TM EHSC        | Design Operation |

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## APPENDIX 2 – MARINE ECOLOGICAL ISSUES

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<td>Good “housekeeping” procedures will be implemented.</td>
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<td>Monitoring of the seabed will be undertaken as part of the monitoring programme to assess the effects of ore build-up.</td>
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<td>2.6.6</td>
<td>V2 S8.4.3 V3 S6.4.6</td>
<td>Ship or barge wrecks</td>
<td>Operational guidelines will be developed, which will include the management of vessel movement to traffic ways and will prescribe early evasion of inclement weather and seas. Guidelines will also include the early departure of barges to their permanent mooring in Angoche.</td>
<td>TM EHSC</td>
<td>All</td>
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<td>Transhipment and fuel supply vessels will be of satisfactory standard and will be equipped with modern, long-range weather monitoring equipment.</td>
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<td>2.6.7</td>
<td>V2 S8.4.4 V3 S6.4.6</td>
<td>Increased turbidity due to propwash</td>
<td>Ore carrier and barge movements will be restricted to the shipping channels and mooring sites. The traffic ways will be demarcated with navigation buoys.</td>
<td>EHSC TM</td>
<td>Operation</td>
</tr>
<tr>
<td>2.6.8</td>
<td>V2 S8.4.5 V3 S6.4.6</td>
<td>Change in sediment patterns</td>
<td>The pier will be designed to ensure low environmental resistance.</td>
<td>TM</td>
<td>Design</td>
</tr>
<tr>
<td>2.6.9</td>
<td>V2 S8.4.5 V3 S6.4.6</td>
<td>Pier may be a hazard to ships</td>
<td>The pier will be registered with the correct maritime mapping agencies. The pier will be equipped with the required safety equipment (e.g. lights and radar reflectors).</td>
<td>TM</td>
<td>Design</td>
</tr>
<tr>
<td>2.6.10</td>
<td>V2 S8.4.5 V3 S6.4.6</td>
<td>Impact of shipping on marine animals</td>
<td>Ore carrier and barge movements will be restricted to the shipping channels and mooring sites. Speed limits will be enforced.</td>
<td>EHSC</td>
<td>Operation</td>
</tr>
<tr>
<td>2.6.11</td>
<td>V2 S8.4.1</td>
<td>Impact of invasive organisms</td>
<td>A ballast water plan will be implemented and monitored. Monitoring of the coral reef for invasive organisms will be undertaken.</td>
<td>EHSC</td>
<td>Construction Operation</td>
</tr>
<tr>
<td>2.6.12</td>
<td>Post EIA</td>
<td>Impacts on the marine environment</td>
<td>Environmental performance objectives and measurable indicators against which the performance of the project can be measured and monitored will be developed for all phases of the project and corrective action undertaken where appropriate.</td>
<td>EHSC</td>
<td>All</td>
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## APPENDIX 3 – SOCIAL ISSUES

### SECTION 1 - ALL PROJECT COMPONENTS

|--------------|-------------------------------------|--------------------------|----------------------|----------------|-------|
| 3.1.1        | V3 S7.2.1                           | The impact of resettlement on existing assets, production systems and community networks | • A Resettlement and Compensation Plan (RCP) will be developed.  
• A Social Development Plan will be developed as part of the RCP.  
• A Resettlement Working Group (RWG) will be established.  
• The resettlement process will be managed and monitored by the EHSC.  
• A rehabilitation programme will be developed to ensure that disturbed areas are rehabilitated and can sustain re-settlers. | EHSC  
RWG  
TM | Design  
Construction |
| 3.1.2        | V2 S11.6.1 V3 S7.2.2             | Reduced capacity for household survival | • Mitigation strategies will be developed during the development of the RCP. For example:  
1. Alternative land of at least the same productive potential will be made available to affected land users at least one year prior to their loss of existing fields.  
2. Kenmare will supplement household food resources and ensure that affected communities regenerate their productive capacities.  
3. Rehabilitated fields will be planted with new and improved varieties of crops as well as other varieties of edible plants, as agreed to during consultation with residents.  
4. People will be allowed to return to cultivate rehabilitated land as soon as possible after an acceptable level of rehabilitation has been reached. | EHSC  
RWG | All |
| 3.1.3        | V2 S11.6.1 V3 S7.2.2             | Increased pressure on surrounding land and resources | • Alternative land near to the existing settlement will be identified and its future agricultural potential assessed.  
• Suitable alternatives when compensating for lost land and productivity will be discussed with the affected parties. | EHSC  
RWG | Design |

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### APPENDIX 3 – SOCIAL ISSUES

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<tr>
<td>3.1.4</td>
<td>V2 S11.6.1 V3 S7.2.2</td>
<td>Increased malnutrition</td>
<td>Kenmare will ensure that affected communities have access to sufficient food resources during the interim period prior to re-establishment of productive systems.</td>
<td>EHSC RWG</td>
<td>Operation</td>
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<td>3.1.5</td>
<td>V2 S11.6.1 V3 S7.2.2</td>
<td>Increased pressure on women to sustain the household</td>
<td>The RCP development, and the establishment of employment policies, will have the direct involvement of women. Kenmare will ensure that the potential benefits of mining are available to women in a manner that they can access. Kenmare will initiate mine-related projects that will ensure the employment of women (e.g. bush clearing; vegetable production to meet the mine’s requirements; outsourced housekeeping for mine accommodation, etc. where practical). A Development Foundation will be established in which the developers, local communities and local government work together to identify and jointly implement appropriate projects for women.</td>
<td>GOV RWG EHSC DF</td>
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<td>3.1.6</td>
<td>V2 S11.6.1 V2 S11.6.5 V3 S7.2.2 V3 S7.2.5</td>
<td>Loss of homesteads, mashambas and ancestral ties Challenges to local and traditional authorities</td>
<td>Affected residents will be integrally involved in every stage of the planning process. A Public Consultation and Disclosure Plan (PCDP) will be developed. A Resettlement Working Group will be established. The Government will carry out an accurate valuation of housing prior to resettlement. Homesteads will be constructed for affected households. Households will be afforded the opportunity to rescue all homestead assets and materials. Transitional support will be provided by Kenmare. Compensation for lost crops will be provided by Kenmare. A host area for mashambas development will be identified, surveyed and developed. Grave resettlement will be treated in accordance with the reasonable requests of the next-of-kin, and all reasonable expenses covered. Project deadlines will not be used unreasonably to push decisions and actions before those affected are in support of the plans. A procedure for reporting environmental complaints from the affected community and employees will be developed.</td>
<td>EHSC RWG GOV GM</td>
<td>All</td>
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<tr>
<td>EMP Ref. No.</td>
<td>Abbreviated Impact/Issue</td>
<td>Management Statement</td>
<td>Responsibility</td>
<td>Phase</td>
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<td>3.1.7 V2 S11.6.1 V3 S7.2.2</td>
<td>Increased potential for conflict over access to land and resources</td>
<td>The identification of compensation alternatives for those being resettled will include careful discussion with other land users (from outside the study area) who may be impacted on as a result of mining operations. Host communities will be actively involved in integrating people resettled off the study area.</td>
<td>EHSC RWG</td>
<td>All</td>
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<td>3.1.8 V2 S11.6.1 V3 S7.2.2</td>
<td>Loss of access to wood resources</td>
<td>Affected communities will be allowed to harvest wood in their fields in advance of mining. Affected communities will be allowed to harvest wood in any natural areas that are to be destroyed by mining activities. Local labour (with employment preference given to affected parties and particularly to vulnerable groups) will be employed to harvest the wood as part of a labour-intensive employment plan. Wood will be made available to those who have lost access to their resource. The possibility of establishing woodlots will be considered together with the affected communities.</td>
<td>EHSC RWG TM</td>
<td>Design Construction</td>
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<tr>
<td>3.1.9 V2 S7.12.2 V3 S6.4.7</td>
<td>Decline in the availability of ethnobotanical resources due to destruction of vegetation communities</td>
<td>People will be relocated to areas of similar resources. The community will be assisted with the replacement of resources to meet their needs with respect to health, boat and house construction, food sources and household artefacts.</td>
<td>EHSC RWG</td>
<td>Construction Operation</td>
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<td>3.1.10 V2 S11.6.1 V3 S7.2.2</td>
<td>Loss of communal resources</td>
<td>Prior to any mining activities, and in conjunction with affected communities, the developer will identify all communal resources and will reach an agreement on their values and replacement options. Compensation will be paid at the time of resettlement.</td>
<td>EHSC RWG</td>
<td>Design Construction</td>
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<tr>
<td>3.1.11 V2 S12.4.2 V3 S8.2.4</td>
<td>Influx of people into the project area Eligibility for resettlement and compensation</td>
<td>The District Administrator will declare a moratorium on settlement of affected communities in the project area. The moratorium will state that no new settlements will be allowed in the area declared as the project area. All persons with land use rights within the boundaries will be eligible for compensation. Claimants will register with the District Administrator.</td>
<td>GOV</td>
<td>Design Construction</td>
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### APPENDIX 3 – SOCIAL ISSUES

#### SECTION 1 - ALL PROJECT COMPONENTS

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<td>3.1.12 V2 S11.6.2 V2 S12.5.4 V3 S7.2.3</td>
<td>• Increased conflict in households and settlements • Increased conflict between settlements and communities</td>
<td>• The EHSC and RWG will function as a channel for ongoing communication between all affected parties and Kenmare. • A PCDP will be developed and implemented, and will provide a mechanism for the community to comment and raise concerns.</td>
<td>EHSC RWG DF</td>
<td>All</td>
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<td>3.1.13 V2 S11.6.2 V3 S7.2.3</td>
<td>• Conflict between local residents and project expatriates</td>
<td>• Kenmare will try to adhere to decisions reached through an inclusive process – particularly with reference to employment policies – and where possible limit their employment of expatriate workers and non-local Mozambicans. • Local employee training and capacity enhancement will be implemented. • Training and capacity enhancement will be planned in a participative manner.</td>
<td>RWG EHSC GOV GM DF</td>
<td>All</td>
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<td>3.1.14 V2 S11.6.2 V3 S7.2.3</td>
<td>• Increased incidence of sexually transmitted diseases (STDs) and AIDS</td>
<td>• All workers will undergo thorough AIDS awareness and education programmes. • The implementation of ongoing, accessible and culturally appropriate awareness programmes with the local residents and workers around the dangers of STDs and the risks of AIDS will be considered in conjunction with the Mozambican national HIV/AIDS awareness programme that is run through the Ministry of Health. • Condoms will be provided to all employees.</td>
<td>EHSC GOV</td>
<td>All</td>
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<td>3.1.15 V2 S11.6.2 V3 S7.2.3</td>
<td>• Increase in prostitution</td>
<td>• On site recreation and games facilities will be provided for employees. • Contract duration will be managed and employees will get regular leave allowances.</td>
<td>TM GM</td>
<td>All</td>
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<td>3.1.16 V2 S11.6.2 V3 S7.2.3</td>
<td>• Decrease in visual quality due to housing</td>
<td>• Design will take into account the surrounding environment, e.g. paint colour, tree screens, etc.</td>
<td>TM</td>
<td>Design</td>
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<td>3.1.17 V2 S11.6.3 V2 S7.12.2 V3 S6.4.7 V3 S7.2.4 Post EIA</td>
<td>• Physical removal or relocation of graves • Social disorientation and psychological insecurity • Increased social tension within the household • Undermining of the authority of elders</td>
<td>• Graves will be relocated with the full participation of affected families and communities. • All the costs associated with the relocation will be covered by the project. • Elder men and women will be included in planning and implementing the relocation of graves. • People will be adequately educated about the changes that will take place in their natural environment and the possible effect on their livelihoods through the PCDP.</td>
<td>EHSC RWG</td>
<td>All</td>
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</table>
### APPENDIX 3 – SOCIAL ISSUES

|--------------|---------------------------------------|--------------------------|----------------------|----------------|-------|
| 3.1.18       | V2 S4.8.1 V3 S6.4.3                   | • Loss of annual fruit and nut production  
• Loss of tree and grass resources (capital loss) | • Compensation will be paid for the loss of fruit and nut production.  
• The amount to be compensated will be determined together with government authorities.  
• Local communities will be allowed to harvest prior to clearing.  
• Trees and grass resources will be replanted as part of the rehabilitation programme. | EHSC RWG | All |
| 3.1.19       | V2 S6.8.3 V3 S9.5.2                   | • Increased health threats | • Awareness programmes will be developed and medical protocols will be established.  
• All hazardous areas will be fenced off. | EHSC | Construction Operation |
| 3.1.20       | V2 S11.6.4 V3 S7.2.5                  | • The construction and operation of the mine will increase job opportunities at the local level  
• Expansion of the skills base | • A Labour Desk/Employment Committee will be established.  
• Guidelines that enhance local labour recruitment will be developed and provided to contractors.  
• Social investment initiatives will be investigated by the DF (e.g. bursaries, educational programmes, awareness programmes, skills development, interactive skills-based adult education programme). | EHSC RWG DF | All |
| 3.1.21       | V2 S11.6.4 V3 S7.2.5                  | • Development of indirect and induced local economic opportunities | • A local procurement policy coupled with a capacity building programme will be developed and implemented.  
• Partnerships will be developed with the local communities (e.g. outsourcing of, laundry and waste collection services, food gardens). | GOV GM DF | All |
| 3.1.22       | V2 S11.6.4 V3 S7.2.5                  | • Socio-economic consequences of the expansion of the national tax base  
• Increased pressure on existing infrastructure and local government’s capacity to deliver services | • Through the DF, Kenmare will negotiate with government to ensure that a percentage of tax revenues goes to the provincial coffers and preferably to the development of service provision in the affected district and locality. | GOV GM DF | Operation |
| 3.1.23       | V2 S11.6.5 V3 S7.2.5                  | • Increased pressure on government to participate in the implementation and monitoring of an environmental management plan | • Kenmare will co-operate with all levels of government affected by the project.  
• Through the DF, Kenmare will provide support (e.g. training) for provincial and local government institutions most burdened by the project. | GOV GM TM EHSC DF | Operation |
| 3.1.24       | V2 S11.6.6 V3 S7.2.7                  | • Increased pressure on access routes during construction and operation | • Road infrastructure will be upgraded to cope with the additional traffic, including roads leading from the mine site to the Nampula/Moma road. | TM | Design Construction |
##APPENDIX 3 – SOCIAL ISSUES

###SECTION 1 - ALL PROJECT COMPONENTS

|--------------|-------------------------------------|--------------------------|----------------------|---------------|-------|
| 3.1.25       | V2 S11.6.6 V3 S7.2.7                | Increased risks to local residents' health and safety | • Strict codes of conduct will be implemented for mine personnel operating heavy and light vehicles.  
• A PCDP will be developed, which will inform locals of health and safety risks. | EHSC           | All               |
| 3.1.26       | V2 S11.6.6 V3 S7.2.7                | Visual impacts           | • The slimes dams and the landfill site will be revegetated.  
• Vegetation will be established as a buffer between residential areas and the project area.  
• The accommodation village will be designed to reduce visual impacts, e.g. choices of building materials, colour and positioning.  
• All undesirable infrastructure will be removed at closure and all areas will be rehabilitated and re-vegetated. | TM  
EHSC       | Design  
Construction |       |
| 3.1.27       | V2 S11.6.7 V3 S7.2.8                | Mine closure and redundant workers | • Profiles of recruits, recruitment strategies and human resource development projects will be carefully considered in closure planning.  
• Informing employees and locals about closure will form part of the PCDP.  
• A full Closure and Rehabilitation Plan (CRP) will be developed and submitted to MICOA for approval. | GM  
DF  
EHSC       | Operation                        |
| 3.1.28       | Post EIA                           | Impacts on the affected communities and employees | • Environmental performance objectives and measurable indicators against which the performance of the project can be measured and monitored will be developed and implemented for all phases of the project. | EHSC           | All               |
### APPENDIX 3 – SOCIAL ISSUES

#### SECTION 2 - DREDGING

|-------------|--------------------------------------|--------------------------|----------------------|----------------|-------|
| 3.2.1       | V2 S9.6.3 V3 S6.5                    | Possible impact of radiation on employees and re-settlers | • A monitoring programme will be developed as part of an overall Radiation Management Plan (RMP).  
• Monitoring will involve ascertaining baseline levels for the entire mine area, surface water and groundwater.  
• The small monazite-containing streams will be mixed with the sand tailings and pumped onto the mining area. Radioactive levels after dredging will be measured and if concentrations are higher than those outlined in the RMP, additional capping will be undertaken.  
• External dose, dust inhalation and surface concentrations will also be monitored within the dredge path.  
• Employees will be given annual medicals. | EHSC TM | Design Operation |

| 3.2.2       | V2 S11.6.6 V3 S7.2.7                | Loss of traditional access and transport routes in the dredge path area | Kenmare will create alternative access links where mining effects roads and footpaths.  
• New access roads will be created around the mining operation, if minor access patterns are disrupted.  
• Access routes will be rehabilitated after mining. | TM EHSC | Design |

See “all project components” above.

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## APPENDIX 3 – SOCIAL ISSUES

### SECTION 3 - PROCESS PLANT

|-------------|-------------------------------------|--------------------------|----------------------|---------------|-------|
| 3.3.1       | V2 S9.6.3 V3 S6.5                   | Possible impact of radiation on employees | • A Radiation Management Plan will be developed, which will monitor radioactivity.  
• External dose, dust inhalation and surface concentrations will also be monitored.  
• A management programme for all waste streams containing elevated levels of monazite will be developed, e.g. storage, transportation, dust prevention, etc.  
• Employees will be given annual medicals. | EHSC TM | Design Operation |

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## APPENDIX 3 – SOCIAL ISSUES
### SECTION 4 - TAILINGS DAM

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<tr>
<td>3.4.1</td>
<td>V2 S4.8.2 V3 S6.4.3</td>
<td>• Permanent loss of land use due to the tailings dams</td>
<td>A Resettlement and Compensation Plan (RCP) will be developed and the tailings dam will be addressed.</td>
<td>RWG EHSC</td>
<td>Design Construction</td>
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</tbody>
</table>
| 3.4.2        | V2 S11.6.6 V3 S7.2.7                 | • Loss of traditional access and transport routes | • New access roads will be created around the tailings dam, if minor access patterns are disrupted.  
• Major access routes will not be disrupted where possible. | TM | Design |
| 3.4.3        | Post EIA                              | • Impact on Health and Safety | The tailings dam will comply with international standards:  
1. The dam will be designed and its construction supervised by experienced and competent professionals.  
2. An independent agency will review the tailings dam design, construction and start-up of operations.  
3. An emergency preparedness / response plan will be developed.  
4. Periodic safety inspections of the dam will be undertaken after completion. | TM | Design Construction Operation |

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## APPENDIX 3 – SOCIAL ISSUES

### SECTION 5 - OPERATIONAL SUPPORT

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<td>3.5.1</td>
<td>V2 S11.6.4 V3 S7.2.5</td>
<td>• Extension of services to the district and local area</td>
<td>• Where possible, local infrastructure will be incorporated into mine planning.</td>
<td>GM GOV TM</td>
<td>Design</td>
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<td>3.5.2</td>
<td>V2 S11.6.6 V3 S7.2.7</td>
<td>• Increased risks to local residents’ health and safety due to waste and sewage disposal</td>
<td>• Information will be distributed to local residents highlighting health and safety risks in areas around the operational area. • The appropriate infrastructure and environmental management planning will be put in place.</td>
<td>EHSC TM</td>
<td>All</td>
</tr>
<tr>
<td>3.5.3</td>
<td>V2 S11.6.7 V3 S7.2.8</td>
<td>• Use of infrastructure after closure</td>
<td>• Closure planning will include alternative uses for housing, camp and office facilities and equipment. • Policies will be developed by all stakeholders to ensure the continuation of social networks and community activities.</td>
<td>GOV GM</td>
<td>Operation</td>
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<td>3.6.1</td>
<td>V2 S7.12.2 V3 S6.4.7</td>
<td>A change in the distribution of migratory pelagic fish resulting in lower catches in the fishery adjacent to the pier</td>
<td>The pier will be designed so that it results in as little change as possible to the nearshore current patterns and sediment movement.</td>
<td>TM</td>
<td>Design</td>
</tr>
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</table>
| 3.6.2       | V2 S7.12.2 V3 S6.4.7                   | Exclusion of fishing activities and boat traffic in the regions adjacent to the pier and around the offshore ore transfer area | A pier policy will be developed with the local community, which will: 
1. Establish the size of the no-fishing zone around the pier. 
2. Allow non-motorised boats through and around the area outside time of loading operations. 
3. Establish the no-go area around the barge and bulk carrier transfer site through negotiation with the industrial prawn fishery and subsistence fisheries. | GM EHSC | Design Construction |
| 3.6.3       | V2 S11.6.6 V3 S7.2.7                   | Increased risks to local residents’ health and safety | Access to the jetty structure will be prohibited to the local community. 
Access to the jetty from below will be prevented. 
Information will be distributed to local residents highlighting health and safety risks in areas around the jetty. | EHSC TM | All |
| 3.6.4       | V2 S11.6.6 V3 S7.2.7                   | Loss of traditional access and transport routes | The jetty will be designed and constructed to allow safe passage below – both on shore and in the water. | TM EHSC | Design |

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### Appendix 4: Waste Disposal Issues

#### SECTION 1 - ALL PROJECT COMPONENTS

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<td>4.1.1</td>
<td>Post EIA</td>
<td>• Impacts on the biophysical and social environments</td>
<td>• Environmental performance objectives and measurable indicators against which the performance of the project can be measured and monitored will be developed and implemented for all phases of the project.</td>
<td>EHSC</td>
<td>All</td>
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#### SECTION 2 - DREDGING

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<tr>
<td>4.2.1</td>
<td>V2 S9.6.3 V3 S6.5 Post EIA</td>
<td>• Possible concentration of radioactive material in the dredge path</td>
<td>• A Radiation Management Plan will be designed and implemented.</td>
<td>EHSC TM</td>
<td>Design Operation</td>
</tr>
</tbody>
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1 V = Volume; S = Section
### APPENDIX 4 - WASTE DISPOSAL ISSUES

#### SECTION 3 - PROCESS PLANT

|--------------|--------------------------------------|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|-------------|
| 4.3.1        | V2 S9.6.3 V3 S6.5                    | Possible concentration of radioactive material in the environment and plant, and associated impact on personnel and local people | • A Radiation Monitoring Programme will be developed to ALARA standards and implemented.  
• A management programme for all waste streams containing elevated levels of monazite will be developed, e.g. storage, transportation, dust prevention, etc. will be developed as part of the overall RMP. | EHSC TM        | Design Operation |
| 4.3.2        | V2 S9.6.4 V3 S6.5                    | Disposal of industrial wastes | • A waste disposal site will be constructed using sound engineering and environmental practices.  
• Industrial waste streams will be handled according to accepted practices.  
• Where possible, solid waste will be recycled.  
• Human and animal access to waste disposal sites will be prevented.  
• An auditing system will be developed to ensure that wastes go to the correct facility. | TM EHSC        | All          |
| 4.3.3        | V2 S9.6.7 V3                         | Disposal of neutralised acid precipitate | • The precipitate will be placed in a sealed area that will be specifically designed and constructed with an impermeable liner.  
• The monitoring of this facility will be incorporated into a monitoring programme.  
• Options for the disposal of a liquid waste bleed stream will be investigated.  
• Once volumes and constituents of the precipitate streams are known, different disposal options will be investigated. These will include the long term environmental implications of concentrating or dispersing these streams. | TM EHSC        | All          |

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|-------------|--------------------------------------|--------------------------|--------------------------------------------------------------------------------------|----------------|--------------|
| 4.4.1       | V2 S9.8.2                            | Disposal of wastes into the tailings dam | • Surface and groundwater quality below the dam will be monitored regularly.  
• The tailings dam will be built with good engineering practice to ensure stability.  
• The tailings will be spread out in layers so that maximum dispersal of material is achieved. | EHSC TM        | Design Operation |

¹ V = Volume; S = Section
### APPENDIX 4 – WASTE DISPOSAL ISSUES

|--------------|--------------------------------------|--------------------------|----------------------|---------------|-------|
| 4.5.1        | V2 S9.6.4 V3 S6.5                    | Disposal of general wastes | - A waste disposal site will be constructed using sound engineering and environmental practices.  
- Waste streams (domestic and medical) will be handled according to accepted practices. Medical waste will be incinerated.  
- A waste management system will be developed to ensure that the classification, collection, transport and disposal are coordinated.  
- An auditing system will be developed to ensure that wastes go to the correct facility.  
- Where possible, solid waste will be recycled or re-used.  
- Human and animal access to waste disposal sites will be prevented. | EHSC TM | All |
| 4.5.2        | V2 S9.6.4 V3 S6.5                    | Disposal of spillages    | - The waste collection and disposal system will be well managed and operated.  
- Wastes that cannot be recycled will be collected regularly and placed in a well designed and operating waste site.  
- Oil traps, cut-off drains, sumps and settling ponds will be installed at all vehicle servicing areas, areas with hydraulic and transformer oils and other areas where needed.  
- Fuel and chemical storage tanks will be designed, located, constructed and managed in suitably bunded areas and in accordance with the accepted international standards.  
- An emergency preparedness /response plan for chemical spills and related incidents will be developed. | EHSC TM | All |
| 4.5.3        | V2 S9.6.5 V3 S6.5                    | Sewage collection, treatment and disposal | - The sewage system will be designed to have sufficient capacity to handle expected waste during construction and operation.  
- All on-site sewage will be reticulated to this system.  
- The temporary facilities to be used while the sewage works is constructed will be designed so as to minimise any groundwater pollution.  
- A monitoring programme will be designed, which will include the regular | EHSC TM DF | Design Construction |

1 V = Volume; S = Section
### APPENDIX 4 – WASTE DISPOSAL ISSUES

#### SECTION 5 - OPERATIONAL SUPPORT

|--------------|-------------------------------------|--------------------------|----------------------|---------------|-------|
|              |                                     | Disposal or accidental spillage of laboratory wastes | monitoring of the sewage system to ensure that the system is operating as designed.  
• The mine will advise and possibly assist the local village in managing its sewage effluent, should this become a problem.  
• A settling facility, through which all laboratory wash water will pass, will be constructed, and will have a facility to remove the heavy liquid for specific treatment and disposal.  
• The laboratory waste stream will be monitored for eco-toxicity and the disposal methods adapted accordingly, if required.  
• Disposal methods will be adapted for different chemicals.  
• A specific area will be designated for the offloading and storage of chemicals/hazardous materials.  
• A training and awareness programme for handling chemical products will be developed.  
• Fuel and chemical storage tanks will be designed, located, constructed and managed in suitably bunded areas and in accordance with the accepted international standards. The bunds will be constructed so that the whole volume of the tank can be contained in the case of spillage.  
• Oil traps will be constructed in vehicle servicing areas.  
• An emergency preparedness / response plan for chemical spills and related incidents will be developed. | TM EHSC | All |
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<tr>
<td>V2 S8.4.1 V3 S6.4.6</td>
<td>• Pollution of coral and nearshore ecosystems by waste and ballast water</td>
<td>• Solid waste will be compressed and stored for shore disposal. • An environmental awareness programme will be developed, which will include the education of materials handling workers so that they do not dispose of waste overboard.</td>
<td>TM EHSC</td>
<td>Design Operation</td>
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¹ V = Volume; S = Section
### Appendix 5: Emission Issues

#### APPENDIX 5 – EMISSION ISSUES

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<tr>
<td>5.1.1</td>
<td>V2 S10.6.1 V3 S6.3; S6.5</td>
<td>The impact on health of the respirable dust produced during the construction phase</td>
<td>A detailed watering programme will be developed and implemented.</td>
<td>EHSC TM</td>
<td>Design Construction</td>
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<td>5.1.2</td>
<td>V2 S11.6.6 V3 S7.2.7</td>
<td>Increased ambient noise levels in surrounding areas</td>
<td>As much vegetation as possible will be retained or established around the construction and operation sites. Where possible, mining operations generating significant amounts of noise will only take place during daylight hours. Noise guidelines will be adhered to.</td>
<td>TM EHSC</td>
<td>Construction Operation</td>
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<td>5.1.3 Post EIA</td>
<td></td>
<td>Impacts of emissions on the biophysical and social environments</td>
<td>Environmental performance objectives and measurable indicators against which the performance of the project can be measured and monitored will be developed for all phases of the project.</td>
<td>EHSC</td>
<td>All</td>
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#### APPENDIX 5 – EMISSION ISSUES

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<tr>
<td>5.2.1</td>
<td>V2 S10.6.1 V3 S6.5</td>
<td>The impact on human health of respirable dust from sources of fugitive dust</td>
<td>Wet suppression will be used during all activities. A detailed watering programme will be developed and implemented.</td>
<td>TM EHSC</td>
<td>Operation</td>
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1. V = Volume; S = Section
2. GM = General Manager; TM = Technical Manager; EHSC = Environmental, Health, Safety & Community Manager; RWG = Resettlement Working Group; DF = Development Foundation; GOV = Mozambican authorities
### APPENDIX 5 – EMISSION ISSUES

#### SECTION 3 - PROCESS PLANT

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<tr>
<td>5.3.1</td>
<td>V2 S9.8.8 V2 S10.6.1 V3 S6.5</td>
<td>The impact on human health of respirable dust from sources of fugitive dust</td>
<td>• Wet suppression will be used on stockpiles. • Efficient dust extraction systems will be installed.</td>
<td>TM EHSC</td>
<td>Operation</td>
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<tr>
<td>5.3.2</td>
<td>Post EIA</td>
<td>Impact of gaseous emissions on the environment from the roaster, plant, generators and vehicles</td>
<td>• An air quality monitoring system will be established and international standards adhered to.</td>
<td>TM EHSC</td>
<td>Construction Operation</td>
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#### SECTION 4 - TAILINGS DAM

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<tr>
<td>5.4.1</td>
<td>Post EIA</td>
<td>Impact of respirable dust arising from the tailings dam on the environment</td>
<td>• Air quality will be monitored around the tailings dam and dust managed using watering programmes.</td>
<td>TM EHSC</td>
<td>Construction Operation</td>
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#### SECTION 5 - OPERATIONAL SUPPORT

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<tr>
<td>5.5.1</td>
<td>V2 S10.6.1 V3 S6.5</td>
<td>The impact on human health of respirable dust from sources of fugitive dust e.g. vehicle-entrained dust from roads</td>
<td>• A detailed watering programme will be developed and implemented. • Various mitigatory measures will be considered, e.g. compaction or stabilisation of stockpiles, covering piles, and making use of storage bags.</td>
<td>EHSC TM</td>
<td>Operation</td>
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## APPENDIX 5 – EMISSION ISSUES

|--------------|--------------------------------------|--------------------------|----------------------|----------------|-------|

See “all project components” above.