Appendix A

Balmoral South Iron Ore Project

Project Environmental Management Plan

International Minerals

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Balmoral South Iron Ore Project

Project Environmental Management Plan

International Minerals Pty Ltd

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The content of this Project Environmental Management Plan has been derived from the Construction Environmental Management Plan prepared for the Sino Iron Project by Maunsell in 2006 and Strategen in 2007.

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1. INTRODUCTION

1.1 BACKGROUND

Australasian Resource Pty. Ltd. (ASX Code: ARH), through its wholly owned subsidiary International Minerals Pty Ltd (IM), plans to develop the Balmoral South Iron Ore Project (the Balmoral South Project) in the Pilbara region of Western Australia. The Balmoral South Iron Ore Project consists of a magnetite iron ore mine, processing facility and infrastructure in the Cape Preston region of Western Australia, 80 km south of Karratha (Figure 1: Location Plan).

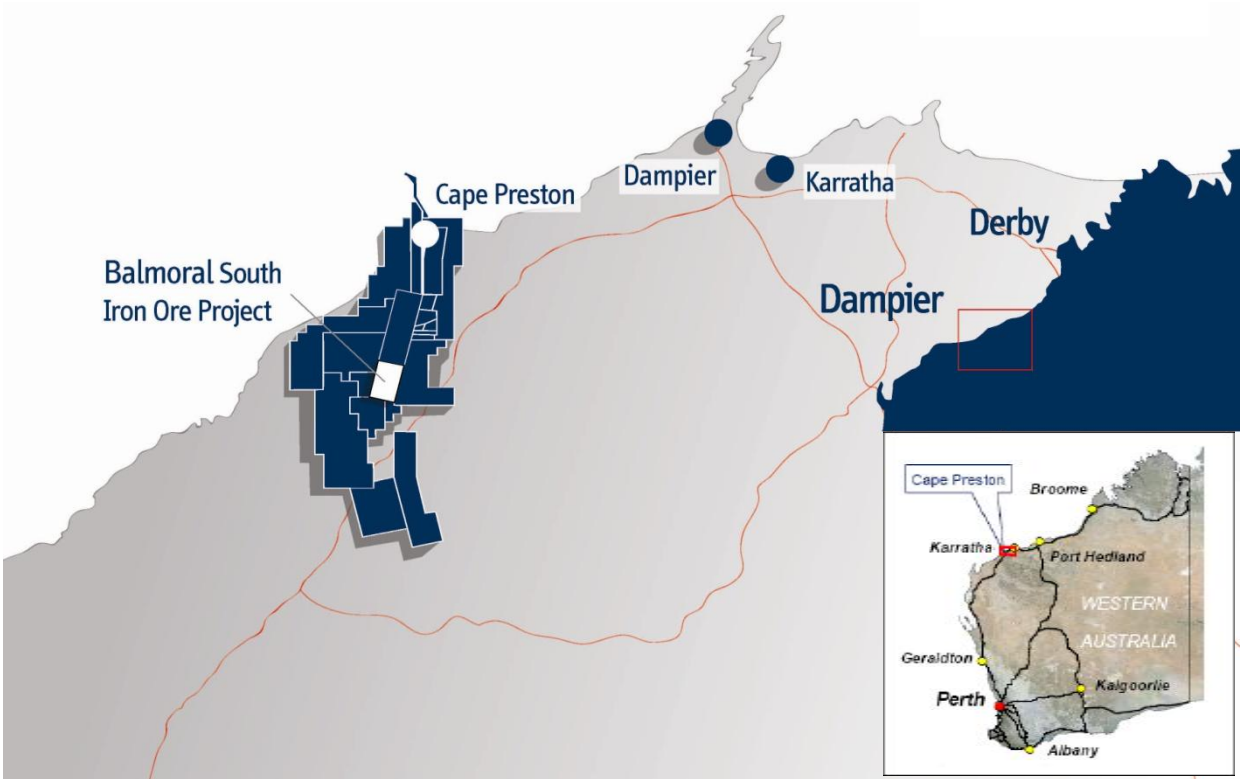

Figure 1: Location Plan

1.2 THE PROPONENT

The Proponent for the Balmoral South Project is:

International Minerals Pty Ltd

Head Office	**Postal Address**	**Contact Person:**
Level 4, 5 Mill Street Perth WA 6000	PO Box 7752, Cloisters Square Western Australia 6850. Telephone: (08) 9322 2288 Facsimile: (08) 9324 2164	Nick Jukes Study Director Email: njukes@austresources.com.au Telephone: (08) 9322 2288

1.3 REQUIREMENT FOR A PROJECT ENVIRONMENTAL MANAGEMENT PLAN

Environmental baseline information related to the Balmoral South Project is covered within the Public Environmental Review (PER). There are a number of environmental and social impacts expected as a result of this project addressed in Chapter 7(Biophysical Issue and Management), Chapter 8 (Pollution Issues and their Management) and 9 (Social Issues and their Management) of the PER document, and as such, IM has committed to the preparation and implementation of a Project Environmental Management Plan (PEMP) to ensure compliance with best environmental management practices throughout the construction, operation and decommissioning of the Balmoral South Project.

The PEMP contains plans, guidelines and procedures to manage environmental issues associated with construction, operation and decommissioning of the Balmoral South Project.

1.4 PURPOSE AND STRUCTURE OF THIS PEMP

This document is a PEMP that has been specifically prepared to provide environmental measures for IM and its contractors to follow for the construction, operation and decommissioning of the Balmoral South Project, to ensure that:

- Activities associated with the Balmoral South Project's development do not adversely affect adjacent environmental and heritage values or the local community; and
- Any potential environmental impacts of the development are managed in accordance with legislative requirements and best environmental management practices.

The PEMP is comprised of an overall environmental management framework and specific management sections to address relevant environmental factors and mitigate potential impacts of the proposed activities. The PEMP has been prepared in accordance with the Department of Environment and Conservation (DEC) guidelines.

This PEMP is a live, interactive document that will be updated in accordance with best practice environmental management practices, standard operating procedures, any Works Approvals and Licence conditions, and in consultation with key project stakeholders.

1.5 ENVIRONMENTAL MANAGEMENT PROGRAMME

The use of stand-alone Environmental Management Plans for each environmental factor has been standard practice in Western Australia. Some of the large industrial projects have developed over 15 individual environmental management plans which address specific environmental factors. IM believes that the management of the environment should be an integrated approach which can be clearly communicated through the construction, operation and decommissioning phases of the Balmoral South Project. As such, IM's Environmental Management Programme is based on one PEMP.

The PEMP establishes the blueprint for how environmental issues will be managed throughout the stages of development. It serves to guide best practice environmental management in line with relevant legislation and IM's corporate goals for the development of the Balmoral South Project. The environmental management framework for the Balmoral South Project is shown in Section 3.

Where appropriate, each of the management sections:

- Defines management objectives for the environmental factor it addresses;
- Describes management measures/actions required to achieve the environmental commitments and environmental management objectives related to the environmental factor;
- Provides a description of monitoring, performance criteria and targets, as required, for meeting environmental commitments and objectives related to the environmental factor;
- Describes contingency measures to be implemented in the event of unexpected or unacceptable environmental impacts; and
- Outlines responsibilities and timing of implementation of described measures.

The PEMP will be supported by an Environmental Management System (EMS) that includes policy, standards and procedures that provide more detailed, step-by-step instructions for personnel involved in construction and operations. Part of this system is the induction package and will include specific environmental training modules according to job duties and accountabilities.

1.6 ENVIRONMENTAL MANAGEMENT SYSTEM

IM's approach to managing environmental aspects for which it is responsible is embodied in the development and implementation of its Environmental Management System (EMS). IM's EMS has been developed to be consistent with the internationally recognised EMS standard ISO 14001. It is a systematic approach to managing environmental issues across all activities. The EMS will assess the level of environmental risk that each activity may pose. ISO14001 outlines the requirement to then manage any of those risks identified to be significant. Following this, an audit protocol and review process is implemented to allow for future amendments to the system and to provide opportunities for continuous improvement.

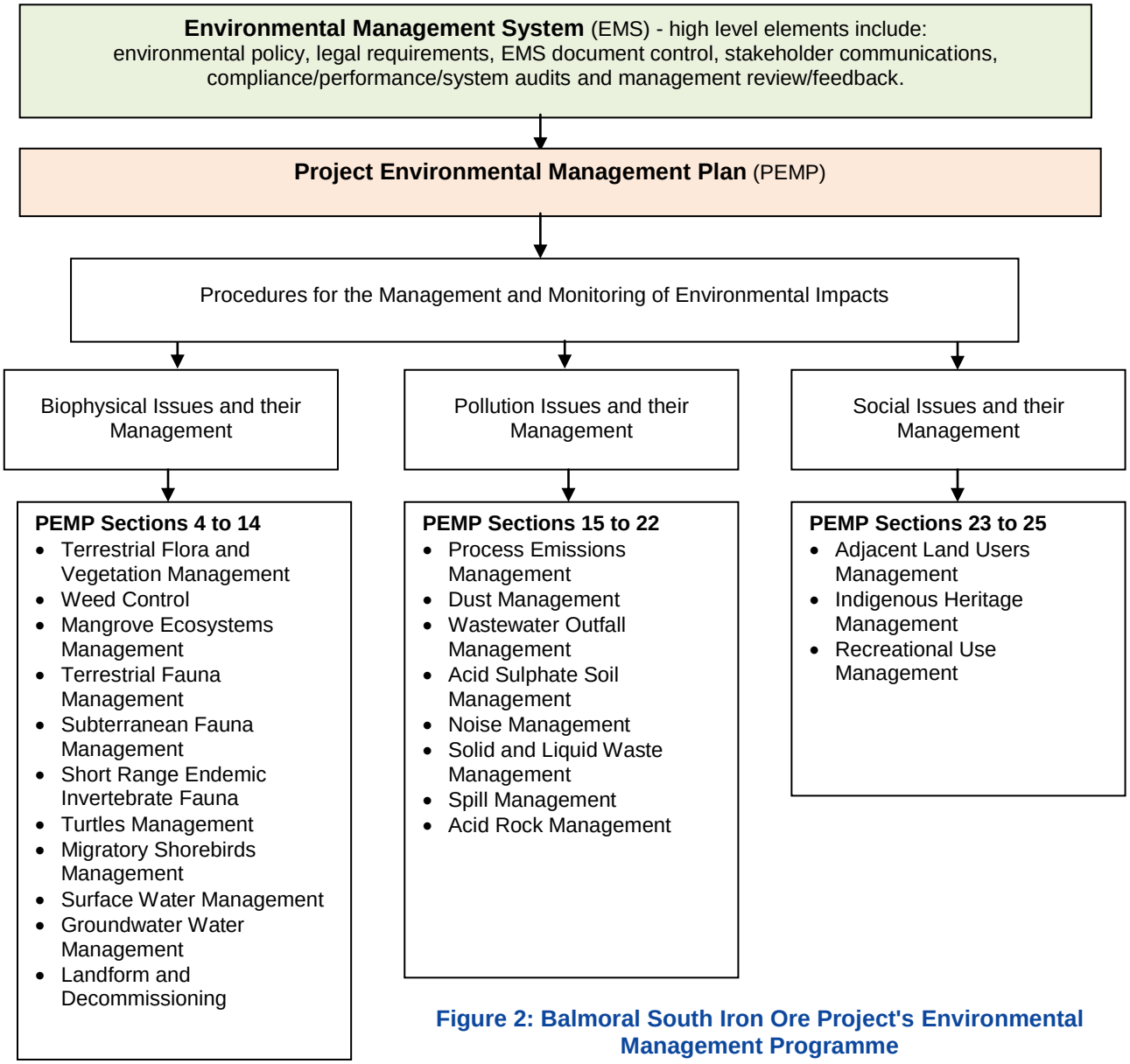

Figure 2: Balmoral South Iron Ore Project's Environmental Management Programme

The Balmoral South Project shown in Figure 3: Balmoral South Iron Ore Project Areas of Disturbance Sheet 1 of 2 and Figure 4: Balmoral South Iron Ore Project Areas of Disturbance Sheet 2 of 2 is expected to operate

for at least 28 years, and extensions beyond this will depend on continued contracts for ore supply and economic analysis.

Table 1: Key Project Characteristics lists the key characteristics for the Balmoral South Project. Whilst best endeavours will be taken to develop plant designs that conform to these specifications, final quantities will not be known until detailed design is developed.

Table 1: Key Project Characteristics

Element	Characteristics (All quantities are NOMINAL)
General	
Development Period	Project Development Stage 1: 3 years Project Development Stage 2: 3 years (immediately after Stage 1)
Operation Period	Minimum 28 years after Project Development Stage 1
Mining	
Ore reserves	2 billion tonnes
Ore mining rate	80 Mtpa
Pit depth (ultimate)	300 m
Overburden and waste	80 Mtpa
Stripping ratio	1.0 / 1.0 waste to ore
Materials handling	Conventional drill, blast, load and haul.
Dewatering rate	Up to 4 GLpa, including groundwater inflows and weather events
Dewatering disposal	To process water stream and dust suppression
Concentrator	
Production	Concentrate: 24 Mtpa
Waste	56 Mtpa
Pelletising	
Production	Pellets: 14 Mtpa.
Infrastructure	
Power	Up to 600 MW installed capacity gas fired combined cycle power station
Conveyor / Slurry Pipeline	~ 30km in length between the Process Plant site and Cape Preston Stockyard
Gas supply	Up to 34,000 Tjpa
Water Supply	40 GLpa desalination plant and up to 4 GLpa pit dewatering
Port Stockyard	2 Mt storage capacity
Roads	General traffic, haulage, mine, accommodation and access, infrastructure maintenance access
Buildings	Administration, maintenance workshops, storage, accommodation village and power station
Sewage	Package treatment plants
Disturbance Areas	
Areas of disturbance and rehabilitation	Total Disturbance During Project 5,282 ha Final Pit Outline Surface Area 355 ha Total Rehabilitation 4,927 ha
Workforce	
Construction	Up to 4,000
Permanent	Up to 1,500
Accommodation	Onsite for the entire workforce

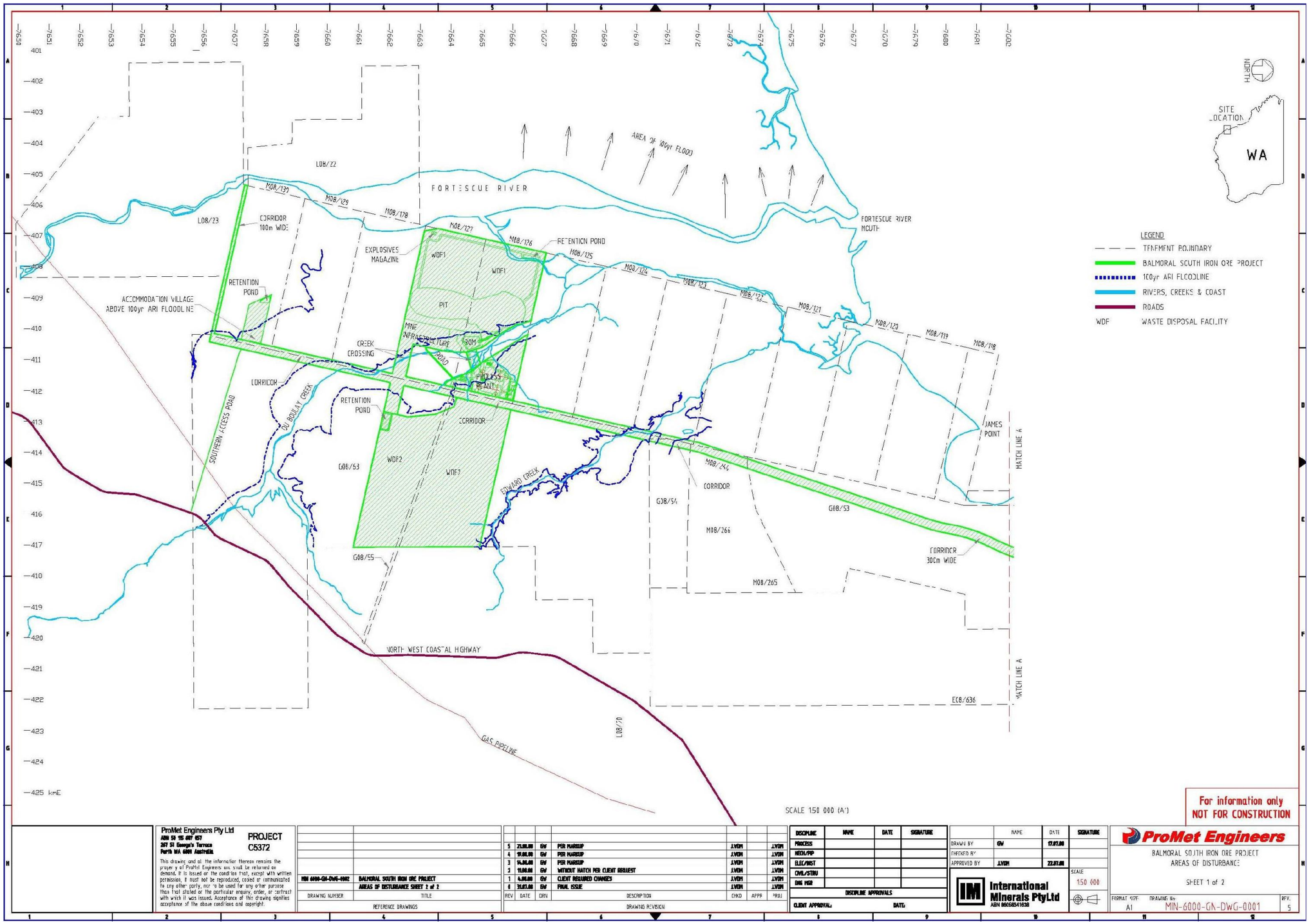

Figure 3: Balmoral South Iron Ore Project Areas of Disturbance Sheet 1 of 2

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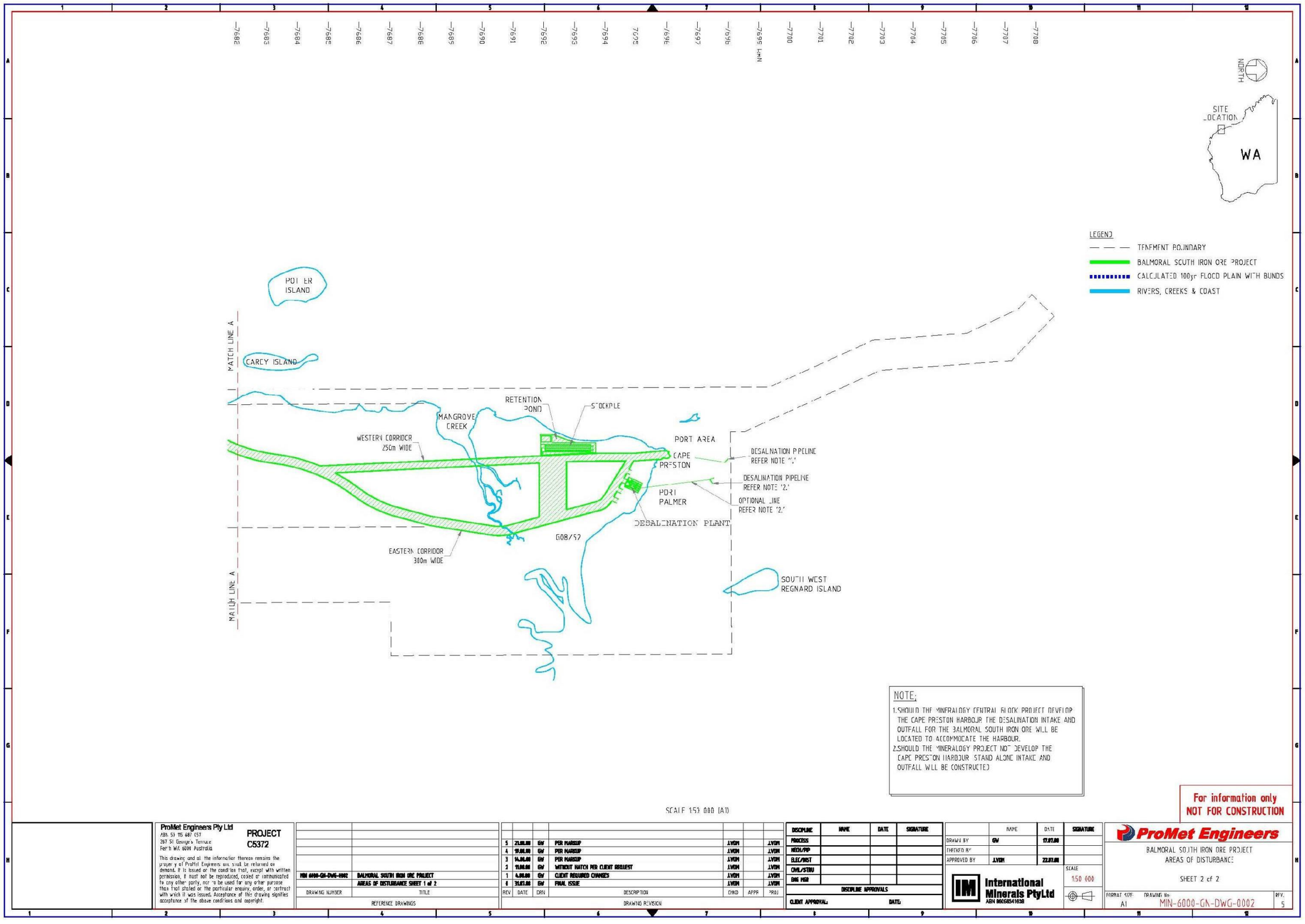

Figure 4: Balmoral South Iron Ore Project Areas of Disturbance Sheet 2 of 2

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Construction Activities

The main construction activities will include:

- Clearing of the mine and infrastructure sites including collection and reuse of topsoil where available;
- Extraction of a bulk sample from the mine pit;
- Pre-strip of the open pit to expose ore in advance of Processing Plant operation;
- Construction of mining infrastructure;
- Construction of monitoring equipment and commencement of monitoring activities;
- Construction of temporary facilities (such as lay down areas, construction camps and offices, workshops, concrete batching plant);
- Construction of crushing, concentrating and pelletising facilities;
- Construction of plant, roads, pipelines, materials handling facilities, power station, communications and other services;
- Construction of permanent accommodation, stream diversions, building pads, waste disposal facility, waste management facilities; and
- Construction of the desalination plant including water intake and wastewater outfall pipes.

Operational Activities

In relation to the operation activities, the Balmoral South Iron Ore Project will operate for at least 28 years and the following summarises the main operation activities:

- Extraction of ore and waste for the mining operations;
- Movement and placement of waste ore/rock into WDFs;
- Operation of processing facilities (such as primary crusher, concentrator and pellet plant);
- Disposal of waste processing material (dewatered tailings) to WDFs;
- Operation of project infrastructure including power station and desalination plant;
- Transportation of finished products from process plant site to stockyard facilities at Cape Preston;
- Operation of desalination intake and wastewater outfall; and
- Processive rehabilitation of waste disposal facilities (WDFs)

Closure Activities

The closure of the mine site would include the following tasks:

- Mine roads ripped and seeded;
- Removal of infrastructure such as above ground structures, pipelines, electrical reticulation and magazines;
- Creation of mine abandonment bunds as per DoIR guidelines;
- Rehabilitation of mine office and workshop site; and
- Removal of the fuel farm.

Timing of Activities

- The precise timing of construction activities is not expected to be of any environmental significance other than the extreme weather and flooding associated with cyclones. Construction activities will continue through this period with particular attention given to cyclone readiness for construction materials, emergency response, runoff control and flooding.
- Table 2 shows the facilities proposed and the predicated construction activities/timing for the Balmoral South Project.

Table 2: Construction Activity and Timing

Facility	Activities	Indicative Timing	
		Active	Complete
Mine pit and waste rock, commencing with bulk sample	Clearing, topsoil stripping, overburden removal, sample mining (including blasting, stockpiling, crushing, dewatering, waste rock placement)	2009	Ongoing
Mine site facilities area	Clearing, earthmoving	2009	2012
Concrete batching plant	Clearing, earthmoving, construction	2009	2010
Offices, workshop, drill core store, laboratory	Clearing, earthmoving, construction	2009	2015
Magazine, nitrate storage	Clearing, earthmoving, construction	2009	2010
Power station	Clearing, earthmoving, construction	2009	2015
Gas pipeline lateral	Clearing, trenching, backfilling, restoration	2010	2011
Concentrator	Clearing, earthmoving, construction	2009	2015
Construction camps	Clearing, earthmoving, construction, wastewater treatment	2009	2014
Section of service corridor south of proposed causeway over tidal flats	Clearing, earthmoving, road building, services construction, heavy haulage	2009	2014
Haul roads	Clearing, earthmoving, heavy haulage, grading	2009	2011
Communications tower	Clearing, earthmoving, construction	2009	2010
Waste management facility	Clearing, earthmoving, construction	2009	Ongoing
Landfill	Clearing, earthmoving, construction	2009	Ongoing
Crushing Facility	Clearing, earthmoving, construction, blasting, crushing	2009	2014

When construction is completed and following commissioning trials, facilities will be operated in accordance with this PEMP, standard operating procedures, and any Works Approvals and Licence conditions. Some operational aspects will overlap with construction activities.

2. ENVIRONMENTAL SETTING

The Balmoral South Iron Ore Project is located on the north-west Pilbara coast near the mouth of the Fortescue River on a largely weed infested cattle grazing country. The Cape Preston Region is affected by cyclones and associated flood events. The PER of Balmoral South Project provides a description of the physical, biological and social environment of the Cape Preston area. In summary, the key environmental values of the Balmoral South Project area include:

- Cracking clays of the Horseflats Land System;
- Mangrove communities occurring between Cape Preston and the mainland;
- Subterranean fauna;
- Short range endemic invertebrate fauna;
- Turtle and shorebirds;
- Surface water flow and quality in the Fortescue River and Du Boulay Creek;
- Groundwater quality in the Fortescue River alluvial;
- Phreatophytic vegetation of the River and Paraburdoo Land Systems; and
- Marine water quality.

An overview of the Cape Preston area is provided below.

2.1 RESERVES AND OTHER PROTECTED AREAS

The Balmoral South Project will not impact on any:

- Bushplan or other System areas or Reserves.
- Wetlands, including Ramsar wetlands and Environmental Protection Policy areas.
- Declared waterways.
- Priority surface and groundwater protection areas.
- Areas in which previous land uses may have contaminated the soil or water resource.
- Declared rare flora.

2.2 CLIMATE

Cape Preston is situated on the Pilbara coast. Rainfall is low throughout the region and quite variable. Annual totals vary from 200 – 450 mm, and many years without significant rainfall occur. The lower totals are typical of the south where tropical cyclone effects are less frequent. Most of the summer rain comes from scattered thunderstorms and the occasional tropical cyclone. A secondary peak in the monthly rainfall occurs in May/June as a result of rainfall caused by tropical cloud bands which intermittently affect the area mostly in these months. These events can also produce low maximum temperatures particularly away from the coast. The number of thunderstorms average 20 - 30 per annum over most of the area but 15 - 20 is more common near the coast. Almost all storms occur in the summer.

2.3 AIR QUALITY

Cape Preston is a remote site, relatively far from existing emission sources. As a result, existing levels of SO_2 and NO_2 are low. Ozone levels are moderate as indicated in the DEP monitoring at Dampier, where, over two years of monitoring, two events with 1-hour concentrations exceeding 0.06 ppm or 60% of the NEPM standard were recorded. These were due to bushfire smoke and, as such, similar levels could be expected at Cape Preston.

NO_x levels are also low with data indicating that the background annual average is around 3 µg/m3 with a 70th percentile 1-hour concentration of 5 µg/m3. Average annual background (concentrations at areas with no local sources) PM_{10} values in the Port Hedland region are around 20 µg/m3.

2.4 SOILS AND GEOLOGY

The landform and vegetation at the Balmoral South Project's proposed mine site is generally described as low hills and slopes with mainly hummock grassland and small shrubs (Austeel, 2000). The Project Area is part of the Rocklea Land System, and is located within the Mardie Station pastoral lease – an active pastoral station producing beef cattle.

The Project Area is underlain by crystalline basement rocks including granite-greenstone rocks of the Pilbara Craton, and volcanic and sedimentary rocks of the Hamersley Basin (predominantly Maddina Volcanics and Kylena Basalt). The basement rocks outcrop extensively throughout the area and are strongly folded and faulted. Granitic rocks underlie the Eramurra Creek floodplain to the east. Groundwater in the Eramurra Creek area occurs in superficial strata and in fractures within underlying crystalline basement rocks.

2.5 SURFACE WATER

The Balmoral South Project is located adjacent to the lower reaches of the Fortescue River and approximately 15 km from the river mouth. The Fortescue River has a well defined main flow channel, typically 4 – 6 m deep and 100 m wide adjacent to the Project Area. Above the Project Area, the Fortescue River has an effective catchment area of approximately 20,000 km^2. The ephemeral Edward and Du Boulay Creeks flow through the Balmoral South Project Area in a north-westerly direction and discharge to the Fortescue River. Du Boulay Creek has a catchment area of approximately 200 km^2.

2.6 HYDROLOGY

The major aquifers in the area are the gravels of the Fortescue River alluvium and to a lesser extent the Yarraloola Conglomerate. Depth to the water table is generally 4 - 12 m below ground level. Groundwater within the Fortescue River alluvium generally conforms to drinking water guidelines. Groundwater users in the Project Area are pastoral wells, phreatophytic vegetation and subterranean fauna.

2.7 TERRESTRIAL FLORA AND VEGETATION

Within the Balmoral South Project Area a total of 500 vascular flora species, from 64 families and 196 genera have been recorded. Several Priority Flora species have been found, or potentially occur, although no Declared Rare or Threatened Flora has been recorded. The Declared Plants *Prosopis pallida* (Mesquite) and *Datura leichhardtii* (Native Thornapple) occur in the area and drainage lines tend to be heavily infested with *Cenchrus ciliaris* (Buffel Grass).

The Project Area is predominantly degraded cattle grazing country within the Fortescue Botanical District, broadly consisting of various *Acacia* shrublands over *Triodia* hummock grasslands on the more rugged, shallow soiled habitats, and *Eragrostis xerophila* tussock grasslands dominating the heavy clay soils. Drainage lines are dominated by *Eucalyptus* spp. over *Melaleuca* and *Acacia* shrublands.

Eighty vegetation communities have been mapped. Of particular importance are the cracking clays of the Horseflats Land System and the phreatophytic vegetation of the River and Paraburdoo Land Systems. In 2004, the Minister for Planning and Infrastructure approved an area of approximately 2,555 ha to be excluded from Mardie Station as part of the "2015 Exclusion Process". The area was identified as particularly valuable for its conservation value because of the Horseflats Land System and related vegetation associations that are poorly represented within the conservation estate. No Threatened Ecological Communities have been recorded.

Three phreatophytic flora species (*Eucalyptus camaldulensis*, *Eucalyptus victrix* and *Melaleuca argentea*) occur within eight vegetation communities.

2.8 MANGROVE

A well-developed and structurally complex mangrove system is associated with the major tidal creek and connective tidal flats that join Cape Preston with the mainland (Mangrove Creek). Other areas of mangrove occur in the wider locality, including a generally narrow zone of *Avicennia marina* which borders the western shoreline and embayment between the creek and the mouth of the Fortescue River.

2.9 FAUNA

The fauna of the Balmoral South Project Area is generally dominated by birds and reptiles. Several species of mammal are also common, predominantly consisting of smaller species such as native mice. Database searches have indicated that several fauna species of conservation significance potentially occur in the area. The fauna habitats within the Project Area are all well represented in the region and none are regarded as regionally significant or unique.

2.10 SUBTERRANEAN FAUNA

Studies to date suggest that the Balmoral South Project Area contains a subset of the subterranean fauna that occurs within the larger Cape Preston area. It appears likely, based on the distribution of the more frequently occurring species and the lack of major geological discontinuities between the mining areas that the same communities extend through all orebodies at Cape Preston.

2.11 SHORT RANGE ENDEMIC INVERTEBRATE FAUNA

SRE fauna are defined as arthropods that display restricted geographic distributions that may be disjunct and highly localised (nominally defined as < 10km2 in Harvey 2002). The most appropriate analogy is that of an island, where the movement of fauna is restricted by the surrounding marine waters, thus isolating the fauna from other terrestrial island populations.

This analogy has limited relevance to the project because the landscape is comprised of an extensive range which is orientated in a north-south direction, thus displaying very few mesic, southern facing slopes and being further dissected by minor and major gullies and a limited number of large gorges. The mesic areas provide ‘island habitats’ within the otherwise arid landscape that defines the Pilbara region generally.

2.12 MARINE ENVIRONMENT

At Cape Preston, nearshore water movements and mixing patterns are driven primarily by large tidal ranges (HAT of 4.75 m), local currents and winds, but are also influenced by seabed topography and the steering effect of islands and reefs. The water column is relatively well mixed with stratification not apparent to any marked degree. Turbidity in the region is generally high, due to the episodic high volume river flows, dominant marine sediment types, strong local winds, large tides and common occurrences of cyanobacterial blooms. Water quality in the area is relatively undisturbed by anthropogenic sources.

Macroalgae dominate submerged limestone reefs within the Cape Preston area, and also grow on stable rubble and boulder surfaces. Seagrasses form interspersed macroalgae beds. Fauna of the shallow water limestone reefs and platforms include hard and soft corals, sponges, ascidians, fan worms, molluscs, crustaceans, urchins and sea stars. Dense areas of high coral cover are sparsely distributed in the region, whilst areas of low coral cover tend to occur as a thin border along steep slopes that descend from shallow algae dominated pavements around islands to a deep sandy seafloor. The nearest major reefs to Cape Preston which support high live coral cover are over three kilometres away.

The beaches of Cape Preston are utilised for a very limited amount of turtle breeding activity. Small numbers of dugong have been sighted in the Dampier Archipelago / Cape Preston region. Migratory shorebirds utilise Pilbara coastal habitats such as beaches, tidal flats and other intertidal wetlands during the non-breeding season. The highest concentration of shorebirds occurs along the western shore of Cape Preston.

2.13 LAND USE

Land use in the area comprises pastoral grazing, mining activities at the Central Block and limited tourism and recreation. The port site is within the Great Sandy Island Nature Reserve and lies west of the proposed Regnard Marine Management Area.

2.14 ABORIGINAL HERITAGE

Archaeological and ethnographic studies have identified the Aboriginal Heritage values of the area and the presence of a number of sites of heritage significance. No sites of European heritage significance occur in the area.

3. PROJECT ENVIRONMENTAL MANAGEMENT FRAMEWORK

3.1 ROLES AND RESPONSIBILITIES

General

All personnel managing or working on the Balmoral South Project shall be responsible for environmental management and continuous improvement in performance.

All personnel associated with the Balmoral South Project shall be required to comply with the requirements of all applicable environmental legislation, regulations, codes of practice as well as project standards, procedures and work instructions. An outline of the environmental responsibilities of key personnel and contractors throughout the life of the Balmoral South Project is given below.

Specific Personnel

Construction or Operations Manager

The Construction or Operations Manager will:

- Ensure the Balmoral South Project specific EMS is effectively implemented;
- Incorporate the PEMP actions and requirements into the Balmoral South Project specific procedures;
- Appoint/nominate the Environmental Manager;
- Review the performance of the EMS and PEMP on a quarterly basis;
- Review any environmental non-conformances, remediation and preventative actions;
- Allocate Project resources to manage environmental issues; and
- Ensure suppliers and contractors comply with environmental requirements.

Project Engineers and Superintendents

The Balmoral South Project Engineers and Superintendents will:

- Implement the PEMP on site.
- Report to the Environmental Manager and/or Site Environmental Officer on environmental issues and non-conformances.
- Ensure that site personnel are aware of their environmental obligations.
- Take corrective action to resolve non-conformances.

Systems Manager (Quality, Environmental, OH&S)

The Systems Manager will:

- Ensure that audits of the Balmoral South Project PEMP and EMS are carried out and reported to the Environmental Manager and Construction/Operations Manager.
- Provide advice and support in relation to environmental issues.
- Review final EMP and EMS to ensure compliance with AS/NZS ISO 14001.

Environmental Manager

The Environmental Manager will:

- Be suitably qualified and have demonstrated experience in construction or operations environmental management.

- Act freely and independently to take all steps necessary to avoid or minimise adverse environmental impacts, including recommending to the Construction or Operations Manager that activities cease due to inadequate environmental performance.
- Report to the Construction or Operations Manager on the performance of the PEMP, EMS and improvement opportunities.
- Ensure that the EMS is effectively established, implemented and maintained at the Balmoral South Project level.
- Review and update the PEMP and associated documentation.
- Be present on site during any critical construction activities and provide support to the Balmoral South Project team to enable them to meet their environmental commitments.
- Arrange for environmental inspection and audit programmes to be completed.
- Implement an appropriate environmental awareness training programme and assist site personnel to complete the training programme.
- Ensure that environmental records and files are maintained.
- Ensure community complaints and non-conformances are recorded and appropriately considered and acted upon.
- Liaise with relevant local authorities regarding works to maintain effective lines of communication.
- Liaise with the general public and key stakeholders, as required.
- Oversee environmental monitoring requirements, as required by approvals, licenses and permits.

Site Environmental Officer (SEO)

The Site Environmental Officer will:

- Be on site during all construction or operations activities.
- Undertake daily and weekly site inspections and audits, as required by the PEMP and EMS.
- Conduct site specific environmental awareness training.
- Investigate and report on any environmental incidents and ensure that appropriate action is taken.
- Complete construction inspection checklists (see Appendix A) and report to the Environmental Manager.
- Undertake environmental monitoring requirements, as required by approvals, licenses and permits.

Contractors

Contractors will:

- Comply with legal and contractual requirements.
- Comply with management/supervisory directions.
- Participate in awareness training as directed by management.
- Notify project management prior to commencement of key activities.
- Regularly report on activities and environmental performance.

All Personnel

All personnel associated with the Balmoral South Project will:

- Comply with the relevant Acts, Regulations, Codes of Practice and Standards.
- Comply with the Environmental Policy and Procedures.
- Promptly report to management any non-conformances and/or breaches of the system.
- Participate in awareness training as directed by management.

General Contractor Requirements

Each construction or operations Contractor will provide a PEMP or EMS demonstrating their ability to manage their environmental impacts. The Contractor's PEMP/EMS will identify how the Contractor will achieve the requirements of this PEMP by defining their management strategies.

As part of the PEMP/EMS, the construction or operations Contractor is required to ensure compliance with all conditions, licences, permits, consents and approvals relating to the construction or operational phases of the Balmoral South Project.

In some instances, contractors will be required to submit a specific Contractor's Management Plan that provides a list of procedures and contingency plans relating to a specialised construction activity requiring environmental management.

3.2 INDUCTIONS

All personnel associated with the Balmoral South Project shall undergo basic environmental management training as part of the initial safety and environmental induction to inform them of their responsibilities. Personnel will be provided with more intensive training according to their role and accountability. The training will be modular and will include information on management systems, waste management, ground disturbance procedures, and other items outlined in this PEMP.

3.3 TRAINING OF PERSONNEL

All employees shall receive appropriate environmental training to ensure they are aware of their responsibilities and are competent to carry out their work in an environmentally acceptable manner.

Environmental requirements shall be explained to employees during a site induction. Ongoing instruction shall be provided via modular training packages, toolbox meetings and the like. All inductions and ongoing instruction shall be recorded.

All employees (including subcontractors) shall receive awareness instruction in the following areas:

- Environmental policies.
- PEMP and related documents.
- Site environmental objectives and targets.
- Understanding the regulatory requirements applying to the Balmoral South Project and their consequent responsibilities as a member of the Balmoral South Project team.
- Significant Project aspects, impacts and controls as detailed in Sections 4 to 25 of this PEMP.
- Potential consequences of departure from procedures.
- Emergency procedures and responses.
- Identification of their legal obligations.

Personnel performing tasks that may cause significant environmental impacts shall receive additional induction and training in a modular format to further inform them of particular requirements, risks and controls or must be certified as having completed induction and training processes, and/or as having gained appropriate experience, before undertaking such tasks.

3.4 COMMUNICATIONS

'Toolbox' meetings shall be regularly held by each crew during construction and operational activities. During these meetings, concerns and questions raised by personnel shall be addressed and any environmental incidents that occurred previously, discussed. In addition, new environmental management procedures or information shall be discussed to ensure effective implementation. If requested by personnel or felt necessary by the Construction or Operations Manager, Project Engineers or Superintendents, Environmental Manager or SEO, specific environmental management procedures already communicated to personnel will be reiterated during these meetings.

Regular meetings between the Construction or Operations Manager and Project Engineers or Superintendents shall be undertaken to establish the progress of development and the schedule and location of activities over the site. This information shall be forwarded to the Environmental Manager.

3.5 PUBLIC COMPLAINT RESOLUTION

All complaints relating to the environmental factors from the general public to IM, its co-proponents or contractors shall be treated as environmental incidents as described in Section 3.7 and Table 3.

3.6 MONITORING

Monitoring, inspection and reporting of environmental aspects of construction or operation of the Balmoral South Project shall be undertaken by the SEO as specified in this PEMP.

3.7 ENVIRONMENTAL INCIDENT RESPONSE

Environmental incidents are defined as being any breaches or non-adherences to objectives and procedures prescribed in the PEMP and environmental management procedures applied to the Balmoral South Project by IM. These incidents are to be reported to the SEO by the person responsible for the incident or the first person at the site of an incident. The SEO shall notify the Environmental Manager and Construction or Operations Manager, who will consider whether the incident resulting may be a breach of statutory conditions and be responsible for any resulting notification. IM may elect to notify authorities of incidents that are not breaches of statutory requirements.

Environmental incidents shall be assigned a level of severity, as defined below for this Project:

- LEVEL 1: Minor non-adherence to procedure, and/or a negligible environmental impact.
- LEVEL 2: Minor non-adherence to procedure and minor environmental impact that requires little management to be rectified.
- LEVEL 3: Moderate breach of procedure and/or an environmental impact that requires management/mitigation to be rectified.
- LEVEL 4: Extreme breach of procedure and/or environmental impact that could lead to a breach of environmental approval conditions.

The level of the environmental incident shall be determined by the relevant Project Engineer and SEO with advice from IM's environmental consultants, if required.

The procedures to follow in the event of environmental incidents are listed in Table 3.

The procedures may vary depending on the level of incident occurring. Contingency actions specific to incidents are described in the individual component management plans contained in this PEMP and will be implemented concurrently with the actions listed in Table 3.

Table 3: Environmental Incident Procedure

Procedure	Responsibility
1. Report incidents to the SEO as soon as practical.	Person responsible or first on the scene.
2. Report all incidents to the Environmental Manager.	SEO.
3. Determine the level of environmental incident and consult on determining a final incident classification with the Construction or Operations Manager.	Relevant Project Engineer and SEO.
4. Advise the Construction or Operations Manager within 24 hours of a Level 2 incident and as soon as practicable within four hours following a Level 3 incident.	Environmental Manager.
5. Cease immediately all work activities causing environmental incidents of Level 2 or higher and apply correct work procedures as detailed in component management plan contingency actions.	All personnel.
6. Take corrective actions to limit the impact of Level 4 incidents on the environment.	Construction or Operations Manager, Environmental Manager and Environmental Consultants (where necessary).
7. Complete and forward an Environmental Incident Report to the Construction or Operations Manager and Environmental Manager for Incidents of Level 2 or higher.	Relevant Project Engineer and SEO.
8. Review the causes, effects and preventative actions for all incidents and document any recommendations in the Environmental Incident Report.	Construction or Operations Manager, Environmental Manager, Project Engineers, SEO and Environmental Consultants (where necessary).
9. Implement the recommendations from Environmental Incident Reports as soon as practicable.	Construction or Operations Manager, Environmental Manager, Project Engineers, SEO and Environmental Consultants (where necessary).
10. Notify the Department of Environment and Conservation immediately of Level 3 and 4 incidents.	Construction or Operations Manager.
11. Sign-off the Environmental Incident Report after agreement on new procedures to prevent re-occurrence of the incident and after any further remedial action has been reached with IM and any regulatory authorities that were involved.	Construction or Operations Manager and Environmental Manager.
12. Issue any new procedures arising from the Environmental Incident process to Project Engineers, Superintendents and the SEO, and add them as addenda to the PEMP.	Construction or Operations Manager and Environmental Manager.
13. Communicate these new procedures to the personnel via the Toolbox meetings described in Section 3.3 *Training of Personnel*.	Construction or Operations Manager and Environmental Manager.

3.8 DOCUMENTATION

Documentation relating to environmental issues during construction and operations comprises this PEMP, permits, Works Approvals, licences and Contractors' Environmental Management Plan(s). This documentation shall be made available via a site intranet.

The relevant Project Engineer or Superintendent shall be responsible for issuing this documentation to contractor personnel and maintaining an inventory of documentation distribution. He/she shall be responsible for ensuring all document holders receive updates to the documents which may be made from time to time.

The documentation/forms will be generated as the following items:

- Ground Disturbance Permit.

- Construction Inspection Checklists.
- Environmental Incident Reports.

Procedures for the use of such documentation shall be included in the site EMS.

Maintenance of PEMP

The PEMP will be updated periodically from the commencement of construction. This PEMP will also be revised to incorporate stakeholder's requirements as IM will maintain ongoing communication with DEC, government departments/agencies, the shire of Roebourne and local Aboriginal representatives throughout the development of the Balmoral South Project in relation to various environmental factors. The procedures are to be communicated to personnel via 'Toolbox' meetings.

General Environmental Management Actions

Table 4 summarises the management actions discussed above.

Table 4: General Environmental Management Actions

Item	Management Actions	Timing	Responsibility
4.1.	Develop an Environmental Policy and implement all aspects of the policy during the life of the Balmoral South Project.	Pre-construction Phase.	Construction or Operations Manager, Environmental Manager, Contractors.
4.2.	Identify key personnel and contractors, and define their environmental responsibilities, during the Balmoral South Project's Construction or Operations phases.	Pre-construction Phase.	Construction or Operations Manager, Environmental Manager, Contractors.
4.3.	Provide environmental requirements to all employees (including construction and operation contractors), awareness training in the following areas: • Environmental policies. • Requirements of the PEMP relative to their work. • Site environmental objectives and targets. • Regulatory requirements applying to the Balmoral South Project. • Responsibilities for compliance with regulatory requirements. • Sensitive environmental features. • Impacts and controls in the PEMP relevant to their work. • Potential consequences of departure from environmental procedures relevant to their work. • Emergency procedures and responses. • Their legal obligations.	Pre-construction/ Construction Phase.	Construction or Operations Manager, Contractors, Environmental Manager, SEO.
4.4.	Provide competency training to personnel performing tasks that may cause significant environmental impacts.	Construction Phase/ongoing.	Construction or Operations Manager.
4.5.	Require all construction or operations contractors to comply with all conditions, licences, permits, consents and approvals relating to the construction or operations phases of the Balmoral South Project.	Pre-construction Phase.	Construction or Operations Manager.

Item	Management Actions	Timing	Responsibility
4.6.	Employ the following methods to communicate to all employees and on site personnel, the requirements of the PEMP: • Internal (i) Meetings. (ii) Project reports. (iii) Performance assessments reports. (iv) Notice boards. (v) Employee induction, training and toolbox sessions. (vi) Sub-contractor co-ordination meetings. • External (i) Meetings and correspondence with appropriate regulatory authorities. (ii) Discussions and consultation with key stakeholders. (iii) Handling of and responding to complaints.	Construction Phase.	Construction or Operations Manager, Environmental Manager, Contractors.
4.7.	Undertake the following audits: • Annual systems audits of the EMS, including compliance procedures. • Quarterly on site PEMP compliance audits. • Audits of environmental performance in accordance with the site audit programme. • Ongoing work area inspections and audits in accordance with the site audit programme. Persons conducting compliance audits shall be accredited auditors with RABQSA.	Ongoing.	Construction or Operations Manager, Environmental Manager, SEO.
4.8.	Undertake the following: • Produce reports in support of annual licences and permit renewal applications. • Produce an Annual Environmental Review identifying the Balmoral South Project environmental performance, to be submitted to the Environmental Protection Authority (EPA), DEC, Department of Industry and Resources (DoIR) and other relevant agencies. • Maintain records in accordance with the EMS. • Internally report results of quarterly PEMP and annual EMS audits, including any environmental monitoring results and compliance with the conditions of approval. • Produce monthly Incident Report summarising any incidents occurring in the period, including comments on response procedures and preventative actions. • Produce monthly Complaints Reports summarising any complaints received by the contractor, Environmental Manager or Construction or Operations Manager in the reporting period, including comments on course of actions and responses .	Construction Phase.	Construction or Operations Manager, Environmental Manager, SEO.

4. TERRESTRIAL FLORA AND VEGETATION MANAGEMENT

4.1 CONTEXT

In general terms, impacts on flora and vegetation communities will be managed through a process of workforce education, avoidance, minimising disturbance, monitoring impacts, implementation of remedial strategies where practical and rehabilitation.

IM will implement vegetation clearing and topsoil management procedures to maximise the effectiveness of rehabilitation. Effective rehabilitation techniques incorporate the use of cleared vegetation as a source of seed, as mulch to protect soil from erosion or as fauna habitat. Topsoil is the most important factor in rehabilitating disturbed areas as it contains the majority of seeds and other plant propagules (rhizomes, lignotubers and roots), soil micro-organisms and organic matter.

Legislations and Relevant Standards

- *Environment Protection and Biodiversity Conservation Act 1999;*
- *Wildlife Conservation Act 1950;*
- *EPA (2000). Environmental Protection of Native Vegetation in Western Australia. Position Statement No. 2;*
- *EPA (2002). Terrestrial Biological Surveys as an Element of Biodiversity Protection. Position Statement No. 3; and*
- *EPA (2004c). Guidance for the Assessment of Environmental Factors No. 51: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia; and*
- *Agriculture and Related Resources Act 1976.*

Stakeholders consultations

As required IM, or its contractors, will notify and consult relevant authorities in the event that inappropriate management of vegetation, overburden or topsoil causes a potentially significant environmental deterioration. If necessary, IM shall seek advice on proper environmental remediation procedures from the relevant authorities.

The Balmoral South Project Engineers shall maintain ongoing communication with DEC, local Aboriginal representatives and the local fire emergency services throughout the development of the Balmoral South Project in relation to protection of vegetation.

DEC shall be consulted regarding vegetation protection measures and the feasibility of the translocation of various native flora and the collection of seed, seedlings and cuttings from vegetation to be cleared.

The local Fire Emergency Services Authority (FESA) shall be informed of activities to be undertaken at the construction site and advised of fire management actions that will be implemented on site. FESA shall also be consulted subsequent to a fire incident to provide advice if required on improving fire management practices.

4.2 POTENTIAL SOURCES AND IMPACTS

Potential Sources

Inappropriate management of vegetation, overburden and topsoil can result from:

- Lack of recognition of the fragile nature of the Pilbara vegetation and soils;
- Indiscriminate clearing of vegetation;
- Vehicle movement other than on designated roads or tracks;

- Uncontrolled dust pollution;
- Failure to recognise the outcomes of flora and vegetation surveys in detailed design; and
- Spread of weeds, particularly Mesquite and Native Thornapple.

Potential Impacts

Potential environmental impacts on terrestrial flora and vegetation include:

- Loss or degradation of vegetation;
- Construction and operation activities impact on priority flora species;
- Generated dust impacts on adjacent vegetation
- Introduction and/or spread of weeds;
- Impacts on vegetation as a result of groundwater drawdown through mine dewatering;
- Erosion of soils;
- Disruption of water courses; and
- Turbidity increase.

4.3 ENVIRONMENTAL MANAGEMENT OBJECTIVES

EPA Objective

The objective is considered relevant to the terrestrial flora and vegetation:

- To maintain the abundance, diversity, geographic distribution and productivity of flora at species and ecosystems levels through the avoidance or management of adverse impacts and improvement in knowledge.

Balmoral South Project Management Objectives

The Management objectives of the Balmoral South Project are consider relevant to the terrestrial flora and vegetation:

- To minimise adverse impacts of clearing as required for construction and operational activities on vegetation and priority flora
- To prevent disturbance of vegetation adjacent to areas of activity;
- To restore/rehabilitate areas which are not required to remain permanently cleared;
- To monitor the effectiveness of vegetation, overburden and topsoil management measures;
- To adaptively respond to results of the vegetation monitoring programme.

Objectives will be met by implementing the key management actions listed in Table 5.

Management Objectives Covered in Other PEMP Sections

To assess the impacts on terrestrial flora and vegetation during construction and operation of the Balmoral South Project, Some management objectives are specifically addressed in other sections of this PEMP, including:

- To implement management measures for weed control (in particular, Mesquite and Native Thornapple, as they are listed as Declared Plants under the Agriculture and Related Resources Protection Act 1976) is specifically addressed in Section 5 (Weed Control).
- To protect phreatophytic vegetation where possible, particularly along creek lines, for fauna habitat and refuge is specifically addressed in Section 13 (Groundwater Management).

- To consider erosion control and sedimentation within disturbed regions is addressed in Section 12 (Surface Water Management).
- To implement dust suppression measures to minimise dust impacts on adjacent vegetation is specifically addressed in Section 16 (Dust Management).

4.4 MANAGEMENT ACTIONS

IM (through the Construction or Operations Manager) will implement a minimum clearing policy on site such that:

- Any clearing for temporary activities will be scheduled to minimise the time between initial clearing and rehabilitation and will be staged to allow for the local migration of mobile fauna species.
- Areas will be cleared only when required and where necessary.
- Ground disturbance permits will be completed and authorised by the relevant manager prior to any ground disturbance.
- Clearing will be completed in a manner that maximises the salvage and retention of topsoil and organic matter.

In order to avoid and reduce the potential impact of activities on the terrestrial flora and vegetation within the Balmoral South Project area, the key management actions that will be carried out to achieve the management objectives have been compiled in Table 5. This table also details at what stage of the development the actions will be implemented and the responsible person(s) for ensuring operational compliance with the management actions.

Table 5: Management Actions for Terrestrial Flora and Vegetation Protection

Item	Management Actions	Timing	Responsibility
5.1	Induction procedures shall emphasise the need to minimise the disturbance of vegetation by staying within authorised clearance area.	Prior to commencement of clearing.	Construction or Operations Manager, SEO.
5.2	Inspect areas planned for clearing as part of clearing demarcation. Ensuring that detailed design minimises impact on areas of significant vegetation communities, Such as vegetation along creeklines and communities containing Priority Flora species. Communities containing Priority Flora species include: • Bx1 which contains Hibiscus brachysiphonius (P3); • Hp which contains Goodenia pascua (P3); • PP2 which contains Goodenia sp. East Pilbara (AA Mitchell PRP 727) (P1); and • Pf1 which contains Phyllanthus aridus (P3).	Prior to commencement of clearing.	Construction or Operations Manager, SEO.
5.3	Implement a minimum clearing policy on site that incorporates clearing for temporary activities being scheduled to minimise the time between initial clearing and rehabilitation, and only clearing areas when required and necessary.	Construction and operations.	Construction or Operations Manager.
5.4	Delineate areas to be cleared on Project drawings and peg/flag areas in the field. Inspect and approve pegged clearing limits before clearing to ensure they comply with design specifications.	Prior to commencement of clearing.	Construction or Operations Manager, Project Engineer.
5.5	Vehicles and machinery shall only use designated tracks and roads, and shall be parked only in designated locations unless otherwise authorised by the Construction or Operations Manager.	Ongoing.	All Personnel.
5.6	Keep road widths to the minimum consistent with their proposed function.	Prior to and during construction.	Construction or Operations Manager, Project Engineer, Contractors.

Item	Management Actions	Timing	Responsibility
5.7	Store materials within areas authorised to be cleared by the Construction or Operations Manager. Stockpile cleared vegetation and topsoil to avoid erosion from works and surface water flow.	During Construction phase and ongoing	Contractors, All Personnel.
5.8	Mark clearly topsoil stockpiles in the field and identify them on a site plan including their volume.	On going.	Project Engineer, Contractor.
5.9	Progressively rehabilitate any temporarily disturbed areas in accordance with the site rehabilitation procedure. Commence rehabilitation as soon as cleared areas are no longer required.	During construction.	Project Engineer, SEO.
5.10	Ensure fire tender vehicles are fit for purpose and emergency response personnel are trained in fire fighting.	Ongoing	Construction or Operations Manager.
5.11	Liaise with local Fire and Emergency Response personnel regarding emergency response plan	Ongoing	Construction or Operations Manager.
5.12	Where possible rehabilitate disturbed areas to vegetation types and fauna habitats that reflect the pre-existing ecosystem. Adhere to the rehabilitation principles contained in the Australian Mining Industry Council guidelines on mine rehabilitation. Apply the following rehabilitation requirements in accordance with the site rehabilitation procedure: • Retained topsoil, vegetation debris, logs and leaf litter will be used during rehabilitation; • Vegetation will be removed and either directly placed on disturbed areas to reduce erosion and encourage seed propagation or stockpiled; • Where topsoil exists it will be stripped prior to land disturbance and consistent with best operational practice; • If the quantity of salvageable topsoil is insufficient for rehabilitation requirements, alternate cover will be determined; • No burning of vegetation will occur, as seed, organic and biological content are destroyed; • topsoil will be applied as soon as practicable • Local provenance seed and plants will be utilised in rehabilitation; • As feasible, vegetation debris, logs and rocks will be returned to areas previously disturbed, as this assists rehabilitation by providing microhabitats for recolonising fauna; • Natural drainage patterns will be reinstated, where practicable; • Reshaped land will be developed to ensure it is stable and adequately drained; • Compacted surfaces will be ripped to a depth commensurate with subsurface conditions to relieve subsurface compaction; • Rehabilitated areas will be monitored and managed until criteria agreed with relevant agencies for tenement relinquishment are achieved.	Ongoing.	Construction or Operations Manager, Project Engineer, SEO, Contractor.

4.5 ENVIRONMENTAL TARGETS AND PERFORMANCE INDICATORS

The key environmental targets and performance indicators will be used to assess performance against the environmental objectives listed in the Section 4.3. Table 6 details environmental targets based on management objectives for terrestrial flora and vegetation protection and performance criteria to assist in assessing the achievement of these targets.

Table 6: Environmental Targets and Performance Indicators for Vegetation Protection

Management objective	Environmental Target	Performance Indicator
To minimise adverse impacts of clearing as required for construction and operational activities on vegetation and flora	Area to be cleared is determined by the Construction or Operations Manager. Vegetation clearance is limited to the area as authorised by the Construction or Operations Manager as essential for the activity.	Map of vegetation clearing is determined by the Construction or Operations Manager. Area of cleared vegetation beyond authorised area as determined through site inspections. Environmental Incident Reports show no unauthorised clearing.
To prevent disturbance of vegetation adjacent to areas of activity.	No direct disturbance of vegetation adjacent to areas of activity.	Area of disturbed vegetation beyond authorised clearing perimeter as determined through site inspections. Environmental Incident Reports show no direct disturbance beyond authorised perimeter.
To restore/rehabilitate areas which are not required to remain permanently cleared.	Areas of temporary disturbance to be rehabilitated are determined by the Environmental Manager. Restoration/rehabilitation conforms with completion criteria.	Map of areas temporarily disturbed prepared by the Environmental Manager. Comparison of results of surveys of rehabilitated areas with completion criteria.
To monitor the effectiveness of controls.	Above targets are met.	Estimate of overall effectiveness through occasional assessment of performance of controls.
To adaptively respond to inadequacies in controls.	PEMP and procedures updated as required.	Extent to which updated PEMP addresses all issues.

4.6 MONITORING AND CORRECTIVE ACTIONS

In order to ensure progress toward the achievement of the management objectives outline in Section 4.3 of this PEMP, ongoing flora and vegetation monitoring will be undertaken.

Construction areas shall be subject to regularly inspections (or as otherwise required by IM on advice from its environmental consultants) during any earthworks and construction. The SEO shall conduct these inspections of the active and constructed areas. Construction Inspection Checklists (Appendix A) are to be utilised during these inspections.

Relevant documentation to be inspected includes the Environmental Incident Reports and previous inspection sheets to check whether problems or non-conformances with these vegetation management procedures have been rectified.

Table 7 details the monitoring programme for terrestrial flora and vegetation protection in the Balmoral South Project Area.

Table 7: Monitoring and Corrective Action Programme for Terrestrial Flora and Vegetation Protection

Item	Activity	Performance Indicator	Corrective Action	Frequency	Responsibility
7.1	Visually monitor site for excessive land disturbance.	Land clearance practices follow plans and procedures.	Stop inappropriate land clearance practices. Check and re-mark clearing perimeter. Commence rehabilitation, where practicable.	Ongoing.	SEO.
		Vegetation is not degraded in areas of no disturbance.	Check land clearance plans and ensure clearing is only occurring in appropriate areas.		
7.2	Visual inspection to ensure vegetation and topsoil is being removed and stockpiled suitably.	Vegetation and topsoil stockpiled effectively.	Stop land inappropriate clearance operations within the area of concern.	Ongoing	SEO.
		Extent of erosion occurring on stockpiles.	Implement correct vegetation and topsoil management as described in Best Practice Environmental Management in Mining (Rehabilitation and Revegetation).		
		Best Practice Environmental Management in Mining (Rehabilitation and Revegetation).			
7.3	Visually monitor for erosion and sedimentation.	Cleared or rehabilitated areas show no effects of erosion.	Implement soil stabilising techniques. Establish drainage networks.	Ongoing	SEO.
7.4	Systematic monitoring of rehabilitated sites.	Rehabilitated areas achieving an identified success criteria level: • Species richness; • Plant density; • Canopy cover; • Seed production; • Fauna return; • Weed control.	Re-seed rehabilitated sites. Implement soil stabilising techniques. Establish drainage networks. Re-establish fauna habitats. Introduce fauna-supporting plant species.	Seasonally	SEO.

Item	Activity	Performance Indicator	Corrective Action	Frequency	Responsibility
7.5	Visually monitor the vegetation health	• Visual health - to be assessed via established photo points; • Health ranking - to be derived from visual assessment, ranging from healthy to dead with various degrees of stress as intermediates; • Alive canopy foliage cover (%) - to be used as a visual measure of tree stress; • Height (m) - to be used as a measure of growth; • Diameter at Breast Height (DBH) - to be used as a measure of growth; and • Percentage weed species.	Corrective action implemented on determination of the impact.	Quarterly.	SEO.

4.7 CONTINGENCY ACTIONS

Triggers for identifying actual and potential non-conformances with the objectives of this plan will be determined for conservation significant species that are likely to be significantly impacted by the Balmoral South Project.

Potential triggers that may exist are described below:

- Unauthorised access beyond clearing boundaries;
- Clearing outside of clearing boundaries; and
- Fire incident
- Decline in vegetation health parameters outlined in Item 7.5 greater than 20% against control sites in similar vegetative communities.

Triggers will be monitored through the monitoring program. In the event that monitoring indicates that a trigger is exceeded or is at risk of being exceeded an investigation will be undertaken to determine the root cause and contingency actions to remediate and avoid further breaches will be determined and completed.

Contingency actions for potential triggers that may be used are described below:

- Investigate cause;
- Rectify immediately if the causes is non-compliance with terrestrial flora and vegetation management actions;
- Implement management action as appropriate to isolate or reduce the causes of impacts;
- Monitor impacts to determine adequacy of control;
- Consult with relevant government agencies on improving the control actions; and
- Complete an Environmental Incident Report

4.8 REPORTING

In the event of a Level 2 incident or higher relating to a fire incident or to terrestrial flora and vegetation protection the personnel involved (or witnesses to) shall complete an Environmental Incident Report.

The other procedures relating to environmental incidents as listed in Section 3.7*Environmental Incident Response* shall also be followed. The Environmental Incident Report (Appendix B).system can be used as a mechanism for reporting contractor non-conformance to this plan to IM or regulatory authorities as required.

5. WEED CONTROL MANAGEMENT

5.1 CONTEXT

Two species listed as declared plants *under the Agriculture and Related Resources Protection Act 1976* were identified within the project area. These are *Prosopis pallida* (Mesquite) and *Datura leichhardtii* (Native Thornapple). Earthworks and disturbance to vegetation has the potential to spread populations of these, and other, species of weeds.

Pursuant to Part V of *the Agriculture and Related Resources Protection Act 1976*, the landowner has an obligation to implement measures to control the spread of declared species.

These weed control procedures contain the controls proposed to minimise the environmental impacts due to the potential spread of weeds during the development of the Balmoral South Project.

Legislations and Relevant Standards

- *Agriculture and Related Resources Act 1976.*
- *Environmental Protection Act 1986*
- *Conservation and Land Management Act 1984*

Stakeholders consultations

IM, or its contractors, shall notify and consult relevant authorities in the event that inappropriate management of weeds causes a potentially significant environmental deterioration. If necessary, IM shall seek advice on potential environmental remediation procedures from the relevant authorities.

The Supervising Engineer shall maintain ongoing communication with representatives from DEC relating to weed control at the development site. This may involve seeking advice on monitoring for weeds and actions to be taken in the potential event of the spread of significant weed infestations.

5.2 POTENTIAL SOURCES AND IMPACTS

Potential Sources

Inappropriate control of weed can result from:

- Lack of recognition of the need to prevent the introduction and spread of weeds;
- Vehicle movement other than on designated roads or tracks;
- Stock movement without sufficient control; and
- Movement of soils or vegetation from one site to another.

Potential Impacts

Potential environmental impacts on weed control include:

- New or expanded weed infestations;
- Increased erosion of soils;
- Potential disruption of water course; and
- Loss of grazing of productive areas.

5.3 ENVIRONMENTAL MANAGEMENT OBJECTIVES

EPA Objective

The objective relevant to weed control is:

- To minimise the risk of introducing weeds not previously recorded in an area;
- To minimise the risk of any increase in known weed density as a minimum, and
- To reduce weed density where this can be achieved effectively.

Balmoral South Project Management Objectives

The Management objectives of the Balmoral South Project are consider relevant to weed control:

- To ensure the construction activities do not introduce new weeds or exacerbate the spread of weeds;
- To minimise the establishment of weeds in areas cleared during construction;
- To ensure that Mesquite and Native Thornapple are not transferred into new areas;
- To monitor the effectiveness of weed control measures; and
- To adaptively respond to results of the weed monitoring programme.

Objectives will be met by implementing the key management actions listed in Table 8.

5.4 MANAGEMENT ACTIONS

Management actions have been developed to reduce the potential for construction or operation activities to exacerbate the spread of weeds and minimise the establishment of weeds within cleared areas of the development. Table 8 details at what stage the actions will be implemented and the responsible person(s) for ensuring operational compliance with the management actions.

Table 8: Management Actions for Weed Control

Item	Management Actions	Timing	Responsibility
8.1	Clearly mark the boundary of the areas to be cleared. Restrict all earthworks and movements of machinery and vehicles to within the marked boundary.	Prior to construction.	SEO, Project Engineer.
8.2	Inspect the site for the presence of Mesquite or Native Thornapple prior to any machinery being moved to a site. Record the results of these inspections.	Prior to mobilisation of machinery.	SEO.
8.3	Inform all site construction or operations personnel of the boundaries defined in Action 5.5.1 as part of their inductions.	Prior to construction.	SEO, Contractors.
8.4	All machinery, vehicles and tools shall be randomly inspected to enforce the policy that they arrive clean of mud or soil that may contain weed seed from other sites before entering the construction or operations site. Any machinery, vehicles or tools not arriving clean shall be turned away.	Ongoing	Project Engineer, Contractors.
8.5	Source topsoil for landscaping from areas of lowest weed infestation where possible.	During construction.	SEO, Project Engineer, Contractors.
8.6	Design new landform contours and drainage so that surface drainage is integrated into natural drainage.	During construction.	Project Engineer.
8.7	Utilise indigenous native species in amenity gardens established by IM.	During construction.	SEO, Contractors.

5.5 ENVIRONMENTAL TARGETS AND PERFORMANCE INDICATORS

The key environmental targets and performance indicators will be used to assess performance against the environmental objectives listed in the Section 5.3. Table 9 details environmental targets based on management objectives for weed control and performance criteria to assist in assessing the achievement of these targets.

Table 9: Environmental Targets and Performance Indicators for Weed Control

Management objective	Environmental Targets	Performance Indicator
To ensure the construction or operations of the proposal does not exacerbate the spread of weeds.	No significant establishment of weed infestations in areas adjacent to cleared areas.	New weed infestations observed during construction site inspections. Environmental Incident Reports show no new weed infestations.
To minimise the establishment of weeds in areas cleared during construction.	No significant establishment of weed infestations in cleared or rehabilitated areas.	Weed infestations observed in cleared or rehabilitated areas during construction site inspections. Environmental Incident Reports show no weed infestations in cleared or rehabilitated areas.
To ensure that Mesquite and Native Thornapple are not transferred into new areas.	No Mesquite or Native Thornapple established in areas where these species were not previously present.	Mesquite or Native Thornapple observed in new areas during Construction or Operations site inspections. Environmental Incident Reports show no Mesquite or Native Thornapple in areas where these species were not previously present.
To monitor the effectiveness of measures.	Above targets are met.	Estimate of overall effectiveness through periodic assessment of performance of controls.
To adaptively respond to results of the weed monitoring programme.	PEMP and procedures updated as required.	Extent to which updated PEMP addresses all issues.

5.6 MONITORING AND CORRECTIVE ACTIONS

In order to ensure progress toward the achievement of the management objectives outline in Section 5.3 of this PEMP, ongoing weed control will be undertaken.

Construction areas shall be subject to inspections (or as otherwise required by IM on advice from its environmental consultants) during any earthworks and construction. The SEO shall conduct these inspections of the active and constructed areas. Construction Inspection Checklists are to be utilised during these inspections.

Relevant documentation to be inspected includes the Environmental Incident Reports and previous inspection sheets to check whether problems or non-conformances with these vegetation management procedures have been rectified.

Table 10 details the monitoring programme for weed control in the Balmoral South Project area.

Table 10: Monitoring and Corrective Action Programme for Weed Control

Item	Activity	Performance Indicator	Corrective Action	Frequency	Responsibility
10.1	Visually monitor site for spread of weeds.	Weed map, weed control practices follow plans and procedures.	Amend weed control procedure.	Ongoing	SEO.
		No unexpected weed infestation.	Check pre-clearance survey and ensure weed control procedures are being implemented.		
10.2	Periodic monitoring of construction areas.	No significant of new weed infestation.	Weed eradication programme. Enhance native species by planting/seeding.	Following rain event or. annually in conjunction with botanical surveys of rehabilitation.	SEO.
10.3	Visually monitor areas subject to weed control	Reduction in size/density of infestation	Implement additional or different control measures.	At a suitable interval after control measure applied.	SEO.

5.7 CONTINGENCY ACTIONS

Triggers for identifying actual and potential non-conformances with the objectives of this plan will be determined for conservation significant species that are likely to be significantly impacted by the Balmoral South Project.

Potential triggers that may exist are described below:

- Significant new weed infestations on cleared areas previously weed-free; and
- Mesquite or Native Thornapple infestation in area proposed to be cleared.

Contingency actions will be initiated if monitoring indicates that significant weed infestations have established in previously weed-free areas or Mesquite/Native Thornapple infestations are discovered.

Contingency actions for potential triggers that may be used are described below:

- Investigate cause;
- Amend management actives and weed control procedures accordingly to prevent reoccurrence;
- Implement P4 Landholder Obligations under Agriculture and Related Resources Protection Act 1976 in consultation with pastoralist.
- Consult with relevant government agencies/pastoralist on improving the control actions; and
- Complete an Environmental Incident Report.

5.8 REPORTING

IM, or its contractors, shall notify and consult relevant authorities in the event that inappropriate management of weeds causes a potentially significant environmental deterioration. If necessary, IM shall seek advice on potential environmental remediation procedures from the relevant authorities.

The Supervising Engineer shall maintain ongoing communication with representatives from DEC relating to weed control at the development site. This may involve seeking advice on monitoring for weeds and actions to be taken in the potential event of the spread of significant weed infestations.

6. MANGROVE ECOSYSTEMS MANAGEMENT

6.1 CONTEXT

The Balmoral South Project includes a service corridor linking the Balmoral South Project mine and Port. As the corridor will cross a tidal creek area south of Cape Preston, IM will build a haulage road across this area in a staged manner.

This service corridor will be extending the currently approved Mineralogy Central Block's corridor (see Ministerial Statement 635). While direct habitat loss is unavoidable, IM commits to ensuring that the extension of the causeway does not reduce the tidal flows through the approved Central Block culverts.

This PEMP has been prepared to identify and manage potential impacts associated with construction and operation of the Balmoral South Project's service corridor between the mine and Cape Preston. It details environmental management measures for the protection of mangrove habitats.

Legislations and Relevant Standards

- *EPA (2001). Guidance for the Assessment of Environmental Factors No. 1: Protection of Tropical Arid Zone Mangroves along the Pilbara Coastline; and*
- *EPA (2004d). Guidance for the Assessment of Environmental Factors No. 29: Benthic Primary Producer Habitat Protection for Western Australia's Marine Environment.*

Stakeholders consultations

As required IM, or its contractors, will notify and consult relevant authorities in the event that inappropriate management of mangroves causes a potentially significant environmental deterioration. If necessary, IM shall seek advice on proper environmental remediation procedures from the relevant authorities.

6.2 POTENTIAL SOURCES AND IMPACTS

Potential Impacts

Potential environmental impacts on mangrove ecosystem include:

- New or expanded weed infestations;
- Loss of native vegetation and fauna habitat;
- Increased erosion of soils;
- Potential disruption of water course; and
- Loss of grazing of productive areas.

6.3 ENVIRONMENTAL MANAGEMENT OBJECTIVES

EPA Objective

The objective is considered relevant to mangrove:

- To minimise the direct impacts to existing mangrove communities from construction of the service corridors and to provide sufficient tidal exchange to mangrove upstream of the causeway for the maintenance of mangrove habitat condition and mangrove survival.

Balmoral South Project Management Objectives

The Management objectives of the Balmoral South Project are consider relevant to mangrove ecosystem:

- Ensure minimal impact is caused to existing mangrove communities;
- Design, construct and operate the service corridor to provide sufficient tidal exchange to mangroves upstream of the tidal creek crossing for the maintenance of mangrove habitat condition and mangrove survival;
- Implement a mangrove monitoring programme to detect impacts to mangroves and provide protection during construction and operation; and
- Ensure that the extension of the causeway does not reduce the tidal flows through the proposed culverts.

Management Objectives Covered in Other PEMP Sections

It is generally acknowledged that mangrove environments contain potentially acid generating soils. Section 18 outlines the objectives to manage the potential impacts of development works that are likely to disturb acid sulphate soils.

Objectives will be met by implementing the key management actions listed in Table 11.

6.4 MANAGEMENT ACTIONS

In order to avoid and reduce the potential impact of construction and operation activities on mangrove ecosystem in the service corridor area, the key management actions that will be carried out to achieve the management objectives have been compiled in Table 11. This table also details at what stage of the development the actions will be implemented and the responsible person(s) for ensuring operational compliance with the management actions.

Table 11: Management Actions for Mangrove Ecosystem Protection

Item	Management Actions	Timing	Responsibility
11.1	The detailed design of the service corridor will take into account local hydrological patterns that may have ecological significance and, to the extent practicable, will maintain natural tidal exchange patterns.	Prior to Construction.	Construction Manager.
11.2	Workforce inductions will include environmental awareness training on the ecological importance of sensitive mangrove habitats and the measures undertaken to protect mangrove areas.	Prior to and during Construction or Operations.	Construction or Operations Manager.
11.3	Mangrove areas outside of the required disturbance envelope are designated as exclusion areas and access into these areas by workers and machinery will be prohibited so that ecological integrity is maintained. Where practical, a buffer area (10 m) between the infrastructure edge and disturbance boundary will be included in site plans to avoid impacts to mangroves outside of the approved area. Prior to site clearing activities, clearance boundaries will be delineated through use of flagging, taping and signage as appropriate to avoid unnecessary disturbance to mangroves.	During Construction.	Construction Manager.
11.4	Where possible mangroves will be scrub-rolled or cut close to ground level rather than removed to provide the maximum opportunity for vegetative recovery of mangroves along the boundary of cleared areas*.	During Construction.	Construction Manager.
11.5	During excavation works undertake appropriate management of potential acid-generating sediments.	During Construction.	Construction Manager.
11.6	Install culverts to design specifications to ensure maximum practicable tidal exchange to mangroves upstream from the service corridor	During Construction.	Construction Manager.

11.7	Dust deposition as a result of construction activities will be managed via Section 16 (Dust Management) of this PEMP	During Construction.	Construction Manager.
11.8	Refuelling and maintenance of construction vehicles will not be carried out in the tidal flats zone in accordance with Section 21 (Spill Management) of this PEMP.	During Construction or Operations.	Construction or Operations Manager.

* Note: The main Pilbara mangrove (*Avicennia marina*) has a great ability to resprout or coppice when under stress. Scrub-rolling or cutting of trees provides the potential for trees at the edge of the cleared area to re-sprout and provide more stability for future rehabilitation via seedling recruitment.

6.5 ENVIRONMENTAL TARGETS AND PERFORMANCE INDICATORS

The key environmental targets and performance indicators will be used to assess performance against the environmental objectives listed in the Section 6.3. Table 12 details environmental targets based on management objectives for mangrove habitats protection and performance criteria to assist in assessing the achievement of these targets.

Table 12: Environmental Targets and Performance Indicators for Mangrove Ecosystem Protection

Management objective	Environmental Targets	Performance Indicator
Ensure minimal impact is caused to existing mangrove communities;	Area to be cleared is determined by the Construction Manager. Vegetation clearance is limited to the area as authorised by the Construction or Operations Manager as essential for the activity.	Map of vegetation clearing is determined by the Construction Manager. Area of cleared vegetation beyond authorised area as determined through construction site inspections. Environmental Incident Reports show no unauthorised clearing.
Design, construct and operate the service corridor to provide sufficient tidal exchange to mangroves upstream of the tidal creek crossing for the maintenance of mangrove habitat condition and mangrove survival;	No significant restriction in tidal flow evident through mangrove areas.	Environmental Incident Reports show no significant restriction in tidal flow evident through mangrove areas.
Ensure that the extension of the causeway does not reduce the tidal flows through the proposed culverts.	No reduction in the tidal flows through the proposed culverts.	No significant restriction to tidal flow through culverts. Tidal level data recorded by monitoring shows that tidal exchange to mangroves upstream of the service corridor is not modified.
Implement a mangrove monitoring programme to detect impacts to mangroves and provide protection during construction and operation; and	Above targets are met.	Estimate of overall effectiveness through periodic assessment of performance of controls.

6.6 MONITORING AND CORRECTIVE ACTIONS

In order to ensure progress toward the achievement of the management objectives outline in Section 6.3 of this PEMP, the overall objective of the Mangrove Monitoring Programme is to detect impacts to mangroves and/or the onset of changes to the processes and conditions required for mangrove survival so that practicable mitigation measures can be taken. It is expected that the service corridor will provide new, additional habitat suitable for mangrove establishment and this will also be monitored.

To achieve this, focus has been placed on parameters that are readily detectable (to provide early warning) and these are linked to the main processes responsible for maintenance of mangrove systems and survival of mangroves (e.g. tidal inundation, sedimentation/erosion, ground/soil water conditions - in particular salinity). Specific objectives and requirements of the programme are:

- Baseline characterisation of mangroves adjacent to the service corridor to provide data with which to assess possible future change.
- Collect tidal level data both upstream and downstream of the tidal creek crossing and map the spatial extent of ponding upstream of the service corridor should it occur.
- Rapid assessment surveillance monitoring of localised impacts (early warning of possible short term changes).
- Determine if any changes in mangrove community health are associated with construction or operations of the service corridor.

Table 13 details the monitoring programme for mangrove ecosystem protection in the Balmoral South Project Area.

Table 13: Monitoring and Corrective Action Programme for Mangrove Ecosystem protection

Item	Activity	Performance Indicator	Corrective Action	Frequency	Respon sibility
13.1	Mapping Mangrove Distribution and Condition	Validate existing mapping and identify any existing (historical) areas of mangrove stress or mortality. Map changes to mangrove distribution that result from the construction of the service corridor and update baseline mapping to depict areas affected by direct or indirect impacts. Overlay actual disturbed mangroves areas onto baseline map of mangrove assemblages (contained within GIS) and calculate the area of mangrove loss.	Check the adequacy of the existing and updated mappings to ensure any changes will be detected.	Prior to construction. Update at completion of main construction stages.	SEO.

Item	Activity	Performance Indicator	Corrective Action	Frequency	Respon sibility
13.2	Tidal Exchange Monitoring	Determine if tidal exchange to mangroves has been modified by comparing water levels upstream and downstream of the service corridor. Monitor tidal levels from gauges located both upstream and downstream from the service corridor at locations where it crosses the main tidal creek and small sub-creeks. Assess the extent of water ponding within mangroves upstream from the service corridor during spring tides where tidal amplitudes are greatest and hence the potential for water ponding is greatest. In addition, IM SEO will undertake fortnightly visual inspections of the extent of ponding and look for evidence of erosion in mangroves near the culverts (coincide with spring tides)	Take immediate short term measures to reduce any potential impacts if necessary.	During both spring and neap tide phases.	SEO.
13.3	Surveillance Monitoring	Assessment of mangrove health to detect short term and localised changes in tree condition and extent of canopy cover. Assessment enables sufficient spatial coverage to be achieved at numerous sites where potential localised impacts may occur. In addition, IM SEO will undertake fortnightly visual inspections along the mangrove transects to collect observations and photographs (where appropriate) of mangrove condition.	Evaluate the adequacy of assessment to ensure any potential localised impacts may occur.	The frequency of subsequent monitoring to be determined once tidal exchange data has been collected and assessed	SEO.
13.4	Groundwater Monitoring	Mangroves are sensitive to changing groundwater conditions and are dependent on tidal inundation patterns to maintain suitable groundwater salinities for mangrove growth and survival. Shallow groundwater monitoring bores will be installed manually and monitored by collecting field data (water table depth, salinity and pH). Groundwater sites will be linked closely to surveillance monitoring sites so that the response of vegetation to changes in groundwater and surface water conditions can be determined.	Evaluate the adequacy of assessment to ensure any potential localised impacts may occur.	The frequency of subsequent monitoring to be determined once tidal exchange data has been collected and assessed	SEO.

6.7 CONTINGENCY ACTIONS

On the basis of data obtained from the Mangrove Monitoring Programme, the need for implementation of additional control measures to mitigate impacts to mangroves will be assessed with regard to the following issues:

- Significance of any changes detected and potential causes (both Project related and natural).
- Scale of impacts to mangroves (if this has occurred) and/or potential for impacts to occur.
- Adequacy of the monitoring programme and the need for further investigation or additional monitoring.
- Impacts on mangroves extend beyond the areas of disturbance approved within the PER

Potential triggers that may exist are described below:

- Clearing or disturbance to mangroves outside of the disturbance boundary;
- Sedimentation in excess of background levels during construction
- Erosion of mangroves
- Excessive dust deposition on foliage(refer to Section 16 Dust Management)
- Hydrocarbon spillage (refer to Section 21 Spill Management)

In order to prevent future potential impacts, a range of potential contingency measures will be considered and implemented as required. It should be noted that prior to implementing any of these measures (or others not yet identified) there is the need to consider the implications of that action on a case-by-case basis in terms of:

- The underlying cause or scenario that has resulted in the problem.
- The practical implementation of a mitigation action and the constraints it may place on the Balmoral South Project.
- What changes or impacts may result from the mitigation measure, both positive and negative, to mangroves (i.e. there is the potential for a mitigation measure to cause corresponding changes/impacts, e.g. the use of machinery on muddy tidal flats in an attempt to rectify a problem may in fact cause more damage than the original impact).

Contingency actions for potential triggers that may be used are described below:

- Investigate causes
- Take immediate short term measures to reduce impacts
- Investigate measures to ameliorate impact on affected mangroves.
- Consult with relevant government agencies/pastoralist on improving the control actions; and
- Complete Environmental Incident Report.

6.8 REPORTING

In the event of a Level 2 incident or higher relating to mangrove ecosystem protection the personnel involved (or witnesses to) shall complete an Environmental Incident Report.

The other procedures relating to environmental incidents as listed in Section 3.7 shall also be followed. The Environmental Incident Report system can be used as a mechanism for reporting contractor non-conformance to this plan to IM or regulatory authorities as required.

7. TERRESTRIAL FAUNA MANAGEMENT

7.1 CONTEXT

Two fauna assessments have been conducted within the Balmoral South Project area between 2000 and 2007. These are:

- Austeel. Biological Survey Phase 1 (Biota Environmental and MF Trudgen and Associates, 2001);
- Balmoral South Environmental Impact Assessment, Flora and Fauna Survey, Balmoral South (Maunsell Australia Pty Ltd, 2006);

One desktop fauna assessment for Balmoral South Project in 2008:

- Targeted fauna desktop assessment (Phoenix Environmental Sciences, 2008a)

The surveys specifically dealt with:

- Observed fauna;
- Evidence of fauna activity;
- Trapped fauna records;
- Potentially present fauna; and
- Inferred fauna habitats.

Legislations and Relevant Standards

- *Environment Protection and Biodiversity Conservation Act 1999;*
- *Wildlife Conservation Act 1950;*
- *Environmental Protection Act 1986;*
- *EPA (2002). Terrestrial Biological Surveys as an Element of Biodiversity Protection. Position Statement No. 3;*
- *EPA (2004f). Environmental Protection of Wetlands. Position Statement No. 4; and*
- *EPA (2004b). Guidance for the Assessment of Environmental Factors No. 56: Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia.*

Stakeholders consultations

IM, or its contractors, shall notify and consult relevant authorities in the event that inappropriate management causes a significant impact on terrestrial fauna. If necessary, IM shall seek advice from the relevant authorities including DEC.

7.2 POTENTIAL SOURCES AND IMPACTS

Potential Sources

Inappropriate management of terrestrial fauna can result from:

- Lack of recognition of the fragile nature of the Pilbara vegetation and soils;
- Indiscriminate clearing of vegetation; and
- Vehicle movement other than on designated roads or tracks.

Potential Impacts

Potential environmental impacts on terrestrial fauna include:

- Habitat loss and modification;
- Direct faunal impacts; and
- Impacts on fauna habitats that is dependent on phreatophytic vegetation from pit dewatering

7.3 ENVIRONMENTAL MANAGEMENT OBJECTIVES

EPA Objective

The objective is considered relevant to the terrestrial fauna:

- Minimise impacts on abundance, species diversity, geographical distribution and productivity of fauna;
- Protect specially Protected (Threatened) Fauna, consistent with the provisions of the *Wildlife Conservation Act 1950*;
- Protect rare and endangered species listed under the *Wildlife Conservation Act 1950*;
- Protect fauna listed on the Schedules of the *Environment Protection and Biodiversity Conservation Act 1999*;
- Monitor and protect, where possible, species listed under the CALM Priority Fauna List; and
- Protect other fauna species of particular conservation significance (e.g. undescribed taxa, range extensions, outliers).

Balmoral South Project Management Objectives

The Management objectives of the Balmoral South Project are consider relevant to the terrestrial fauna:

- Ensuring barriers to native fauna are kept to a minimum;
- Excluding pets, traps and firearms from the Balmoral South Project Area;
- Undertaking clearing at the time of the year least likely to impact breeding or nesting species;
- Minimising the loss of fauna linkage corridors;
- Preventing native fauna, including snakes, from being deliberately impaired or killed by mine site personnel;
- Checking any trenches or open excavations daily for fauna and removing fauna as soon as possible without damage to the animal;
- Providing suitable instruction on environmental issues as part of the mine site induction process to ensure that employees are aware of their environmental responsibilities and are competent to carry out their work in an environmentally responsible manner.

Objectives will be met by implementing the key management actions listed in Table 14.

Management Objective Covered in Other PEMP Sections

The most important factor in managing the impacts of the Balmoral South Project on terrestrial fauna is through the protection of fauna habitat. Section 4 (Terrestrial Flora and Vegetation Management) of this PEMP addresses the protection of fauna habitat and specifically the following terrestrial fauna management actions:

- Avoid important habitats (e.g. cracking clay grasslands and drainage lines);
- Establish rehabilitation programmes during construction, post construction and operations;
- Return suitable fauna habitat where possible; and
- Minimise or avoid impacts on target species and habitats such as cracking clay grasslands and drainage lines.

Noise can also impact on terrestrial fauna. Specific management actions for minimising the impact of noise on fauna are addressed in Section 19 (Noise Management) of this PEMP.

7.4 MANAGEMENT ACTIONS

In order to avoid and reduce the potential impact of activities on the terrestrial fauna within the Balmoral South Project area, the key management actions that will be carried out to achieve the management objectives have been compiled in Table 14. This table also details at what stage of the development the actions will be implemented and the responsible person(s) for ensuring operational compliance with the management actions.

Table 14: Management Actions for Terrestrial Fauna Protection

Item	Management Actions	Timing	Responsibility
14.1	Ensure barriers to native fauna are kept to a minimum.	Prior to construction.	SEO, Project Engineer.
14.2	Minimise fencing in areas where fauna are known to move (known fauna corridor).	Prior to construction.	SEO, Project Engineer.
14.3	Use fauna friendly fencing such as reduced mesh size and no top wires. Install sonic reflectors where safety and security requires the installation of barbed wire.	Prior to construction.	SEO, Project Engineer.
14.4	Exclude pets, traps and firearms from the Balmoral South Project Area.	Prior to construction.	SEO.
14.5	Ensure correct disposal of wastes, especially food materials.	Prior to construction and ongoing.	SEO; Construction or Operations Manager.
14.6	Cover all foundation holes, drill holes and trenches, wherever practicable, to prevent injury to human, stock or fauna.	Prior to construction and ongoing.	Construction or Operations Manager.
14.7	Implement monitoring and control programmes targeting foxes and cats.	During construction and ongoing.	SEO; Construction or Operations Manager.
14.8	Develop and implement system for minimising impact and evaluate significance of nest sites.	During construction and ongoing.	SEO.
14.9	Offset unavoidable loss of nest sites through the use of nesting boxes.	During construction and ongoing.	SEO.
14.10	Report to Construction Manager the location and significant times of year of nesting or breeding fauna areas.	During construction and ongoing.	SEO;
14.11	Where possible, reduce vehicle movements during peak fauna movement periods as determined through a log of fauna deaths (species, location and time).	During construction and ongoing.	SEO; Construction or Operations Manager.
14.12	Impose speed restrictions in known fauna corridor.	During construction and ongoing.	SEO; Construction or Operations Manager.
14.13	Trench length and excavation time will depend upon the physical nature of the area excavated and the logistics of the services being installed. IM do not envisage that any significant lateral services will be installed, and as such, the length of any single open trench will be capped at 1,000m. Egress ramps will be installed at 100m intervals.	During construction and ongoing..	Construction Manager.
14.14	Check any trenches or open excavations at nominal times at the start and end of each day (within 2 hours of sunrise and 2 hours prior to sunset).for fauna and removing fauna as soon as possible without damage to the animal. Report trench-related fauna deaths to the DEC.	Ongoing.	Construction Manager.

Item	Management Actions	Timing	Responsibility
14.15	Manage the construction of open trenches such that: In the event of a cyclone impacting on the area, excavation activity will be reduced, and installation activity increased such that a maximum of 100m is left open at the time of operational shutdown.	During construction and ongoing.	Construction or Operations Manager.
14.16	Minimise the time that trenches or holes are left open and if it is necessary for a trench to remain open for extended periods, install suitable escape ramps at regular intervals along the trench;	During construction and ongoing.	Construction or Operations Manager.
14.17	If it is necessary for a trench to remain open for extended periods, suitable escape ramps to be installed at regular intervals.	During construction and ongoing.	Construction or Operations Manager.
14.18	Obtain appropriate permits and licenses for fauna handling. Restrict the handling of bats to only those personnel trained and permitted to do so. This will be reinforced via induction training.	During construction and ongoing.	SEO.
14.19	Minimise clearing as much as practicable commensurate with the requirements of mining and Project development.	Ongoing.	SEO, Project Engineer, Contractors.
14.20	Retain possible hollow logs as fauna habitats within rehabilitation sites.	Ongoing.	SEO; Construction or Operations Manager.
14.21	Monitor the effectiveness of measures.	Ongoing.	SEO, Project Engineer, Contractors.

7.5 ENVIRONMENTAL TARGETS AND PERFORMANCE INDICATORS

The key environmental targets and performance indicators will be used to assess performance against the environmental objectives listed in the Section 7.3. Table 15 details environmental targets based on management objectives for terrestrial fauna protection and performance criteria to assist in assessing the achievement of these targets.

Table 15: Environmental Targets and Performance Indicators For Terrestrial Fauna Protection

Management objective	Environmental Targets	Performance Indicator
Ensuring barriers to native fauna are kept to a minimum.	No significant loss of movement of native fauna.	Number of fauna trapped in fence lines.
Excluding pets, traps and firearms from the Balmoral South Project Area.	No introduction of feral animals. No traps. No firearms.	Number of reports of introduced feral animals. Number of traps removed. No firearms.
Undertaking clearing at the time of the year least likely to impact breeding or nesting species.	Clearing to be minimised during nesting or breeding of species.	Environmental incidents arising from impact on breeding or nesting species during site clearing.
Minimising the loss of fauna linkage corridors.	Reinstatement of fauna linkage corridors as soon as practicable.	Map of areas temporarily disturbed prepared by the Environmental Manager. Comparison of results of surveys of rehabilitated areas with completion criteria.

Management objective	Environmental Targets	Performance Indicator
Preventing native fauna, including snakes, from being deliberately impaired or killed by mine site personnel.	No deliberate loss of native fauna from site personal.	Environmental incidents arising from fauna deliberately impaired or killed by mine site personnel.
Checking any trenches or open excavations daily for fauna and removing fauna as soon as possible without damage to the animal.	No loss of fauna as a result of excessive time trapped in trenches or open excavations.	Environmental incidents arising from death of fauna in any trenches or open excavations.

7.6 MONITORING AND CORRECTIVE ACTIONS

In order to ensure progress toward the achievement of the management objectives outline in Section 7.3 of this PEMP, IM will undertake monitoring for the early detection of potential impacts that the Balmoral South Project may have on local fauna.

Construction areas shall be subject to regularly inspections (or as otherwise required by IM on advice from its environmental consultants) during any earthworks and construction. The SEO shall conduct these inspections of the active and constructed areas. Construction Inspection Checklists are to be utilised during these inspections.

Relevant documentation to be inspected includes the Environmental Incident Reports and previous inspection sheets to check whether problems or non-conformances with these vegetation management procedures have been rectified.

Table 16 details the monitoring programme for terrestrial fauna protection in the Balmoral South Project Area.

Table 16: Monitoring and Corrective Action Programme for Terrestrial Fauna Protection

Item #	Activity	Performance Indicator	Corrective Action	Frequency	Responsibility
16.1	Visually inspect fence lines, trenches and open excavations to ensure that fauna are not trapped.	Number of fauna trapped in fence lines and other barriers to native fauna.	Investigate the need for fencing and provide access where possible.	Fortnightly for construction areas for general site and twice daily for known fauna barriers.	SEO.
16.2	Exclude pets, traps and firearms from the Balmoral South Project Area.	Number of reports of introduced of feral animals. Number of traps removed. No firearms.	Remove firearms. Relocate feral animals. Remove any traps.	At a suitable interval after control measure applied.	SEO.
16.3	Visually inspect prior to clearing at time of the year likely to impact breeding or nesting species.	Environmental incidents arising from impact on breeding or nesting species during site clearing.	Relocate fauna. Installation of nesting boxes.	Pre and post construction.	SEO.

Item #	Activity	Performance Indicator	Corrective Action	Frequency	Responsibility
16.4	Check any trenches or open excavations for fauna and removing fauna as soon as possible without damage to the animal.	Environmental incidents arising in death of fauna in any trenches or open excavations.	Where frequent number of fauna relocated from trenches or open excavations, provide ramp for fauna access.	Twice daily.	SEO.
16.5	Record fauna deaths from collisions with vehicles.	Number of fauna deaths from collisions with vehicles.	Reduce speed limit in key sections of the road where deaths are high. Erect signage. Educate personnel.	Ongoing.	SEO.
16.6	Undertake feral animal surveys.	No long term increase in abundance or distribution.	Implement feral animal control programmes.	Annually.	SEO.

7.7 CONTINGENCY ACTIONS

Triggers for identifying actual and potential non-conformances with the objectives of this plan will be determined for conservation significant species that are likely to be significantly impacted by the Balmoral South Project.

Potential triggers that may exist are described below:

- Significant impact on fauna are observed from trenches or open excavations;
- Observation of any Feral animals, pets, traps and firearms from the Balmoral South Project Area; and
- Significant impact on fauna breeding or nesting habitat.

Contingency actions will be initiated if monitoring indicates that fauna are observed, including:

- Investigate cause;
- Amend management actives and weed control procedures accordingly to prevent reoccurrence;
- Monitor impacts to determine adequacy of control;
- Consult with relevant government agencies on improving the control actions; and
- Complete an Environmental Incident Report.

7.8 REPORTING

In the event of a Level 2 incident or higher relating to terrestrial fauna protection the personnel involved (or witnesses to) shall complete an Environmental Incident Report.

The other procedures relating to environmental incidents as listed in Section 3.7 shall also be followed. The Environmental Incident Report system can be used as a mechanism for reporting contractor non-conformance to this plan to IM or regulatory authorities as required.

8. TROGLOFAUNA MANAGEMENT

8.1 CONTEXT

There are two kinds of subterranean animals: stygofauna and troglofauna. Stygofauna are aquatic and occur in groundwater. Troglofauna are air-breathing and occur in underground cavities and small fissures above the water table. Nearly all subterranean fauna are invertebrates.

Balmoral South Project area is no rich in stygofauna and all species present are known to be more widely distributed. The development of the Balmoral South Project is unlikely to have any effect on the conservation of stygofauna species. As a result no management actions for stygofauna are provided in this PEMP.

Troglofauna have only recently become a focus of environmental assessment in the Pilbara and there is relatively little information about their distribution, although knowledge is being gained rapidly. Including Cape Preston, four areas with significant troglofaunal communities are currently known in the western Pilbara. The areas are:

- Pisolitic mesas of the Robe Valley (Biota 2006);
- Cane River deposits (Biota, unpublished data) to the south and south-west, respectively, of Cape Preston;
- Ord Ranges between Port Hedland and the De Grey River (Subterranean Ecology 2007); and
- Other coastal communities of troglofauna occur at Cape Range and Barrow Island (Humphreys 1993, Biota 2005).

There are also troglofaunal communities in the eastern Pilbara (Bennelongia 2008a,b).Initial assessment has shown that troglofauna community at the Balmoral South Project is part of a larger Cape Preston community that extends southwards from the Central Block Project. The purpose of this management plan is further quantify the results of the initial assessment.

Legislations and Relevant Standards

- *Environmental Protection Act 1986;*
- *Environment Protection and Biodiversity Conservation Act 1999;*
- *EPA (2003). Guidance for the Assessment of Environmental Factors No. 54: Consideration of Subterranean Fauna in Groundwater and Caves during Environmental Impact Assessment in Western Australia; and*
- *EPA (2007). Draft Guidance for the Assessment of Environmental Factors No 54a: Sampling Methods and Survey Considerations for Subterranean Fauna in Western Australia.*

Stakeholders consultations

IM has developed this plan in consultation with DEC. IM will continue to consult with DEC and other key stakeholders through the implementation of this plan.

8.2 POTENTIAL SOURCES AND IMPACTS

Potential Sources

Impacts on abundance, species diversity, geographical distribution and productivity of troglofauna can result from:

- Lack of understanding of the distribution of species; and
- Lack of understanding of the impacts of mining.

Potential Impacts

Potential environmental impacts on troglofauna include:

- Habitat loss and modification as a result of mine development

8.3 ENVIRONMENTAL MANAGEMENT OBJECTIVES

EPA Objective

The objective is considered relevant to troglofauna:

- To maintain the abundance, diversity and geographic distribution of subterranean fauna at species and ecosystem levels through the avoidance or management of adverse impacts and through improvements in knowledge.

Balmoral South Project Management Objectives

The Balmoral South Project's management objective is:

- To further assess the species belonging to the Balmoral South subterranean community to avoid at a risk of becoming extinct as a result of mine development.

8.4 MANAGEMENT ACTIONS

Based on the inferred distribution of troglofauna species through most of the ranges at Cape Preston and minimal detrimental effects of dewatering, it is unlikely that development of Balmoral South will affect conservation of troglofauna species. However, IM has applied a precautionary approach to the management of subterranean fauna at Cape Preston and is committed to undertaking further studies to ensure the objectives in section 8.3 are met.

8.5 ENVIRONMENTAL TARGETS AND PERFORMANCE INDICATORS

The key environmental targets and performance indicators will be used to assess performance against the environmental objectives listed in the Section 8.3.details environmental targets based on management objectives for troglofauna protection and performance criteria to assist in assessing the achievement of these targets.

Table 17: Environmental Targets and Performance Indicators for Subterranean Fauna Protection

Management objective	Environmental Targets	Performance Indicator
To maintain the abundance, diversity, geographic distribution and productivity of subterranean fauna at species and ecosystem levels through the avoidance or management of adverse impacts and through improvements in knowledge.	Highly unlikely that the species belonging to the Balmoral South troglofauna community are at risk of becoming extinct as a result of mine development.	The troglofauna community on the Balmoral South Project area is demonstrated to be part of the Cape Preston community across all three ore bodies and/or are part of a wider Pilbara community.
To further assess the species belonging to the Balmoral South subterranean community to avoid at a risk of becoming extinct as a result of mine development.		

8.6 MONITORING AND CORRECTIVE ACTIONS

In order to ensure progress toward the achievement of the management objectives outline in Section 8.3 of this PEMP, IM will undertake the *Balmoral South Troglofauna Distribution Study (the "Study")*.

The purpose of the Study is to examine the distribution of the Cape Preston troglofauna community and its constituent species. To ensure the management objectives outlined in Table 8.1 are met, the specific outcome of the Study is to demonstrate:

- The troglofauna community on the Balmoral South Project area is part of the Cape Preston community across all three ore bodies and/or are part of a wider Pilbara community.

To achieve this outcome the following activities will form part of the Study:

- Additional sampling of bores and leaf litter on the Cape Preston northern orebody and further sampling to the to the extent of the southern orebody;
- Taxonomy analysis of species found at Cape Preston with species found in the wider Pilbara Region (subject to samples being made available)
- Assessment of the additional information to consider:
    - How far the community extends beyond areas proposed for mining;
    - The ranges and conservation status of component species;
    - How the species from Cape Preston relate to those at other Pilbara orebodies; and
    - Whether the members of the troglofauna community sometimes come to the surface, thus aiding dispersal.

8.7 CONTINGENCY ACTIONS

If the Balmoral South Troglofauna Distribution Study fails to confirm the findings of the intital assessment, IM will consult with DEC and committed to undertaking additional samplying programmes and/or implementing other management practices.

8.8 REPORTING

The Balmoral South Troglofauna Distribution Study will be completed by March 2009. IM will consult with DEC on the finding of the report and contingency actions will be implemented in the unlikely event that the Study's objectives are not met.

9. SHORT RANGE ENDEMIC INVERTEBRATE FAUNA MANAGEMENT

9.1 CONTEXT

There is currently no formal Environmental Protection Authority (EPA) guidance on the preferred survey methods for terrestrial short range endemic (SRE) invertebrates in the context of EIA. Therefore, the survey methods employed were based on Phoenix's previous experience in undertaking SRE surveys in the Southwest, Goldfields, Midwest, Pilbara and Kimberley regions of WA.

The methods employed adhere to the principles and guidelines outlined in EPA Position Statement No. 3: Terrestrial Biological Surveys as an Element of Biodiversity Protection (EPA 2002) and Phoenix understands that the Department of Environment and Conservation (DEC) and Western Australian Museum (WAM) are currently developing a Guidance Statement for SRE surveys that will be formally adopted by the EPA in the near to medium term.

Legislations and Relevant Standards

- *EPA (2002), EPA Position Statement No. 3: Terrestrial Biological Surveys as an Element of Biodiversity Protection.*
- *EPA (2004), EPA Guidance Statement No. 56: Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia.*

Stakeholders Consultations

IM developed the survey scope in conjunction with DEC. Discussions with the DEC (Brad Durrant and Stephen Van Leeuwen) concluded with a commitment by the proponents to undertake a targeted land snail survey in the 08/09 wet season.

The aim of the survey is to record land snail species that have not been recorded in the main SRE survey due to perceived dry conditions. The survey will be conducted immediately following rainfall and will involve the collection of additional leaf litter samples from within the main SRE sampling sites. Sites will be selected at the bases of larger trees where decent litter samples are available. Sites will be chosen both within and external to the proposed area of direct impact. All samples will be processed in accordance with methods employed in the main SRE survey.

DEC considered that 4 – 6 species should be found within the area. IM will consult with the DEC to ensure protection of SRE invertebrate fauna from mining impact.

9.2 POTENTIAL SOURCES AND IMPACTS

Potential Sources

There are a number of processes that may threaten SRE fauna and their isolated habitats and thus may threaten their long term survival in a given area / habitat, including:

- Land clearance;
- Grazing: much of the site is already degraded. Buffel Grass (Cenchrus cilllaris) and Bidens (Bidens pilosa) are found along most drainage courses and the infestation of Mesquite is one of the worst in the Pilbara;
- Changed fire regimes: an altered fire regime may act to promote the premature 'drying' of mesic refuge habitats for SREs; and
- Changed hydrology such as altered flow regimes affecting riparian vegetation:

Potential Impacts

Potential impacts on Short Range Endemic fauna revolve around the loss of habitat, and the direct relationship that has on the continued viability of individuals, communities and in some instances possibly species. Surveys completed to date have shown that SRE, whilst present in the Balmoral South project area, are also represented in locations outside of the zone of potential impact from the Project. This indicates that the potential for Project activities have adverse impacts on SRE at community or species level is low. Some individuals will undoubtedly be directly adversely affected.

9.3 ENVIRONMENTAL MANAGEMENT OBJECTIVES

EPA Objective

The objective is considered relevant to SRE invertebrate fauna:

- To maintain the abundance, diversity, geographic distribution and productivity of SRE invertebrate fauna at species and ecosystem levels through the avoidance or management of adverse impacts and through improvements in knowledge.

Balmoral South Project Management Objectives

The Management objective of the Balmoral South Project are consider relevant to SRE invertebrate fauna:

- To assess the impact of the Balmoral South Project's activities on SRE invertebrate fauna

Objective will be met by implementing the key management actions .

9.4 MANAGEMENT ACTIONS

It is considered the likelihood of recording SRE taxa as low; as such management strategies have focused on further validating the finding of the initial assessment through a regional survey to ensure that the development of the project does not lead to the extinction of any SRE species.

The aim of the surveys is to determine the potential impact of the various Cape Preston projects on SRE Invertebrate Fauna, where (if) they are present.

The scopes of the surveys being undertaken are:

- Habitat assessment in relation to SRE taxa within the project impact footprint.
- Identification of disjunct or isolated habitat types (if any).
- Installation and removal of wet pitfall traps (52 sites).
- Hand-searches for SRE taxa within those habitats (52 sites x minimum 30 minutes).
- A targeted land snail survey in the coming wet season

9.5 ENVIRONMENTAL TARGETS AND PERFORMANCE INDICATORS

The key environmental targets and performance indicators will be used to assess performance against the environmental objectives listed in the Section 9.3.details environmental targets based on management objectives for SRE invertebrate fauna and performance criteria to assist in assessing the achievement of these targets.

Table 18: Environmental Targets and Performance Indicators for SRE Invertebrate Fauna Protection

Management objective	Target	Performance Indicator
To assess the impact of the Balmoral South Project's activities on SRE invertebrate fauna.	Quantify the impact of Project development on SRE invertebrate fauna.	Number of individuals and species of SRE invertebrate fauna.

9.6 MONITORING AND CORRECTIVE ACTIONS

Direct monitoring of SRE abundance and diversity will be conducted on an annual basis using methodologies applied during initial baseline surveys. Sites will be selected such that they are outside the zone of direct impact (clearing). Control sites will be established outside of the zone of potential impacts. If monitoring indicates that sites within the zone of potential impact have reduced levels of SRE abundance and diversity compared to baseline sites, corrective actions will depend upon analysis of monitoring results and investigation into the potential cause of any decline in abundance or diversity.

9.7 CONTINGENCY ACTIONS

IM will consult with DEC and commit to develop the contingency actions if necessary.

9.8 REPORTING

Results of SRE monitoring will be incorporated into annual reporting to DoIR and DEC

10. TURTLES AND NESTING BEACHES HABITAT MANAGEMENT

10.1 CONTEXT

Turtle species, or potentially nest on the beaches at Cape Preston within the period from July to April depending on seasonal environmental conditions.

Turtle nesting surveys of Cape Preston have been completed in 2000, 2002, 2004 and 2006. The results show Cape Preston beaches are not significant sea turtle rookeries on a regional or national scale.

Although, it is considered that the Balmoral South Project's activities are unlikely to significantly impact upon important turtle habitat, IM has committed to a precautionary approach to the management of this environmental factor.

The potential impact from the Balmoral South Project's activities was identified in consultation with the DEC during the preparation for the Mineralogy Central Block's assessment and management programmes (Ministerial Statement 635). IM has adopted a common approach to the management of turtle.

Legislations and Relevant Standards

- EPA (2004d). Guidance for the Assessment of Environmental Factors No. 29: Benthic Primary Producer Habitat Protection for Western Australia's Marine Environment
- *Environmental Protection Act 1986;*
- *Environment Protection and Biodiversity Conservation Act 1999*; and
- *Wildlife Conservation Act 1950*.

Stakeholders consultations

As required IM, or its contractors, will notify and consult relevant authorities in the event that inappropriate management of turtles causes a potentially significant environmental impact. If necessary, IM shall seek advice on proper environmental remediation procedures from the relevant authorities.

10.2 POTENTIAL SOURCES AND IMPACTS

Potential Impacts

Potential environmental impacts on turtles and nesting beach habitat include:

- Disruption of turtle feeding and nesting behaviour from access to, or improper behaviour at, the beaches, mangroves, tidal creeks and near-shore waters;
- Disorientation of turtle hatchlings from light spill and noise emissions from both the port's land-based facilities and shipping operations;
- Introduction or spread of feral animals (e.g. foxes, dogs) from improper waste disposal and employees bringing pets into the Balmoral South Project Area; and
- Disruption to turtle migration along the coast from ship movements.

10.3 ENVIRONMENTAL MANAGEMENT OBJECTIVES

EPA Objective

The objective is considered relevant to turtles and nesting beach:

- To avoid loss of coastal habitat, specifically at Cape Preston beach, and to avoid significant disturbance marine turtles and nesting beach habitat.

Balmoral South Project Management Objectives

The Management objectives of the Balmoral South Project are consider relevant to turtles and nesting beach habitat:

- Control of access to nesting beaches;
- Lighting design and use during turtle nesting season;
- Management of drainage;
- Feral animal control programmes; and
- Control of small vessel movements.

Objectives will be met by implementing the key management actions listed in Table 19.

10.4 MANAGEMENT ACTIONS

To avoid and reduce potential impact of activities on turtles and nesting beach habitat, the key management actions that will be carried out to achieve the management objectives have been compiled in Table 19. This table also details at what stage of development the actions will be implemented and person(s) responsible for operational compliance with the management actions.

Table 19: Management Actions for Turtles and Nesting Beach Habitat Protection

Item	Action	Timing	Responsibility
19.1	Install lighting which is: • Shielded/redirected/lowered/recessed to avoid/minimise light spill towards the southern and eastern beaches. • Of low disruptive colour (e.g. yellow and red) and/or long wavelength (e.g. low-pressure sodium vapour lights, or yellow filters/bug lights for larger areas/roads, or red LED lights for paths). If practicable and safe, develop a procedure for minimal light use during February to April. Buildings will use low reflectivity paints.	During design and ongoing.	Construction or Operations Manager.
19.2	There will be authorised access only to beaches utilised by marine turtles between November and February. All interaction is to be in accordance with the DEC Code of Conduct for interaction with turtles.	Ongoing.	SEO, Construction or Operations Manager.
19.3	Post-construction assessment of light spill and effectiveness will be conducted, particularly during nesting season for turtle response to lighting.	Ongoing.	SEO, Construction or Operations Manager.
19.4	Restrict recreational activities by employees in mangrove creeks and near-shore waters used by turtles for foraging.	July to April.	SEO, Construction or Operations Manager.
19.5	Develop a procedure and induct/train personnel, who are either in control of boats or interact with nesting turtles, of correct behaviour in accordance with the DEC Code of Conduct.	Ongoing.	SEO, Construction or Operations Manager.

Item	Action	Timing	Responsibility
19.6	Install stormwater drainage from Project facilities with appropriate treatment structures to be collected and, where practicable, disposed of away from the southern and eastern beaches.	During Project design.	Construction or Operations Manager.
19.7	Establish a fox baiting programme and, if necessary, control programmes for other feral animals.	Prior to construction.	SEO.
19.8	Install facilities with higher noise and vibration levels as far as practicable from the beaches and, where practicable, noisy construction activity will be avoided/minimised in near-shore areas during November to February.	Design and construction.	SEO, Construction or Operations Manager.
19.9	Surfaces near to beaches will be sealed or adequately watered to minimise dust emissions.	Design and construction.	Construction or Operations Manager.
19.10	Training/induction for all employees will include and emphasise measures to avoid disturbance to turtles.	Ongoing.	SEO, Construction or Operations Manager.
19.11	In consultation with DEC, finalise the Turtle Monitoring Programme and, as soon as possible, implement the programme.	Prior to construction.	Construction or Operations Manager.

10.5 ENVIRONMENTAL TARGETS AND PERFORMANCE INDICATORS

The key environmental targets and performance indicators will be used to assess performance against the environmental objectives listed in the Section 10.3. Table 20 details environmental targets based on management objectives for turtles and nesting beach habitat protection and performance criteria to assist in assessing the achievement of these targets.

Table 20: Environmental Targets and Performance Indicators for Turtles and Nesting Beach Habitat Protection

Management objective	Environmental Targets	Performance Indicator
Control of access to nesting beaches.	No access to turtle nesting beach by employees. To maintain the current level of turtle usage of the area.	Map turtle beaches. Prohibit access to nesting beaches determined through site inspections. Environmental Incident Reports show no unauthorised access.
Lighting design and use during turtle nesting season to minimise impacts.	No direct light pollution on turtle beaches. To maintain the current level of turtle usage of the area.	Disorientation of turtle hatchlings. Environmental Incident Reports show no direct light disturbance.
Management of drainage.	All runoff contained no pollution on beach. To maintain the current level of turtle usage of the area.	Detection of spills or escape of hazardous materials during construction site inspections. Environmental incidents arising from spills. Equipment and bund integrity and bund water accumulation as determined during site inspections.
Control feral animal.	Decrease in the number of feral animals. To maintain the current level of turtle usage of the area.	Feral animal observations.
Control of small vessel movements.	No uncontrolled use of small vessels. To maintain the current level of turtle usage of the area.	Uncontrolled use of small vessels observed.

10.6 MONITORING AND CORRECTIVE ACTIONS

In order to ensure progress toward the achievement of the management objectives outline in Section 10.3 of this PEMP, the monitoring program will include activities to be performed throughout the life of Balmoral South Project.

The aim of this monitoring will be to determine both turtle usage of beaches at Cape Preston and the impact on usage resulting from both construction and operational phases of the Balmoral South Project. Monitoring will be conducted during peak nesting season for the four turtle species and will consist of:

- A track census over a standard length of beach to identify the relative significance of nesting beaches for each species, to monitor populations and assess trends at key nesting beaches and to measure effectiveness of sea turtle management;
- A water activity census in areas considered to be of significance to feeding turtles; and
- Consultation with staff to establish any incidents/information in relation to sea turtles (e.g. hatchling disorientation reports, etc.).

Monitoring will also:

- Establish the levels of predation on nests;
- Determine the abundance of nests on specific sections of beach over specified time intervals for each species; and
- Map hatchlings to assess response to lighting.

Data will be collected on successful nesting emergences, disturbance, and spatial and temporal distribution of the main nesting species. It is anticipated that this will contribute to a greater understanding of the turtle populations in this region and assist in addressing information gaps.

Table 21 details the monitoring programme for turtles and nesting beach habitat protection in the Balmoral South Project Area.

Table 21: Monitoring and Corrective Action Programme for Turtles and Nesting Beach Habitat Protection

Item	Activity	Performance Indicator	Corrective Action	Frequency	Responsibility
21.1	Survey light spill on nesting beaches.	Nesting turtles and turtle hatchlings are not disturbed by Project activities.	Identify cause of disturbance and rectify. Compile Incident Report and, if needed, develop contingency action.	Post construction and any changes to operation	SEO, Construction or Operations Manager.
21.2	Check for evidence of predation on nesting beaches.	No predation.	Increase feral animal control programme.	Weekly during turtle nesting and hatching.	SEO.
21.3	Check incidents of unauthorised access.	No unauthorised access.	Compile Incident Report. Develop contingency action.	Weekly during nesting and hatching periods.	SEO.

Item	Activity	Performance Indicator	Corrective Action	Frequency	Responsibility
21.4	Monitoring successful nesting emergences, usage, and spatial and temporal distribution of the main nesting species.	Adequate time series data of turtle usage of area.	Programme will be amended as necessary in consultation with DEC.	During nesting season.	SEO.

10.7 CONTINGENCY ACTIONS

Triggers will be monitored through the monitoring program. In the event that monitoring indicates that a trigger is exceeded or is at risk of being exceeded an investigation will be undertaken to determine the root cause and contingency actions to remediate and avoid further breaches will be determined and completed. Contingency actions will be developed in consultation with DEC.

10.8 REPORTING

In the event of an incident involving detrimental impacts on turtles, the personnel involved (or witnesses to) shall complete an Environmental Incident Report.

The procedures relating to environmental incidents as listed in Section 3.7 shall also be followed. The Environmental Incident Report system can be used as a mechanism for reporting contractor non-conformance to this plan to IM or regulatory authorities as required.

11. MIGRATORY SHOREBIRDS AND COASTAL HABITAT MANAGEMENT

11.1 CONTEXT

In considering the significance of the Cape Preston area for migratory bird species, survey results were benchmarked against the two criteria under the Ramsar Convention for identifying wetlands of international importance (Hassell 2002). These are defined as sites that regularly support:

- 20,000 or more waterfowl (including shorebirds); or
- 1% or more of the individuals in a population of one species or sub-species of waterfowl (including shorebirds).

Although, it is considered that the Balmoral South Project's activities are unlikely to significantly impact upon important migratory shorebirds and coastal habitat, IM has committed to a precautionary approach to the management of this environmental factor.

The potential impact from the Balmoral South Project's activities was identified in consultation with the DEC during the preparation for the Mineralogy Central Block's assessment and management programmes (Ministerial Statement 635). IM has adopted a common approach to the management of turtle.

Legislations and Relevant Standards

- *EPA (2004d). Guidance for the Assessment of Environmental Factors No. 29: Benthic Primary Producer Habitat Protection for Western Australia's Marine Environment.*
- *Environmental Protection Act 1986;*
- *Environment Protection and Biodiversity Conservation Act 1999*; and
- *Wildlife Conservation Act 1950*.

Stakeholders consultations

As required IM, or its contractors, will notify and consult relevant authorities in the event that inappropriate management of turtles causes a potentially significant environmental impact. If necessary, IM shall seek advice on proper environmental remediation procedures from the relevant authorities.

11.2 POTENTIAL SOURCES AND IMPACTS

Potential Impacts

Potential environmental impacts on migratory shorebirds and coastal habitat include:

- Disruption of shorebird feeding and roosting behaviour from uncontrolled access to the beaches, mangroves and tidal creeks;
- Disruption of shorebird behaviour from light spill and noise emissions from land-based facilities at the port; and
- Introduction or spread of feral animals (e.g. foxes, dogs).

11.3 ENVIRONMENTAL MANAGEMENT OBJECTIVES

EPA Objective

The objective is considered relevant to migratory shorebirds and coastal habitat:

- To avoid loss of coastal habitat, specifically at Cape Preston beach, and to avoid significant disturbance migratory shorebirds and coastal habitat.

Balmoral South Project Management Objectives

IM's environmental objective for this factor is to avoid loss of coastal habitat and to avoid significant disturbance to both the migratory (and endemic) shorebird populations. IM's target for this factor is to maintain the current level of shorebird usage of the area (as determined from current and future surveys).

The Management objectives of the Balmoral South Project are consider relevant to migratory shorebirds and coastal habitat:

- Control of access to coastal area;
- Lighting design in the coastal area;
- Management of drainage; and
- Feral animal control programmes.

Objectives will be met by implementing the key management actions listed in Table 22.

11.4 MANAGEMENT ACTIONS

In order to avoid and reduce the potential impact of activities on migratory shorebirds and coastal habitat, the key management actions that will be carried out to achieve the management objectives have been compiled in Table 22. This table also details at what stage of the development the actions will be implemented and the responsible person(s) for ensuring operational compliance with the management actions.

Table 22: Management Actions for Migratory Shorebirds and Coastal Habitat Protection

Item	Management Actions	Timing	Responsibility
22.1	Install lighting which is: • Shielded/redirected/lowered/recessed to avoid/minimise light spill towards the southern and eastern beaches. • Of low disruptive colour (e.g. yellow and red) and/or long wavelength (e.g. low-pressure sodium vapour lights, or yellow filters/bug lights for larger areas/roads, or red LED lights for paths). If practicable and safe, develop a procedure for minimal light use during October and November. Buildings will use low reflectivity paints.	During design and ongoing.	Project Engineer.
22.2	Install facilities with higher noise and vibration levels as far as practicable from the beaches and, where practicable, noisy construction activity will be avoided/minimised in near-shore areas during October/November.	During design and construction.	Project Engineer.
22.3	Prohibit unauthorised access to coastal habitat of the southern beach between September and April.	Ongoing.	SEO.
22.4	Maximise distance between noise sources and the coastal habitat, and construct noise barriers if required, in consultation with DEC.	During design.	Project Engineer.

Item	Management Actions	Timing	Responsibility
22.5	Install stormwater drainage from Project facilities with appropriate treatment structures to be collected and, where practicable, disposed of away from the southern beaches. A Stormwater Management Plan will be developed for the port onshore facility.	During design and construction.	Project Engineer.
22.6	Conduct further annual surveys of the shorebirds in consultation with DEC and, based on the information, establish a monitoring regime.	During design and construction.	SEO.

11.5 ENVIRONMENTAL TARGETS AND PERFORMANCE INDICATORS

The key environmental targets and performance indicators will be used to assess performance against the environmental objectives listed in the Section 11.3. Table 23 details environmental targets based on management objectives for migratory shorebirds and coastal habitats protection and performance criteria to assist in assessing the achievement of these targets.

Table 23: Environmental Targets and Performance Indicators for Migratory Shorebirds and Coastal Habitat Protection

Management objective	Environmental Targets	Performance Indicator
Control of access to coastal area	To maintain the current level of migratory birds usage of the area.	Map migratory birds beaches. Prohibit access to nesting beaches determined through site inspections. Environmental Incident Reports show no unauthorised access.
Lighting design and use in the coastal area	No direct light pollution on migratory birds' beaches. To maintain the current level of migratory birds usage of the area.	Disorientation of migratory birds activities. Environmental Incident Reports show no direct light disturbance.
Management of drainage.	All runoff contained no pollution on beach. To maintain the current level of migratory birds of the area.	Detection of spills or escape of hazardous materials during construction site inspections. Environmental incidents arising from spills. Equipment and bund integrity and bund water accumulation as determined during site inspections.
Control feral animal.	Decrease in the number of feral animals. To maintain the current level of migratory birds usage of the area.	Feral animal observations.

11.6 MONITORING AND CORRECTIVE ACTIONS

In order to ensure progress toward the achievement of the management objectives outline in Section 11.3 of this PEMP, the monitoring program for migratory shorebirds includes activities to be performed throughout the life of the Balmoral South Project and which, if the target is not achieved, will result in corrective action

Table 24details the monitoring programme for migratory shorebirds and coastal habitat protection in the Balmoral South Project Area.

Table 24: Monitoring and Corrective Action Programme for Migratory Shorebirds and Coastal Habitat Protection

Item	Activity	Frequency	Target	Corrective Action	Responsibility
24.1	Observe light spill and noise level on coastal habitats.	Monthly during construction between September and April.	Birds are not disturbed by Project activities.	Identify cause of disturbance and rectify. Compile Incident Report and, if needed, develop contingency action.	SEO.
24.2	Check incidents of unauthorised access to coastal habitats.	Monthly or opportunistically.	No unauthorised access by employees.	Compile Incident Report. Develop contingency action.	SEO.

11.7 CONTINGENCY ACTIONS

Triggers will be monitored through the monitoring program. In the event that monitoring indicates that a trigger is exceeded or is at risk of being exceeded an investigation will be undertaken to determine the root cause and contingency actions to remediate and avoid further breaches will be determined and completed. Contingency actions will be developed in consultation with the Construction/Operations Manager and Environmental Manager and DEC.

11.8 REPORTING

In the event of an incident involving detrimental impacts on migratory shorebirds, the personnel involved (or witnesses to) shall complete an Environmental Incident Report. The procedures relating to environmental incidents as listed in Section 3.7 shall also be followed. The Environmental Incident Report system can be used as a mechanism for reporting contractor non-conformance to this plan to IM or regulatory authorities as required.

12. SURFACE WATER MANAGEMENT

12.1 CONTEXT

All proposed mine infrastructure of the Balmoral South Project will be located outside the Fortescue River (100 year ARI) floodplain. The location of WDF1 and bunding to protect infrastructure are shown in Figure 3: Balmoral South Iron Ore Project Areas of Disturbance Sheet 1 of 2.

The proposed WDF lies along the western side of the lease area, which is inside the Fortescue River floodplain. As such, the WDF will potentially impact the river flood levels adjacent to the site.

On the approved Central Block Project immediately to the north, the proposed waste dump also lies inside the Fortescue River floodplain. A number of studies have been carried out on the assessment of such infrastructure with respect to the 100 year ARI flood in the main Fortescue River, as follows:

- "Fortescue River Flood Study" (Aquaterra, March 2002)
- "Proposed International Minerals Iron Ore Mine, Cape Preston – Impacts of Amended Waste Dump Footprint on Flood Levels in the Fortescue River" Letter Ref. 021b, Aquaterra - April 2005 (revised assessment)
- "Fortescue Iron Ore Project Surface Water Management Plan" (Aquaterra, Report 012f, April 2007)

These reports provided the predicted flood levels adjacent to the Central Block Project waste dump. As the Balmoral South Project lies south and upstream of the Central Block Project, the surface water investigations focus on the potential impacts of mining operations that are additional to those of the approved Central Block Project. The surface water study of the Balmoral South Project (Aquaterra Report 773/B1/015e – Appendix G of PER) includes:

- Conduct a 100 year ARI flood assessment of the Fortescue River floodplain, adjacent to the Balmoral South project, and the accommodation village.
- Conduct a 100 year ARI flood assessment of the DuBoulay Creek floodplain, adjacent to the Balmoral South process plant and pits.
- Conduct an assessment of the mine site accommodation village with respect to the 100 year ARI flood in the Fortescue River.
- Assess the Surface Water Management Plan of the proposed development areas including village site, plant site and waste disposal facility.

Legislations and Relevant Standards

- *DoW Water Quality Protection Guidelines; and*
- *ANZECC and ARMCANZ Australian and New Zealand Guidelines for Fresh and Marine Water Quality.*

Stakeholders Consultations

As required IM, or its contractors, will notify and consult relevant authorities in the event that inappropriate management of surface water causes a potentially significant environmental impact. If necessary, IM shall seek advice on proper environmental remediation procedures from the relevant authorities.

12.2 POTENTIAL SOURCES AND IMPACTS

Potential Sources

Surface water impacts can result from:

- Excessive slope of cleared areas;
- Failure to install berms and sumps;
- Unforseen rainfall beyond design predictions; and
- Failure to design Project to withstand major flood events.

Potential Impacts

Potential environmental impacts on surface water include:

- Erosion of soil;
- Deposition of eroded soil;
- Increased turbidity of streams;
- Interruption to the existing surface water flow patterns;
- Reduction of surface water runoff volume and quality in the downstream environment;
- Impact on downstream vegetation communities that may be dependent on this drainage;
- Discharge of various chemicals, including hydrocarbons;
- Impacts from haul roads and other infrastructure; and
- Pooling of water, growth of invasive vegetation in low-lying areas and sediment basins.

12.3 ENVIRONMENTAL MANAGEMENT OBJECTIVES

EPA Objective

The objective is considered relevant to surface water:

- To maintain or improve the surface and groundwater quality within the development area relative to pre-development conditions, to maintain the total water cycle balance within development areas relative to the pre-development conditions, to maximise the reuse of stormwater and to retain natural drainage systems and protect ecosystem health.
- To maintain the integrity, functions and environmental values of watercourses and sheet flow; and
- To maintain the quality of surface water to ensure that existing and potential uses, including ecosystem maintenance is protected.

Balmoral South Project Management Objectives

The Management objectives of the Balmoral South Project are consider relevant to surface water:

- To maintain the water regime of streams external to construction areas to ensure the protection of stream-dependent environmental values;
- To maintain the quality of streams external to construction areas;
- To ensure Project infrastructure are built above the 1:100 year flood levels or armoured to withstand flood velocities;
- To control erosion/sedimentation in disturbed areas;
- To monitor effectiveness of controls; and
- To adaptively respond to inadequacies in controls.

Objectives will be met by implementing the key management actions listed in Table 25. The DeBoulay and Edwards creeks are generally dry and are not considered functional aquatic ecosystems (Strategen, 2008). For this reason, the objectives, targets, monitoring measures and management actions described in the Balmoral South PEMP are aimed at protecting the environmental values of the aquatic systems of the Fortescue River.

12.4 MANAGEMENT ACTIONS

In order to avoid and reduce the potential impact of activities on surface water, the key management actions that will be carried out to achieve the management objectives have been compiled in Table 25. This table also details at what stage of the development the actions will be implemented and the responsible person(s) for ensuring operational compliance with the management actions.

Table 25: Management Actions for Protection of Surface Water

Item	Management Actions	Timing	Responsibility
25.1	Investigate and determine which upstream surface flows will be diverted around structures.	Prior to commencing construction.	Project Engineer, SEO, Contractor.
25.2	Divert upstream surface water flows identified by the above investigations around structures into defined adjacent or downstream surface water flow pathways.	During construction.	Project Engineer, SEO, Contractor.
25.3	Establish flood protection around the pit by linking the WDF to a flood bund along Du Boulay Creek. Ensure flood protection works are constructed to provide a minimum 2 m freeboard above the predicted 100 year ARI flood levels.	Prior to construction.	Project Engineer.
25.4	Ensure WDF is enclosed in a bund to protect the landform from external flood attacks from both the Fortescue River and Du Boulay Creek floodplains.	Construction phase and ongoing.	Project Engineer, Construction Manager, Operation Manager.
25.5	Ensure armouring is provided where impinging flood velocities exceed 2 m/s, and where the edge of the bund is near deeper flow channels.	Prior to construction.	Project Engineer.
25.6	Armouring and diversion works are designed to effectively divert and prevent natural runoff waters originating outside the development sites from mixing with internal site runoff.	Prior to construction.	Project Engineer.
25.7	Provide Department of Water (DoW) with evidence that Project has been designed to comply with Items 11.5.4, 11.5.5 and 11.5.6.	Prior to construction.	Project Engineer.
25.8	Apply for Bed and Banks permits for any stream diversions or crossings.	Prior to construction.	Construction Manager, SEO.
25.9	Identify locations and timing where short-term erosion and sediment control measures are likely to be required to ensure that excess sediment is not washed into undisturbed areas adjacent to the works.	Prior to and during construction.	Construction or Operations Manager, Project Engineer, Contractors.
25.10	Construct erosion control berms near cleared areas to regulate surface water runoff. Construct erosion control berms to follow land contours and with gradients to ensure low velocity discharge disperses away from disturbed soils.	Construction phase.	Project Engineer, Contractor.
25.11	Inspect regularly disturbed areas and erosion control measures. Maintain a record of inspections.	Ongoing.	SEO.
25.12	Implement a ground disturbance procedure.	Prior to construction.	Construction Manager, Environmental Manager.
25.13	Temporarily stabilise high erosion risk zones in construction areas.	During construction.	Project Engineer, SEO, Contractor.

Item	Management Actions	Timing	Responsibility
25.14	Divert surface water discharge over spreader mechanisms to slow and disperse flows where ecosystem sensitive sheet flow zones are located immediately downstream.	During construction.	Project Engineer, SEO, Contractor.
25.15	Surface water runoff from disturbed areas, soil and stockpiles is potentially sediment laden and requires treatment in sediment traps, prior to discharging to the downstream environment. Water will be analysed to ensure compliance with ANZECC standards for stock water prior to discharge.	During construction.	Project Engineer, SEO, Contractor.
25.16	Direct potentially contaminated flow to ponds fitted with outflow baffles, to prevent the discharge of oil and grease products. Water will be analysed to ensure compliance with ANZECC standards for stock water prior to discharge.	During construction.	Project Engineer, SEO, Contractor.
25.17	Direct runoff from any area where acid rock is exposed to lined holding ponds and adjust the pH where required. Water will be analysed to ensure compliance with ANZECC standards for stock water prior to discharge.	During construction and ongoing	Project Engineer, SEO, Contractor.
25.18	Encapsulate within the waste rock dump, any acid-generating material encountered. Prepare for cyclone season by maximising cover.	During construction.	Project Engineer, SEO, Contractor.
25.19	The areas require bunding as appropriate, to contain surface water runoff for treatment prior to discharge to the external environment.	During construction.	Project Engineer, SEO, Contractor.
25.20	Disturbance should be kept to the minimum to achieve the design function and necessary for safe working conditions. Vehicle movements should be kept to the minimum necessary and existing tracks used where possible.	During construction.	Project Engineer, SEO, Contractor.
25.21	Limit clearing, apply adequate buffer zones between the areas of disturbance and natural drainage lines, use temporary erosion and sediment control structures such as diversion banks, drains, and sediment traps (and baffle pond outlets to prevent the discharge of oil and grease products).	During construction and ongoing.	Project Engineer, SEO, Contractor.
25.22	Prevent disruption of major flow paths by haul road and other infrastructure that cross surface water flow paths by the provision of culverts where necessary.	During construction.	Project Engineer, SEO, Contractor.
25.23	Surface runoff from haul roads will be kept local to minimise downstream impact. Haul roads and other infrastructure that interrupt surface water flows will require floodways to ensure major flow paths are not disrupted	During construction and ongoing.	Project Engineer, SEO, Contractor.
25.24	Dispose of wastewater treatment plant (WWTP) effluent by irrigation to land in accordance with State and local government approvals.	Ongoing.	Project Engineer, SEO, Contractor.
25.25	Construction on or near natural flow paths should be planned for the dry season where practicable.	Ongoing.	Project Engineer, SEO, Contractor.
25.26	Sediment or silt traps to control erosion and the deposition of sediment downstream, are generally more effective when located close to the source of sediment, and when sediment laden water is not allowed to mix with the “clean water”, so as to reduce the volume of water to be treated. The sedimentation basins will be sized appropriately for the rainfall events.	Ongoing	Project Engineer, SEO, Contractor.

12.5 ENVIRONMENTAL TARGETS AND PERFORMANCE INDICATORS

Key environmental targets and performance indicators will be used to assess performance against the environmental objectives listed in the Section 12.3. Table 26 details environmental targets based on management objectives for surface water protection and performance criteria to assist in assessing the achievement of these targets.

Table 26: Environmental Targets and Performance Indicators for Surface Water Protection

Management objective	Environmental Target	Performance Indicator
To maintain the water regime of streams external to construction areas to ensure the protection of stream-dependent environmental values.	No change to water regime of streams beyond the immediate boundaries of construction sites. No erosion in nearby streams from the discharge of stormwater. No observed changes to vegetation adjacent to water courses beyond the immediate boundaries of construction sites.	Observed water flows. Observed vegetation and stream condition as determined during construction site inspections. Environmental incidents arising from changes to water regime of streams.
To maintain the quality of streams external to construction areas.	No observed increase in turbidity or decrease in pH in nearby streams external to construction areas.	Observed turbidity and pH in nearby streams observed during construction site inspections. Environmental incidents arising from increased turbidity or reduced pH in streams.
To ensure Project infrastructure are built above the 1:100 year flood levels or armoured to withstand flood velocities.	Surface water management requires an integrated approach, defining the discrete catchment/drainage areas, and allowing appropriate engineering solutions.	Observed flood encroaching on Project infrastructure. Observed degradation of flood protection works.
	Generally for all Project infrastructures ensure flood protection works will be constructed to provide a minimum 2 m freeboard above the predicted 100 year ARI flood levels.	
	Armouring will be provided where impinging flood velocities exceed 2 m/s, and where the edge of the works is near deeper flow channels.	
	Armouring and diversion works will be designed to effectively divert and prevent natural runoff waters originating outside the development sites from mixing with internal site runoff.	
	Ensure village is constructed above or armoured to withstand flood velocities from the Fortescue River floodplains.	
	Ensure WDF is enclosed in a bund to protect the landform from external flood attacks from both the Fortescue River and Du Boulay Creek floodplains.	
To control erosion/sedimentation in disturbed areas.	No erosion or sedimentation effects beyond clearing perimeters.	Area of vegetation affected by erosion or sedimentation as determined through site inspections. Environmental Incident Reports show no erosion or sedimentation effects beyond clearing perimeter.
To monitor effectiveness of controls.	Above targets are met.	Estimate of overall effectiveness through occasional assessment of performance of controls.
To adaptively respond to inadequacies in controls.	PEMP and procedures updated as required.	Extent to which updated PEMP addresses all issues.

12.6 MONITORING AND CORRECTIVE ACTIONS

In order to ensure progress toward the achievement of the management objectives outline in Section 12.3 of this PEMP, the monitoring program for surface water includes activities to be performed throughout the life of the Balmoral South Project and which, if the target is not achieved, will result in corrective action Table 27 details the monitoring programme for surface water protection of the Balmoral South Project. Construction Inspection Checklists shall be used and shall include assessment of surface water management actions as listed in Table 26.

Relevant documentation to be inspected includes the Environmental Incident Reports and previous week's inspection sheets to check whether problems or non-adherences to surface water management procedures have been rectified.

Table 27: Monitoring and Corrective Action Programme for Surface Water Protection

Item	Activity	Performance Indicator	Corrective Action	Frequency	Responsibility
27.1	Visual monitoring.	No "damming" of drainage lines.	Divert drainage around site. Install culvert.	Weekly. Opportunistic after rain.	SEO.
27.2	Visual monitoring.	No increase in erosion.	Install erosion control mechanism (e.g. rip-rap).	Weekly. Opportunistic after rain.	SEO.
27.3	Visual monitoring	Minimise uncovered waste that may pollute water.	Cover waste as soon as practicable. Review procedures.	Monthly.	SEO.
27.4	Inspect vegetation adjacent to stream lines.	No significant deterioration in vigour.	Re-instate surface water flows.	Monthly.	SEO.
27.5	Inspect WWTP irrigation area.	No ponding or runoff.	Change "rotation" frequency of irrigation system. Enlarge irrigation area.	Monthly.	SEO.
27.6	Check wastewater holding tanks.	No overflow.	Increase frequency of pump-out.	Monthly.	SEO.
27.7	Monitor runoff water quality	No unacceptable change from background water quality. pH greater than 6.	Determine source. Review activities and procedures. Improve acid rock drainage management.	Opportunistic after rain.	SEO.

12.7 CONTINGENCY ACTIONS

Triggers for identifying actual and potential non-conformances with the objectives of this plan will be determined for surface water protection of the Balmoral South Project.

Potential triggers that may exist are described below:

- Visual observation detects "damming" of stream lines;
- Visual observation detects excessive erosion, turbidity or pH;
- Inspection detects deterioration in vigour of stream-line vegetation;
- WWTP irrigation area shows ponding or runoff outside the irrigation area;
- Inspection reveals evidence of overflow of a wastewater holding tank; and
- Instrumental monitoring data indicate surface water pH is lower than 6.

Contingency actions will be initiated if monitoring indicates that surface water systems are being significantly altered. The contingency actions shall be implemented concurrently with appropriate incident procedures..

Contingency actions for potential triggers that may be used are described below:

- Investigate cause;
- Implement management actions as appropriate to isolate or reduce causes;
- Monitor the impact to determine adequacy of control;
- Consult with relevant government agencies/pastoralist on improving the control actions; and
- Complete an Environmental Incident Report.

12.8 REPORTING

In the event of an incident involving detrimental impacts on surface water, the personnel involved (or witnesses to) shall complete an Environmental Incident Report.

The procedures relating to environmental incidents as listed in Section 3.7 shall also be followed. The Environmental Incident Report system can be used as a mechanism for reporting contractor non-conformance to this plan to IM or regulatory authorities as required.

13. GROUNDWATER MANAGEMENT

13.1 CONTEXT

The approved Central Block Project will impact the hydrogeological regime of the region. These impacts have been quantified and management plans developed as part of the Central Block Project approvals (including the Central Block Project Groundwater Management Plan, Aquaterra 2007).

The primary objective of this section presents management of the potential impacts that the Balmoral South Project (predominantly pit dewatering), in addition to those of the Central Block Project, may have on local/regional groundwater resources and any consequent additional management of impacts on other local users and groundwater dependent ecosystems (GDEs).

The groundwater assessment (Appendix G of PER) of Balmoral South Project includes:

- Outline of local and regional hydrogeology;
- Assessment of the site specific hydrogeological properties of the Southern Block ore body;
- Prediction of groundwater inflows to the proposed Balmoral South mine throughout the life of the mine;
- Prediction of groundwater level drawdown due to dewatering the Central Block ore body only;
- Prediction of cumulative groundwater level drawdowns in response to dewatering both the Balmoral South and Central Block ore bodies;
- Assessment of the potential additional impacts of mining/dewatering the Southern Block ore body on groundwater quantity and quality;
- Assessment of the potential additional impacts of mining/dewatering the Southern Block ore body on other groundwater users and GDE's;
- Prediction of the final pit void water levels and assessment of the potential impacts on groundwater flow and quality; and
- Groundwater management strategies including monitoring programmes, identification of trigger levels for further action and some impact management measures.

Legislations and Relevant Standards

- *ANZECC and ARMCANZ Australian and New Zealand Guidelines for Fresh and Marine Water Quality;*
- *Rights in Water and Irrigation Act 1914;*
- *Water and Rivers Commission Act 1997;*
- *Water and Rivers Commission (2000). Environmental Water Provisions Policy for Western Australia: Statewide Policy No. 5; and*
- *ANZMEC and MCA (2000) Strategic Framework for Mine Closure.*

Stakeholders Consultations

As required IM, or its contractors, will notify and consult relevant authorities in the event that inappropriate management of surface water causes a potentially significant environmental impact. If necessary, IM will seek advice on environmental remediation procedures from the relevant authorities.

13.2 POTENTIAL SOURCES AND IMPACTS

Potential Sources

Groundwater impacts can result from:

- Groundwater drawdown beyond predicted levels;
- Leaks from storage tanks, pipes and valves;
- Rupture of storage tanks or pipes; and
- Overflow of storage tanks or bunds.

Potential Impacts

Potential environmental impacts on groundwater include:

- **L**oss of supply to existing groundwater users: Bores and wells which tap the basement rock aquifers will experience interference drawdowns and some shallow wells close to the pit may dry up.
- Loss of supply to existing phreatophytic vegetation: There is the potential for the loss of vegetation within the cone of depression of groundwater level drawdowns.
- Loss of supply to existing subterranean fauna: There is the potential for the localised impact on stygofauna, through the loss of habitat due to groundwater level drawdowns in both the basement rock aquifers and in the creek alluvium.
- Contamination of groundwater leading to the damage or destruction of vegetation and fauna.
- Salinity build-up in shallow groundwater beneath the pit (pit void)
- The salinity of the water within the dump could increase due to evaporative concentration

13.3 ENVIRONMENTAL MANAGEMENT OBJECTIVES

EPA Objective

The objectives are considered relevant to groundwater:

- To maintain the quantity and quality of water so that existing and potential environmental values, including ecosystem maintenance, are protected;
- To ensure that discharges do not adversely affect water quality or the health, welfare and amenity of people and land uses by meeting statutory requirements and acceptable standards; and
- To ensure that alterations to groundwater flows and quality do not have an adverse impact on beneficial or environmental uses of the water and that the integrity, functions and environmental values of watercourses are maintained.

Balmoral South Project Management Objectives

The Management objectives of the Balmoral South Project are consider relevant to groundwater:

- To maintain the quantity and quality of water supply to existing vegetation, fauna and pastoral users.
- To maintain the integrity, functions and environmental values of watercourses and sheet flow.
- To monitor effectiveness of controls.
- To adaptively respond to inadequacies in controls.

Objectives will be met by implementing the key management actions listed in Table 28.

Management Objectives Covered in Other PEMP Section

The impacts on groundwater come from many sources; some environmental objects are specifically addressed in other sections of this PEMP, namely:

- to minimise the risk of spillage or escape of fuels or chemicals;
- To ensure storage and handling of fuels and chemicals at the site does not pose a threat to the environment; and
- To ensure that any spill or incident associated with fuels and chemicals are cleaned up quickly and effectively.

These environmental objectives are covered in Section 21 *Spill Management*.

13.4 MANAGEMENT ACTIONS

A detailed Groundwater Operating Strategy will be prepared to support the application for a 5C Groundwater Licence which will be required prior to any dewatering. The Operating Strategy will be developed using data contained within previous reports and all newly available data, and include details of the groundwater, vegetation and subterranean monitoring assessment and management measures. This Operating Strategy will require approval by DoW with input from the DEC. As such, when complete the Operating Strategy will form an attachment to this PEMP and will guide groundwater management.

The following sections of this Groundwater Management strategy for the PEMP provide the minimum environmental management commitments. The Operating Strategy will incorporate and build on these commitments.

In order to avoid and reduce the potential impact of activities on groundwater, the key management actions that will be carried out to achieve the management objectives have been compiled in Table 28. This table also details at what stage of the development the actions will be implemented and the responsible person(s) for ensuring operational compliance with the management actions.

Table 28: Management Actions for Groundwater Protection

Item	Management Actions	Timing	Responsibility
28.1	In the case of pastoral wells predicted by dewatering, it is proposed to ensure continuation of water supply by running a small diameter feed line to water troughs at affected wells. In cases where water level drawdowns are not too great the installation of deeper replacement wells may be an option.	Prior to pit dewatering.	Project Engineer, SEO, Contractor.
28.2	Minimising the rates of drawdown by the adoption of a steady vertical (i.e. depth) development progression in the mine plan.	Prior to pit dewatering.	Project Engineer, SEO, Contractor.
28.3	Monitoring vegetation and vegetation stress to assess actual versus predicted impacts in high drawdown areas.	Prior to pit dewatering.	Project Engineer, SEO, Contractor.
28.4	Establishment of trigger levels to identify and quantify impacts.	Prior to pit dewatering.	Construction Manager, SEO.
28.5	Undertake trend analysis of dewatering impacts during annual aquifer reviews so that alternative water supplies can be put in place in advance of water level decline causing wells to go dry.	Prior to pit dewatering.	Project Engineer, SEO.
28.6	Undertake more detailed investigations of ground conditions in potential pit inflow areas.	Prior to Stage 2 Mining.	Project Engineer.

13.5 ENVIRONMENTAL TARGETS AND PERFORMANCE INDICATORS

The key environmental targets and performance indicators will be used to assess performance against the environmental objectives listed in the Section 13.3. Table 29 details environmental targets based on management objectives for groundwater protection and performance criteria to assist in assessing the achievement of these targets.

Table 29: Environmental Targets and Performance Indicators for Groundwater Protection

Management objective	Environmental Target	Performance Indicator
To maintain the quantity and quality of water supply to existing vegetation, fauna and pastoral users.	No change to water regime of groundwater beyond the predicted drawdown.	Observed groundwater water flows. Environmental incidents arising from changes to groundwater regime beyond predicted levels.
To maintain the integrity, functions and environmental values of watercourses and sheet flow.	No change to water regime of groundwater beyond the predicted drawdown cones.	Observed groundwater flows. Environmental incidents arising from changes to groundwater regime beyond predicted levels.
To monitor effectiveness of controls.	Above targets are met.	Estimate of overall effectiveness through occasional assessment of performance of controls.
To adaptively respond to inadequacies in controls.	PEMP and procedures updated as required.	Extent to which updated PEMP addresses all issues.

13.6 MONITORING AND CORRECTIVE ACTIONS

A detailed groundwater monitoring programme will form part of the Operating Strategy. The following provides the minimum environmental management commitments. The Operating Strategy will incorporate and build on these commitments.

The main areas of monitoring are as follows:

- Fortescue River Alluvium - utilising seven existing DoW (Old GSWA) monitoring bores;
- Ore Body and Basement Rocks - construct six new monitoring bores; four bores located along the strike of the ore bodies and two located in the flanking basement rocks either side of the ore body;
- Standing water within any post-closure pit void;
- WDFs- construct six new monitoring bores; and
- Pastoral Wells - monitoring all of the pastoral wells in the area.

In order to ensure progress toward the achievement of the management objectives outline in Section 13.3 of this PEMP, the monitoring program for groundwater includes activities to be performed throughout the life of the Balmoral South Project and which, if the target is not achieved, will result in corrective action Table 30 details the monitoring programme for surface water protection of the Balmoral South Project. Construction Inspection Checklists shall be used and shall include assessment of surface water management actions as listed in Table 29.

The Balmoral South and Central Block Project propose to share all monitoring data with a view to undertaking joint reporting of groundwater monitoring. The Balmoral South Project proposes to complete the following groundwater monitoring in order to provide full coverage of the cumulative impact of both projects.

The Central Block Project has committed to develop a groundwater monitoring network comprising both existing and purposely constructed bores (Aquaterra 2007). These bores will be monitored to assess regional drawdown and groundwater quality impacts of dewatering, and to provide data for refinement of predicted future impacts. An adaptive approach to monitoring is to be adopted with groundwater abstraction and water level data used to recalibrate the groundwater model and to refine predictions of future dewatering requirements and associated impacts.

Ore Body and Basement Lithologies

The Balmoral South Project proposes to install an additional 2 monitoring bores located in the flanking basement rocks to the east of the Central Block and Balmoral ore bodies, as illustrated in Figure 5

Waste Disposal Facility

The Balmoral South Project proposes to construct monitoring bores for the monitoring of groundwater in the vicinity of the combined waste disposal facility (WDF). Initially it is proposed to install a number of monitoring bores around WDF1 with additional bores to be installed around WDF2 as it is brought online (Figure 5).

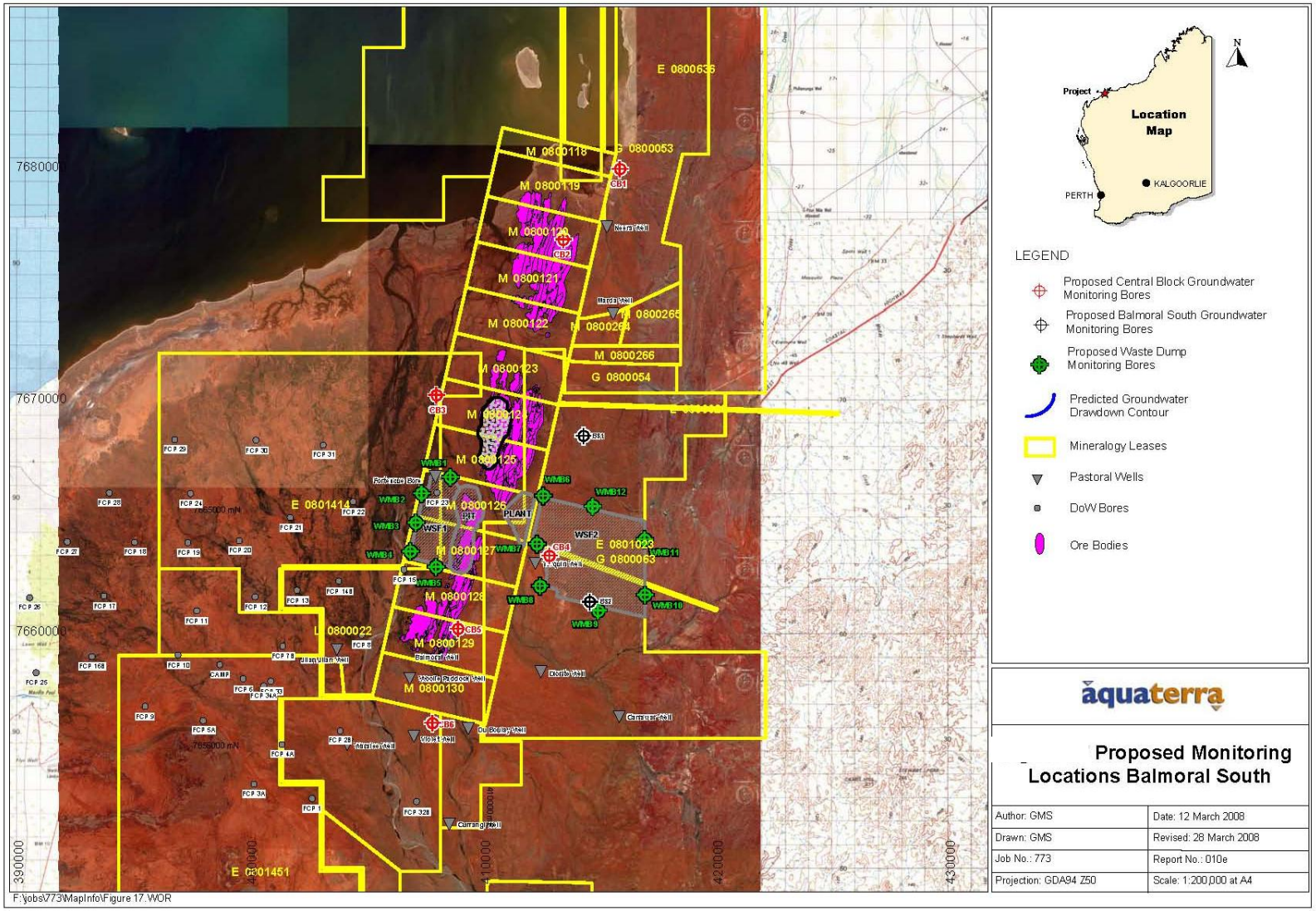

Figure 5: Proposed Groundwater Monitoring Locations for the Balmoral South Project

Relevant documentation to be inspected includes the Environmental Incident Reports and previous week's inspection sheets to check whether problems or non-adherences to surface water management procedures have been rectified.

Table 30: Monitoring and Corrective Action Programme for Groundwater Protection

Item	Activity	Performance Indicator	Corrective Action	Frequency	Responsibility
30.1	Water Levels: Monitor existing pastoral wells within the area influenced.	Water levels maintained.	Ensure continuation of water. In cases where water levels drawdowns are not too great the installation of deeper replacement wells may be an option.	As required.	SEO.
30.2	Dewatering Quantity Measure quantity of water by installing a flow meter on each pump.	An exceedance of 20% or greater of the predicted dewatering rate for a given depth of mining will trigger a more detailed analysis and review of dewatering and monitoring.	Undertake a more detailed analysis and review of dewatering and monitoring. Quantify the impacts from excessive dewatering. Consult with DoW on appropriate corrective actions.	Monthly.	SEO.
30.3	Water Quality: Measure hydrochemistry in any post-closure pit void standing water, particularly salinity (EC) and pH.	pH greater than 6. Any persistent increasing (or decreasing) trend in salinity, pH or other monitored parameter will trigger a detailed analysis and review of dewatering and monitoring data.	Determine source. Review activities and procedures. Improve acid rock drainage management.	Monthly.	SEO.
30.4	Water Quality: Measure hydrochemistry from WDFs monitoring bores, dewatering bores and sumps.	Improve acid rock drainage management. Any persistent increasing (or decreasing) trend in salinity, pH or other monitored parameter will trigger a detailed analysis and review of dewatering and monitoring data.	Determine source. Review activities and procedures. Improve acid rock drainage management if determined as source.	Monthly.	SEO.
30.5	Monitor health of phreatophytic vegetation outside predicted area of impact as appropriate including:	No adverse impact outside predicted area of impact.	Undertake a more detailed analysis and review of dewatering and monitoring. Quantify the impacts from excessive dewatering. Consult with DEC and DoW on appropriate corrective actions.	Quarterly or as appropriate.	SEO.
	Visual health.	To be assessed via established photo points.			
	Health ranking.	To be derived from visual assessment, ranging from healthy to dead with various degrees of stress as intermediates.			

Item	Activity	Performance Indicator	Corrective Action	Frequency	Responsibility
	Alive canopy foliage cover (%)	To be used as a visual measure of tree stress.			
	Height (m) – to be used as a measure of growth.	To be used as a measure of growth.			
	Diameter at Breast Height (DBH).	To be used as a measure of growth.			

13.7 CONTINGENCY ACTIONS

Triggers for identifying actual and potential non-conformances with the objectives of this plan will be determined for groundwater protection of the Balmoral South Project.

Potential triggers that may exist are described below:

- Visual observation detects impact to phreatophytic vegetation outside predicted impact areas.
- Water monitoring shows pastoral wells will dry up.
- Sampling detects excessive pH or salinity.
- Instrumental monitoring data indicate standing water pH is lower than 6, or that metals concentrations exceed those assigned for stock consumption within any post closure pit void.
- Water levels within the post-closure pit void demonstrate a rising trend that may result in standing water levels at or above 0mAHD.

Contingency actions will be initiated if monitoring indicates that groundwater systems are being significantly altered. The contingency actions shall be implemented concurrently with appropriate incident procedures.

Contingency actions for potential triggers that may be used are described below:

- Investigate cause;
- Implement management actions as appropriate to isolate or reduce causes;
- Monitor the impacts to determine adequacy of control;
- Consult with relevant government agencies on improving the control actions; and
- Complete an Environmental Incident Report.

13.8 REPORTING

In the event of an incident involving detrimental impacts on groundwater, the personnel involved (or witnesses to) shall complete an Environmental Incident Report.

The procedures relating to environmental incidents as listed in Section 3.7 shall also be followed. The Environmental Incident Report system can be used as a mechanism for reporting contractor non-conformance to this plan to IM or regulatory authorities as required.

14. LANDFORM AND DECOMMISSIONING MANAGEMENT

14.1 CONTEXT

This section addresses the specific environmental management in the Balmoral South Project landform, decommissioning and closure phases and to ensure sufficient consideration is given to mine closure during the initial planning phase of the Balmoral South Project.

Legislations and Relevant Standards

- *Environmental Protection and Biodiversity Conservation Act 1999*
- *Conservation and Land Management Act 1984*
- *Contaminated Sites Act 2003*
- *Environmental Protection Act 1986*
- *Mining Act 1978*
- *Mine Safety and Inspection Act 1994*
- *Soil and Land Conservation Act 1945*
- *Rights in Water and Irrigation Act 1914*

Stakeholders Consultations

IM, or its contractors, shall notify and consult relevant authorities in the event that inappropriate management of landforms causes a potentially significant environmental deterioration. If necessary, IM shall seek advice on potential environmental remediation procedures from the relevant authorities.

In consultation with DEC, DoIR and other key stakeholders, IM will develop a final Decommissioning and Closure plan, incorporating a rehabilitation plan, from commencement and as part of ongoing mine planning, to mitigate inappropriate management of landforms..

14.2 POTENTIAL SOURCES AND IMPACTS

Potential Sources

Landform and decommissioning impacts can result from:

- Lack of consideration to mine closure during the initial planning, construction and operational phases of the Balmoral South Project;
- Failure to recognise decommissioning and rehabilitation as a progressive and flexible practice through the life of mine including ongoing rehabilitation policies; and
- Failure to identify issues that are necessary to meet legal requirements and other obligations for rehabilitation and decommissioning.

Potential Impacts

Potential environmental impacts on landform and decommissioning include:

- Dust generation;
- Contamination of groundwater;
- Contamination of surface water;
- Fauna and flora mortality;
- Increase in public health and safety risks; and
- Inability of land to be used for post development intended use.

14.3 ENVIRONMENTAL MANAGEMENT OBJECTIVES

EPA Objective

The objective is considered relevant to landform and decommissioning:

- To ensure that rehabilitation achieves an acceptable standard compatible with the intended land use, and consistent with appropriate criteria;
- To ensure, as far as practicable, that rehabilitation achieves a stable and functioning landform which is consistent with the surrounding landscape and other environmental values.

Balmoral South Project Management Objectives

The Management objectives of the Balmoral South Project are consider relevant to landform and decommissioning:

- To ensure early identification of issues that are necessary to meet legal requirements and other obligations for rehabilitation and decommissioning;
- To minimise the potential risk to cause environmental harm from the cessation of activities on the land once rehabilitation has taken place;
- To construct WDFs and other landforms that are stable in the long term, and that will not be subject to producing dust, erosion or slumping;
- Management of noxious materials to avoid the creation of contaminated areas;
- To prevent or minimise long term environmental and public health and safety impacts;
- To ensure that adequate resources are set aside to implement environmental plans during operations and closure; and
- To create a stable landform suitable for an agreed subsequent land use.

Objectives will be met by implementing the key management actions listed in Table 31.

Management covered in other PEMP Sections

Rehabilitation and decommissioning are ongoing processes where key management issues are identified and implemented early in the Balmoral South Project development. IM recognises the importance of ongoing rehabilitation as a key objective and as such has developed management objectives, management procedures and monitoring activities which are specifically addressed in Section 4 *Terrestrial Flora and Vegetation Management* in this PEMP.

14.4 MANAGEMENT ACTIONS

In order to avoid and reduce the potential impact of activities relevant to Landform and decommissioning, the key management actions that will be carried out to achieve the management objectives have been compiled in Table 31. This table also details at what stage of the development the actions will be implemented and the responsible person(s) for ensuring operational compliance with the management actions.

Table 31: Management Actions for Landform and Decommissioning

Item	Management Actions	Timing	Responsibility
31.1	The outer layer of the WDFs will be constructed with inert mine waste. Any hazardous material or material unsuitable to form a long term stable slope will not be used to form the outer layer	Engineering design, prior to construction and ongoing.	Project Engineer, Construction or Operations Manager.
31.2	In areas that may be exposed to frequent water action, rip-rap over size material (boulders >1 tonne) will be used to prevent further erosion.	Engineering design, prior to construction and ongoing.	Project Engineer, Construction or Operations Manager.
31.3	Carry out revegetation trials to validate final rehabilitation design and prescription, using vegetative cover that reflects the surrounding environment, with likely exceptions as follows: • Concave slopes such as those proposed in consultation with DoIR contain by necessity portions of slope where the angle is greater than that which can be safely trafficked by machinery (>20 degrees from horizontal). These areas will be seeded by hand with *Triodia spp*, but cannot be topsoiled in the same manner as slopes with angles < 20 degrees from the horizontal. • Similarly, areas that have been reinforced with large >2m boulders as a method for controlling erosion (ie at spill points) cannot be topsoiled or revegetated in the same manner as the remainder of the landform.	Engineering design, prior to construction and ongoing.	Project Engineer, Construction or Operations Manager.
31.4	Investigate and test the use of a various WDFs profiles, including concave profiles, to arrive at the best practical solution for placement of topsoil (where available), minimise long term erosion effects, and assist in revegetating with local native plant growth where possible, in preference to a traditional waste disposal facilities profile.	Engineering design, prior to construction and ongoing.	Project Engineer, Construction or Operations Manager.
31.5	Cover the top surface of the dump in scree, raked out of the waste, so that the surface is dust free.	Engineering design, prior to construction and ongoing.	Project Engineer, Construction or Operations Manager.
31.6	Construct settling ponds that have an overflow design allowing water to discharge into the natural drainage system in times of high rainfall.	Engineering design, prior to construction and ongoing.	Project Engineer, Construction or Operations Manager.
31.7	Undertake further test work on the potential for acid formation from the waste material encountered.	Prior to construction.	Project Engineer, Construction or Operations Manager.
31.8	Manage noxious materials through life of the Balmoral South Project to avoid the creation of contaminated areas.	See Section 21 *Spill Management* of this PEMP	
31.9	Ensure rehabilitation areas are free from public health and safety risks.	Prior to rehabilitation and ongoing.	SEO, Construction or Operations Manager.
31.10	Create a stable landform suitable for an agreed subsequent land use.	Decommissioning.	Project Engineer, Construction or Operations Manager.
31.11	Roads ripped and seeded – rehabilitated in accordance with management procedures outlined in Section 4 of this PEMP.	Decommissioning.	SEO, Construction or Operations Manager.
31.12	Removal of all Project infrastructures including pipelines, electrical reticulation, magazines.	Decommissioning.	SEO, Operations Manager.

Item	Management Actions	Timing	Responsibility
31.13	Creation of mine abandonment bunds as per DoIR guidelines.	Decommissioning.	Project Engineer, Construction or Operations Manager.
31.14	Rehabilitation of mine office and workshop site.	Decommissioning.	SEO, Operations Manager.
31.15	Removal of the fuel farm and clean up of any contaminated areas.	Decommissioning.	SEO, Operations Manager.
31.16	Ensuring that the natural drainage is restored as far as is practicable to minimise erosion at the time of closure.	Decommissioning.	Project Engineer, Construction or Operations Manager.
31.17	Undertaking five yearly reviews of this plan to ensure that it reflects developing standards and expectations of both the public and regulatory authorities.	Prior to construction, five yearly intervals.	Project Engineer, Construction or Operations Manager.
31.18	Develop a final Decommissioning and Closure plan not less than five years prior to cessation of site operations, incorporating a rehabilitation plan that draws on the findings of the rehabilitation trials.	not less than five years prior to cessation of site operations.	Project Engineer, Operations Manager.

14.5 ENVIRONMENTAL TARGETS AND PERFORMANCE INDICATORS

The key environmental targets and performance indicators will be used to assess performance against the environmental objectives listed in the Section 14.3 above. Table 32 details environmental targets based on management objectives for landform and decommissioning and performance criteria to assist in assessing the achievement of these targets.

Table 32: Environmental Targets and Performance Indicators for Landform and Decommissioning

Management objective	Environmental Targets	Performance Indicator
To ensure early identification of issues that is necessary to meet legal requirements and other obligations for rehabilitation and decommissioning.	Acceptance of Rehabilitation and Decommissioning section by DEC and DoIR.	Number of comments received.
To minimise the potential risk to cause environmental harm from the cessation of activities on the land once rehabilitation has taken place.	Land rehabilitated to pre-development state.	Environmental Incident Reports show no environmental impacts in rehabilitated areas.
To construct waste disposal facilities that are stable in the long term.	Rehabilitated WDFs not producing dust, erosion or slumping.	Environmental Incident Reports show dust, erosion or slumping of WDFs in rehabilitated areas.
Management of noxious materials to avoid the creation of contaminated areas.	No contamination in rehabilitated areas.	Detection of contamination from monitoring or visual inspection.
To prevent or minimise long term environmental and public health and safety impacts.	No injury or death caused from inadequate rehabilitation techniques.	Injury to personnel or public in rehabilitated areas.
To create a stable landform suitable for an agreed subsequent land use.	Land is returned to agreed subsequent use.	Complaints from subsequent land users that rehabilitated areas are not fit for intended use.
To monitor the effectiveness of measures.	Above targets are met.	Estimate of overall effectiveness through occasional assessment of performance of controls.
To adaptively respond to results of the monitoring programme.	PEMP and procedures updated as required.	Extent to which updated PEMP addresses all issues.

14.6 MONITORING AND CORRECTIVE ACTIONS

In order to ensure progress toward the achievement of the management objectives outline in Section 14.3 of this PEMP, the monitoring program for rehabilitation and decommissioning includes activities to be performed throughout the life of the Balmoral South Project and does not address specific decommissioning activities such as the removal of infrastructure

Table 33 details the monitoring programme for rehabilitation and decommissioning of the Balmoral South Project.

IM has adopted a life of development approach to rehabilitation and decommissioning and as such many of the management and monitoring requirements have been incorporated into this PEMP, namely:

- Rehabilitation is covered in Section 4 (Terrestrial Flora and Vegetation Management).
- Contamination is covered in Section 21 (Spill Management).
- Groundwater management and monitoring is covered in Section 13 (Groundwater Management).

Table 33: Monitoring and Corrective Action Programme for Landform and Decommissioning

Item	Activity	Performance Indicator	Corrective Action	Frequency	Responsibility
33.1	Review engineering designs for waste disposal facilities and other landforms to ensure management actions identified in Management Actions 13.1.3 to 13.1.9 have been incorporated in the design.	All items incorporated in design.	Amend engineering designs.	Prior to construction.	SEO, Project Engineer, Construction or Operations Manager.
33.2	Inspect constructed WDFs and other landforms to ensure management actions identified in Management Actions 13.6.3 to 13.6.9 have been incorporated in the construction.	All items incorporated in construction.	Amend construction techniques.	During construction.	SEO, Project Engineer, Construction or Operations Manager.

14.7 CONTINGENCY ACTIONS

Triggers will be monitored through the monitoring program. In the event that monitoring indicates that a trigger is exceeded or is at risk of being exceeded an investigation will be undertaken to determine the root cause and contingency actions to remediate and avoid further breaches will be determined and completed. Contingency actions will be developed in consultation with the Construction/Operations Manager and Environmental Manager and DEC.

14.8 REPORTING

Relevant documentation to be inspected includes the Environmental Incident Reports and previous inspection sheets to check whether problems or non-conformances with the PEMP have been rectified.

15. PROCESS EMISSIONS MANAGEMENT

15.1 CONTEXT

Project development activities will produce process emissions which will extend into the surrounding environment. The Mining Leases encompassing the Cape Preston Project Area are within the boundaries of the Mardie pastoral station and accordingly, the Balmoral South Project area is isolated from any substantial human development.

Legislations and Relevant Standards

- *National Environment Protection Council (NEPC) National Environmental Protection Measure (NEPM) for Ambient Air Quality 1998. The standards defined in this measure are concentrations set to ensure that public health, amenity and the environment are protected;*
- *World Health Organisation (WHO) Air Quality Guidelines for Europe, 2nd edition, 2000;*
- *EPA (2000a). Guidance for the Assessment of Environmental Factors No. 15: Emissions of Oxides of Nitrogen from Gas Turbines; and*
- *DoE (2006). Air Quality Modelling Guidance Notes.*
- *Australian Department of Climate Change (2008) – National Greenhouse and Energy Reporting Guidelines*
- *Australian Department of Climate Change (2008) – National Greenhouse and Energy Reporting (Measurement) Technical Guidelines 2008 v1.0*
- *Australian Department of Climate Change (2008), National Greenhouse Accounts (NGA) Factors – January 2008*

Stakeholders Consultations

Inappropriate management of process emissions causes a potentially significant environmental impact. If necessary, IM shall seek advice on proper environmental remediation procedures from the relevant authorities.

The Part V Licence application will be prepared in consultation with DEC and other key stakeholder which will incorporate and build on the commitments made through this PEMP. As a minimum, IM will also report to DEC on the following:

- Actual emissions compared to predicted emissions assessed in PER;
- Compliance with National Environment Protection Council (NEPC) National Environmental Protection Measure (NEPM) for Ambient Air Quality 1998. These standards are set to ensure that public health, amenity and the environment are protected;
- Compliance with WHO Air Quality Guidelines for Europe, 2nd edition, 2000;
- Emissions per unit of produced;
- Greenhouse gas emission review which will include calculations of emissions per tonne of product; and
- Greenhouse emission targets.

15.2 POTENTIAL SOURCES AND IMPACTS

Potential Sources

Process emissions from the Balmoral South Project's activities will occur from:

Pellet Plant:

- Combustion products from the burners used in the induration process. Emissions of concern are NO_X from nitrogen and SO_X from sulphur present in the fuel;

- particulates primarily from particles entrained in the air during the screening process;
- Hydrogen fluoride (HF) and hydrogen chloride (HCl) if present in the iron ore.

Power Station:

- Will consist of two gas-fired combined cycle units.
- Pollutants of concern from the power station are primarily NO_X, with small amounts of SO_2, CO and particulates.

Other:

- Negligible atmospheric emissions of concern are anticipated from the desalination plant; and
- Combustion products from vehicles are considered to have a minor impact because they occur over a relatively large area.
- Fuel consumption by mobile construction equipment
- Fuel consumption by mining equipment
- Fuel consumption by light vehicles
- Combustion of Ammonium Nitrate Fuel Oil (ANFO) for blasting
- The use of limestone in the process
- The use of dolomite in the process
- Losses of synthetic gases used in refrigeration and electrical switchgear
- Deposition of solid waste to on-site landfill
- Waste water treatment

Potential Impacts

Potential environmental impacts relevant to process emission include:

- Human health;
- Animal health;
- Welfare and amenity of surrounding land users; and
- Global warming; and
-
- Annual increase 0.42% of the total baseline (1990) Australian emissions and approximately 3.98% of the total Western Australian emissions.

15.3 ENVIRONMENTAL MANAGEMENT OBJECTIVES

EPA Objective

The objective is considered relevant to process emission:

- To ensure that emissions do not adversely affect environment values or the health, welfare and amenity of people and land uses by meeting statutory requirements and acceptable standards
- To minimise emissions to levels as low as practicable on an on-going basis and consider offsets to further reduce cumulative emissions.

Balmoral South Project Management Objectives

The Management objectives of the Balmoral South Project are to consider relevant to process emission:

- To ensure that emissions do not adversely affect environmental values or the health, welfare and amenity of surrounding land users;

- To minimise greenhouse gas emissions in absolute terms and reduce emissions per unit of product to as low as reasonably practicable;
- To utilise best engineering technology and management practices to minimise process emissions in design, construction and operating the plant;
- To minimise airborne emissions through all reasonable and practicable measures;
- To monitor the effectiveness of process emissions management measures; and
- To adaptively respond to inadequacies in controls through preventative action.

Objectives will be met by implementing the key management actions listed in Table 34.

15.4 MANAGEMENT ACTIONS

Emission Mitigation Initiatives and Consideration

The Project will be a significant user of energy. As such, particular attention has been paid during the planning and design phases to maximise energy efficiency.

- *Combined Cycle Gas Turbine Generation*

The majority of energy and emissions will result from the generation of electricity. The Project has therefore adopted industry best practice technology to maximise efficiency and reduce greenhouse gas emissions from this activity. It is proposed to install a combined-cycle utility class gas turbine power station with a 600 MW capacity, which should produce an estimated 3.8 million MWh per annum. Natural gas will be sourced from the Mineralogy Central Block gas supply pipeline.

The gas turbines will be equipped with a heat recovery system, which will convert heat energy from the gas turbine exhaust to steam and feed this to steam turbines. This generation arrangement is expected to achieve a thermal efficiency of between 51% and 56%, depending on the particular machines selected.

The selection of this technology involved detailed consideration of alternative technologies such as:

- open cycle aero-derivative
- open cycle frame
- open cycle utility class
- open cycle – inlet air cooled.

The power station is also proposed to include a power plant management system to control, monitor and optimise fuel efficiency. The system will monitor and control inlet air temperature, inlet air evaporative cooling, turbine inlet guide vanes, heat recovery steam generator exhaust temperature pinch point, mechanical draft cooling tower and other systems that impact on the overall plant efficiency

- *Process Plant Waste Heat Capture*

The process includes a cooling section, where heat is recovered from the fired pellets of concentrate, limestone and dolomite. In an effort to minimise heat losses, the plant is set up so that hot gases from the cooling zone are used to provide preheated air to the burners in the firing zone, and then the off-gases are transferred from the firing zone to the drying zone.

- *Geothermal Energy*

There are two geothermal power stations in Australia. These plants are based on using geothermal aquifer technology and geothermal hot dry rock technology. A 150 kW geothermal plant is currently in operation at Birdsville in South East Queensland (Ergon Energy) and a demonstration plant is currently being constructed in the Cooper Basin in South Australia (Geodynamics). Geodynamics have also recently been provided government funding for development of a commercial geothermal plant in the Hunter Valley in New South Wales.

It is understood that some geological hot rocks exist in the Pilbara and may be considered in the future for generation of electricity. However, given that the source of the hot rocks area is remote from the Project site, geothermal energy is currently not considered as a commercially viable option for the Project.

- *Solar Energy*

Present solar technology is not considered suitable for base load operations. Barring cloud cover, solar electricity production peaks during the day and is zero at night, such that approximately 5.5 to 6 hours of full electricity production per day could be expected (Worley Parsons, 2007). Although solar energy may offset gas generation and reduce greenhouse gas emissions, it is still necessary to install full capacity gas generation infrastructure to ensure sufficient supply when solar energy is not available. Operation of the gas gensets at reduced capacity (when being partially offset by solar energy) would also impact on the thermal efficiency of those gensets.

For the Project, solar energy infrastructure would also be susceptible damage during cyclone events.

Present commercially available solar hot water heaters are subject to overheating in the Pilbara environment and present a safety hazard to personnel. Solar heating of camp accommodation may be possible if a safe designed unit becomes available on the market. Consideration has also been given to the use of solar lighting.

- *Wind Energy*

The cost range for a wind energy installation is typically between $1,600 / kW and $2,200 / kW of installed capacity for relatively large installations. In order for wind energy to be financially viable a minimum average wind speed of 7 metres per second is generally required (Worley Parsons, 2007). As with solar energy, gas generation capacity to meet full demand will still be required for times when wind energy is not available and the infrastructure would be susceptible to cyclone damage.

- *Biofuels*

Consideration has been given to the use of bio diesel as an alternative to natural gas. Currently there is not adequate product available to meet demands and would otherwise still represent a 250% increase in energy costs compared to natural gas.

- Renewable Energy Certificates

The Mandatory Renewable Energy Target (MRET) is implemented trough Federal Government legislation and is designed to increase the amount of electricity generated from eligible renewable energy sources. Renewable Energy Certificates (RECs) are an electronic form of currency initiated by the Renewable Energy (Electricity) Act 2000. Under the scheme, accredited power generators are eligible to create RECs which can be sold or traded with liable parties. It is likely that opportunities exist for International Minerals to gain some subsidy on the cost of renewable energy through the sale of REC's and this should be included in any future consideration of renewable energy options.

- *Emissions Trading*

The Australian Government's proposed implementation of the Carbon Pollution Reduction Scheme in 2010 will theoretically ensure the most efficient allocation of resources towards greenhouse gas mitigation measures. The scheme should allow resources to be allocated to mitigation measure where the marginal costs of carbon abatement are the lowest.

Once the scheme commences, International Minerals will have the option to either acquire and relinquish 100% of the necessary carbon permits, or to offset these permits with actual reductions in emissions. It is recommended in that International Minerals continue to compile the details of the various emission mitigation measures available to them (irrespective of current feasibility) and develop an understanding of their marginal cost of carbon abatement. This will facilitate decision making on these projects as carbon prices fluctuate. For example, if carbon reaches a particular price, a project that is not currently financially viable may become viable.

- *Progressive Revegetation*

The emissions from vegetation clearing at the Project are expected to be minimal due to the sparseness of the existing vegetation. Most of these emissions are however expected to be eventually offset through the carbon sequestration by the proposed progressive revegetation activities.

- *Solid Waste Management*

Greenhouse gas emissions are generated from the decomposition of waste materials in landfill facilities. Waste materials with the highest emission factors are paper and cardboard, wood and straw (Department of Climate Change, 2008). A total waste management programme has been developed with an external waste contractor for implementation at the Project. The programme involves extensive recycling and reuse of materials and is expected to result in significant reductions in the quantity of waste to landfill that would otherwise decompose and generate greenhouse gases.

- *Building Design*

International Minerals have indicated a commitment to the following design features for the accommodation village and other buildings (e.g. offices, crib rooms):

- Use of energy efficient light globes where possible
- Use of heat pump 5-star plus energy efficient water heaters
- Use of 5-star WELS rated water fixtures to reduce water and power consumption
- Use of best practice energy efficient housing materials as defined in the Building Code of Australia to reduce heating and cooling requirements in the village

Management Strategies

In order to avoid and reduce the potential impact of activities relevant to process emission, the key management actions that will be carried out to achieve the management objectives have been compiled in Table 34. This table also details at what stage of the development the actions will be implemented and the responsible person(s) for ensuring operational compliance with the management actions.

Table 34: Management Actions for Process Emission

Item	Management Actions	Timing	Responsibility
34.1	Focus on the quality of fuel/lubricants used with an objective to reduce hydrocarbon waste and increase productivity per truck.	During design, construction and ongoing.	Project Engineer, Construction or Operations Manager.
34.2	Aim to improve fuel consumption efficiency per tonne of ore hauled	During design, construction and ongoing.	Project Engineer, Construction or Operations Manager.
34.3	Assess alternative waste and ore disposal technologies, such as in-pit crushing and conveyor to reduce fuel burn.	During design, construction and ongoing.	Project Engineer, Construction or Operations Manager.
34.4	Evaluation of best carbon sequestration method to offset CO_2-e emissions.	During design, construction.	Project Engineer, Construction or Operations Manager.
34.5	Ensure power station to use the best practice technology.	During design.	Project Engineer, Construction or Operations Manager.
34.6	Undertake a greenhouse gas emission review which will include calculations of emissions per tonne of product.	Once the Balmoral South Project is in operational mode and actual emission rates are being monitored and quantified and ongoing.	SEO, Project Engineer, Construction or Operations Manager.
34.7	Setting greenhouse emission targets.	Once the Balmoral South Project is in operational mode and actual emission rates are being monitored and quantified and ongoing.	SEO, Project Engineer, Construction or Operations Manager.
34.8	Review of greenhouse gas emission targets.	Once the Balmoral South Project is in operational mode and actual emission rates are being monitored and quantified and ongoing.	SEO, Project Engineer, Construction or Operations Manager.
34.9	Continually monitor of renewable energy technologies, government subsidy programmes to determine future viability	Once the Balmoral South Project is in operational mode and actual emission rates are being monitored and quantified and ongoing.	Project Engineer, Construction or Operations Manager.
34.10	Establish comprehensive monitoring, calculation and reporting systems to satisfy the requirements of the National Greenhouse and Energy Reporting Scheme (NGERS) and Energy Efficiency Opportunities (EEO) programmes	Once the Balmoral South Project is in operational mode and actual emission rates are being monitored and quantified and ongoing.	SEO, Project Engineer, Construction or Operations Manager.
34.11	Allocate sufficient resources and establish internal procedures and processes to satisfy the requirements of the EEO programme	Once the Balmoral South Project is in operational mode and actual emission rates are being monitored and quantified and ongoing.	SEO, Project Engineer, Construction or Operations Manager.
34.12	Establish the range of carbon abatement options available to International Minerals and determine the costs of each option.	Once the Balmoral South Project is in operational mode and actual emission rates are being monitored and quantified and ongoing.	SEO, Project Engineer, Construction or Operations Manager.

15.5 ENVIRONMENTAL TARGETS AND PERFORMANCE INDICATORS

The key environmental targets and performance indicators will be used to assess performance against the environmental objectives listed in the Section 15.3. Table 35 details environmental targets based on management objectives for process emission and performance criteria to assist in assessing the achievement of these targets.

Table 35: Environmental Targets and Performance Indicators for Process Emission

Management objective	Environmental Targets	Performance Indicator
Ensure that emissions do not adversely affect environment values or the health, welfare and amenity of surrounding land users.	Process emissions are attached to PER (Appendix I and J of PER)	Actual emissions compared to predicted emissions assessed in the PER. Compliance with National Environment Protection Council (NEPC) National Environmental Protection Measure (NEPM) for Ambient Air Quality 1998. These standards are set to ensure that public health, amenity and the environment are protected. Compliance with World Health Organisation (WHO) Air Quality Guidelines for Europe, 2nd edition, 2000.
Utilise best engineering technology and management practices to minimise process emissions in design, construction and operating the plant.	Industry best practice.	Emissions per unit of product.
Use all reasonable and practicable measures to minimise airborne emissions.	Process emissions are attached to PER (Appendix I and J of PER)	Emissions per unit of product.
Monitor the effectiveness of management measures.	Above targets are met.	Estimate of overall effectiveness through occasional assessment of performance of controls.
Adaptively respond to inadequacies in controls through preventative action.	PEMP and procedures updated as required.	Extent to which updated PEMP addresses all issues.

15.6 MONITORING AND CORRECTIVE ACTIONS

The major Project components that produce emissions include the power station, concentrator, desalination plant and pellet plant. These facilities are subject to a Works Approval application as required under Part V of the *Environmental Protection Act 1986*. The Part V Works Approval process requires the proponent to detail the monitoring and management commitments based on the finalisation of detailed design to ensure all environmental objectives are met. The following sections of this process emissions strategy for the PEMP provide the minimum environmental commitments. The Part V Licensee application will be prepared in consultation with DEC and other key stakeholders which will incorporate and build on these commitments.

In order to ensure progress toward the achievement of the management objectives outline in Section 15.3 of this PEMP, the monitoring program for process emission includes activities to be performed throughout the life of the Balmoral South Project. Table 36 details the monitoring programme for rehabilitation and decommissioning of the Balmoral South Project.

Table 36: Monitoring and Corrective Action Programme for Process Emission

Item	Activity	Performance Indicator	Corrective Action	Frequency	Responsibility
36.1	Monitors on the exhaust stacks will measure O_2, NO_x, and CO_2 levels. Stack and ground level monitoring in order to ensure that emissions comply with guideline levels.	Actual emissions compared to predicted emissions assessed in PER. Compliance with National Environment Protection Council (NEPC) National Environmental Protection Measure (NEPM) for Ambient Air Quality 1998. These standards are set to ensure that public health, amenity and the environment are protected. Compliance with WHO Air Quality Guidelines for Europe, 2nd edition, 2000. Emissions per unit of product.	Adjust the firing accordingly to control emissions.	Real-time with daily reviews until environmental objectives are met, then as agreed through the Part V Works Approval.	SEO.

15.7 CONTINGENCY ACTIONS

Triggers will be monitored through the monitoring program. The potential trigger might be:

- Like NO_x and SO_x levels from stack and ground level monitoring exceed NEPM standards.

In the event that monitoring indicates that a trigger is exceeded or is at risk of being exceeded an investigation will be undertaken to determine the root cause and contingency actions to remediate and avoid further breaches will be determined and completed. Contingency actions will be developed in consultation with the Construction/Operations Manager and Environmental Manager.

The contingency actions for the potential trigger might be used:

- Investigate cause
- Rectify immediately if the cause is non-compliance with process emissions management actions;
- Revise process emissions management actions to rectify situation if activities are in compliance with process emissions management actions; and
- Complete an Environmental Incident Report.

15.8 REPORTING

In the event of an incident involving detrimental impacts from process emissions, the personnel involved (or witnesses to) shall complete an Environmental Incident Report.

The procedures relating to environmental incidents as listed in Section 3.7 shall also be followed. The Environmental Incident Report system can be used as a mechanism for reporting contractor non-conformance to this plan to IM or regulatory authorities as required.

16. DUST MANAGEMENT

16.1 CONTEXT

During the construction phase of the Balmoral South Project dust is likely to be generated as a result of the disturbance of soil and rock and the handling of bulk construction materials such as rock aggregate. The potential for wind-generated dust arises from the removal of vegetation and the layer of stable soil which would normally form a seal against wind dispersion. Consequent environmental effects are usually localised but under adverse weather conditions dust can travel considerable distances, potentially affecting relatively remote locations.

The following dust management procedures contain the controls proposed to minimise the environmental impacts due to dust generation during the development of the Balmoral South Project.

Legislations and Relevant Standards

- *National Environment Protection Council (NEPC) National Environmental Protection Measure (NEPM) for Ambient Air Quality 1998. The standards defined in this measure are concentrations set to ensure that public health, amenity and the environment are protected;*
- *EPA (2000b). Guidance for the Assessment of Environmental Factors No. 18: Prevention of Air Quality Impacts from Land Development Sites; and*
- *DEC (2008). Draft - A guideline for the development and implementation of a dust management program.*

Stakeholders Consultations

As required IM, or its contractors, will notify and consult relevant authorities in the event that inappropriate management of dust causes a potentially significant environmental impact. If necessary, IM shall seek advice on proper environmental remediation procedures from the relevant authorities.

16.2 POTENTIAL SOURCES AND IMPACTS

Potential Sources

Dust has the potential to be generated from construction and operational activities of the Balmoral South Project including:

- Vegetation clearing, topsoil clearing and replacement;
- Vehicle movements on the access roads and site roads during construction and operations;
- Mining activities (blasting, earthmoving and dumping);
- Materials handling and processing activities including crushing, screening, stacking and reclaiming of ore; and
- Dust pick-up (wind erosion) from exposed areas including pit, areas cleared for process plant and offices, access roads, stockpiles, waste disposal facilities, WDFsd and accommodation camp.

Potential Impacts

Potential environmental impacts relevant to dust include:

- Reduced visual amenity;
- Smothering of surrounding vegetation;
- Disturbance to fauna;
- Risk to human health; and
- Nuisance to personnel and the public.

16.3 ENVIRONMENTAL MANAGEMENT OBJECTIVES

EPA Objective

The objective is considered relevant to dust:

- To protect the surrounding land users, such that dust emissions will not adversely affect their welfare and amenity or cause health problems and to protect mangroves and marine communities in the vicinity of Cape Preston from dust.

Balmoral South Project Management Objectives

The Management objectives of the Balmoral South Project are consider relevant to dust:

- To implement all reasonable and practicable measures to ensure the prevention or minimisation of dust from all construction related activities for the Balmoral South Project;
- To ensure that dust emissions do not adversely affect environment values or the health, welfare and amenity of people and adjacent land uses by meeting statutory requirements and acceptable standards;
- To monitor the effectiveness of controls; and
- To adaptively respond to results of the monitoring programme.

Objectives will be met by implementing the key management actions listed in Table 37.

16.4 MANAGEMENT ACTIONS

In order to avoid and reduce the potential impact of activities relevant to dust, the key management actions that will be carried out to achieve the management objectives have been compiled in Table 37. This table also details at what stage of the development the actions will be implemented and the responsible person(s) for ensuring operational compliance with the management actions.

Table 37: Management Actions for Dust

Item #	Management Actions	Timing	Responsibility
37.1	Keep the area of exposed surfaces (such as stockpiles and cleared areas) to the minimum required for construction activities.	During construction and operation.	Project Engineer, SEO.
37.2	Stabilise all cleared/exposed surfaces to prevent dust lift off.	During construction and operation.	Project Engineer, SEO, Contractor.
37.3	Conduct earthworks immediately following the clearing of vegetation or as otherwise advised by the Balmoral South Project Engineer in consultation with the SEO.	During construction and operation.	Project Engineer, SEO, Contractor.
37.4	Stabilise cleared areas immediately following clearing and earthworks or as otherwise advised by the Balmoral South Project Engineer in consultation with the SEO.	During construction and operation.	Project Engineer, SEO, Contractor.
37.5	Conduct all blasting only under wind and weather conditions that will not cause direct impacts.	During construction and operation.	Project Engineer, SEO, Contractor.
37.6	Rehabilitate disturbed areas progressively to reduce the potential for windborne dust generation in accordance with the site rehabilitation procedure.	During construction and operation.	Project Engineer, SEO, Contractor.
37.7	Apply water to exposed stockpiles when there is potential for dust lift off.	During construction and operation.	Project Engineer, SEO, Contractor.

Item #	Management Actions	Timing	Responsibility
37.8	Apply sufficient water to any dry, dust-prone areas or material handling areas to prevent dust emissions from these areas as a result of winds, handling of materials or usage by vehicles.	During construction and operation.	Project Engineer, SEO, Contractor.
37.9	Prohibit the use of dry, dust prone areas by vehicles unless sufficient water has been applied to prevent dust emissions. Use water for dust suppression that is of a quality approved by the SEO.	During construction and operation.	Project Engineer, SEO, Contractor.
37.10	Provide onsite water carts in good working condition.	During construction and operation.	Project Engineer, SEO, Contractor.
37.11	Apply water spray to exposed soil during potentially dusty open activities such as loading and unloading material in dust prone conditions.	During construction and operation.	Project Engineer, SEO, Contractor.
37.12	Make provision for onsite soil stabilisation material which can be available for use within 48 hours.	During construction and operation.	Project Engineer, SEO, Contractor.
37.13	Maintaining the moisture content of the run-of-mine (ROM) and crushed ore stockpiles in the processing plant through the use of water sprays.	During construction and operation.	Project Engineer, SEO, Contractor.
37.14	Use of water trucks and chemical suppressants on the access and site roads and enforcing speed limits to minimise dust entrainment.	During construction and operation.	Project Engineer, SEO, Contractor.

16.5 ENVIRONMENTAL TARGETS AND PERFORMANCE INDICATORS

The key environmental targets and performance indicators will be used to assess performance against the environmental objectives listed in the Section 16.3. Table 38 details environmental targets based on management objectives for dust and performance criteria to assist in assessing the achievement of these targets.

Table 38: Environmental Targets and Performance Indicators for Dust

Management objective	Environmental Target	Performance Indicator
To implement all reasonable and practicable measures to ensure the prevention or minimisation of dust from all construction related activities for the Balmoral South Project.	No sustained visual dust observed beyond the immediate boundaries of construction sites.	Observed dust movement during construction site inspections. Environmental incidents arising from dust emissions.
To ensure that dust emissions do not adversely affect environment values or the health, welfare and amenity of people and adjacent land uses.	No significant dust deposition on vegetation adjacent to construction sites. Construction dust does not cause excessive dust levels in public recreation areas.	Observed dust movement during construction site inspections. Environmental incidents arising from dust level in public areas. Public complaint about dust from construction.
To monitor effectiveness of controls.	Above targets are met.	Estimate of overall effectiveness through occasional assessment of performance of controls.
To adaptively respond to inadequacies in controls.	PEMP and procedures updated as required.	Extent to which updated PEMP addresses all issues.

16.6 MONITORING AND CORRECTIVE ACTIONS

In order to ensure progress toward the achievement of the management objectives outline in Section 15.3 of this PEMP, the monitoring program for dust includes activities to be performed throughout the life of the Balmoral South Project. Table 39 details the monitoring programme for dust of the Balmoral South Project.

Construction areas shall be subject to regular (or as required by IM in consultation with its environmental consultants) inspections during earthworks and construction. The SEO shall conduct these inspections. Construction Inspection Checklists shall be used and shall include assessment of dust management actions as listed in Table 37.

Relevant documentation to be inspected includes the Environmental Incident Reports and previous week's inspection sheets to check whether problems or non–conformances to the dust management procedures have been rectified.

Table 39: Monitoring and Corrective Action Programme for Dust

Item	Activity	Performance Indicator	Corrective Action	Frequency	Responsibility
39.1	Visual monitoring.	Low level of dust is being generated.	Increase/improve dust suppression measures.	Daily opportunistic.	SEO, Contractor.
39.2	Visual monitoring.	Any dust generated is localised within the perimeters of working areas.	Increase/improve dust suppression measures.	Daily opportunistic.	SEO, Contractor.
39.3	Inspect vegetation adjacent to working areas.	No significant build-up of dust on vegetation.	Increase/improve dust suppression measures.	Weekly.	SEO.
39.4	Portable continuous particle monitors (High Volume or Tapered Element Oscillating Membrane) to monitor PM 10 and TSP in accordance with AS/NZS 3580	<90% of National Environmental Protection Council (NEPC) standards for PM_{10} and TSP and fibrous materials.	Increase/improve dust suppression measures.	Continuous.	SEO.
39.5	Placement of monitors in accordance with AS/NZS 3580 to ensure that sampling is representative of operational and meteorological conditions.		Increase/improve dust suppression measures.	Continuous.	SEO.
39.6	Implementation of Quality Assurance and Quality Control principles on data collection and analysis, such as the use of NATA accredited laboratories.		Increase/improve dust suppression measures.	Continuous.	SEO.

16.7 CONTINGENCY ACTIONS

Triggers will be monitored through the monitoring program. The potential triggers might be:

- Visual observation detects excessive dust incident.
- Instrumental monitoring data indicate dust emissions are potentially at unacceptable levels.

In the event that monitoring indicates that a trigger is exceeded or is at risk of being exceeded an investigation will be undertaken to determine the root cause and contingency actions to remediate and avoid further breaches will be determined and completed. Contingency actions will be developed in consultation with the Construction/Operations Manager and Environmental Manager.

The contingency actions for the potential trigger might be used:

- Investigate cause
- Rectify immediately if the cause is non-compliance with dust management actions;
- Revise dust management actions to rectify situation if activities are in compliance with management actions; and
- Complete an Environmental Incident Report.

16.8 REPORTING

In the event of an incident involving excessive dust emissions the personnel involved (or witnesses to) shall complete an Environmental Incident Report.

The procedures relating to environmental incidents as listed in Section 3.7 shall also be followed. The Environmental Incident Report system can be used as a mechanism for reporting contractor non-conformance to this plan to IM or regulatory authorities as required.

17. WASTEWATER OUTFALL MANAGEMENT

17.1 CONTEXT

This section outlines the procedures IM will implement to manage the potential environmental effects of constructing and operating a seawater return outfall for the desalination plant, assuming that a port will already be in place at Cape Preston and that the intake and outfalls will be able to hang off existing facilities. This section also outlines the procedures IM will implement to manage the potential environmental effects of constructing a brine outfall pipeline and diffuser north of Cape Preston and filter backwash into the marine environment to support construction of a 40GL/a reverse osmosis desalination plant onshore at Cape Preston.

The proposed Balmoral South Project Desalination plant has discharges of:

- Produce 109 000 m3/day of fresh water
- Produce 157 000 m3/day of brine
- 78.8 ppt salinity (approximately)
- TDS approximately twice that of incoming seawater

The modelled Balmoral South Project Desalination Plant has discharges of:

- Produce 175 000 m3/day of fresh water
- Produce 252 000 m3/day of brine
- 78.8 ppt salinity (approximately)
- TDS approximately twice that of incoming seawater

This discharge (157 000 m3/day) of the proposed Balmoral Project Desalination plant is well below the modelled discharges of 252 000 m3 /day

The Marine impact assessment(Appendix F of PER), which analyses the dispersion of the brine outfall from a proposed desalination plant at Cape Preston for the Balmoral South Project and the potential environmental impacts of such an outfall, include:

- Describe the key characteristics of the marine environment in the area,
- Describe the proposed construction activities required for the various outfalls, seawater intake and via hydrodynamic modelling,
- Determine the scale of mixing zone required to achieve the number of dilutions necessary to meet the water quality criteria established for the Austeel project at Cape Preston by Ministerial Statement 635 (October 2003).
- Present an assessment based on literature review of the impacts of the brine effluent discharge and the level of risk it poses to the marine environment off Cape Preston.

Legislations and Relevant Standards

- *EPA Guidance Statement No. 29: Benthic Primary Producer Habitat Protection for WA's marine environment*
- *DEC (2006).Pilbara coastal water quality consultation outcomes. Environmental Values and Environmental Quality Objectives. Marine Report Series Report No.1. Perth WA;*
- *ANZECC & ARMCANZ (2000). Australian and New Zealand Guidelines for Fresh and Marine Water Quality; and*

Stakeholders Consultations

As required IM, or its contractors, will notify and consult relevant authorities in the event of any non-compliance with Table 44 Interim EVs, EQOs and EQC for Cape Preston Waters.

17.2 POTENTIAL SOURCES AND IMPACTS

Potential Sources

Wastewater outfall impacts can result from:

- Construction of the brine outfall pipeline;
- Construction of the seawater intake;
- Operation of the brine outfall (the discharge);
- Construction and operation of the seawater return outfall; and
- Cumulative effects of a second brine discharge at Cape Preston.

Potential Impacts

Potential environmental impacts relevant to wastewater outfall include:

- Direct impact on sensitive Benthic Primary Producer Habitat (BPPH) as a result of trenching activities for the installation of the pipeline;
- Cause a localised decline in water quality as a result of pipeline construction activities, mainly turbidity;
- Indirect impact on sensitive BPPH due to turbidity generated by pipeline construction activities;
- Reduce local marine water and sediment quality
- Adversely affects individual marine biota within the vicinity of the outfall; and
- Reduce the abundance of sensitive BPPH, including nearby coral communities.

17.3 ENVIRONMENTAL MANAGEMENT OBJECTIVES

EPA Objective

The objective is considered relevant to wastewater outfall:

- To maintain an adequate level of water quality in the waters surrounding Cape Preston; and
- To limit the area required for brine mixing surrounding the diffuser.

Balmoral South Project Management Objectives

The Management objectives of the Balmoral South Project are consider relevant to wastewater outfall:

- To provide a high level of protection to the waters in the region of Cape Preston, except for the mixing zone surrounding the outfalls.
- To protect sensitive habitats from construction and layout of the pipeline.
- To protect sensitive habitats from the operation of the pipeline outfall.
- To protect all social values (swimming and fishing).
- To develop monitoring and feedback programmes for the wastewater stream within the outfall to provide an early warning of potential risks to environmental quality.
- To develop monitoring of ecosystem health indicators in the receiving marine environment and select appropriate control sites for inclusion in the monitoring programme.

- To monitor the effectiveness of wastewater outfall management measures.
- To adaptively respond to inadequacies in controls through preventative action.

Objectives will be met by implementing the key management actions listed in Table 41.

17.4 MANAGEMENT ACTIONS

IM commits to the preparation and application of a Water Quality Management Framework (WQMF). WQMF will be the key tool in achieving the environmental management objectives. It will be developed to ensure that an adequate level of water quality within the Cape Preston region is maintained as a result of the brine discharge. The WQMF will include:

- Establishing EQOs for uses and values and where they will be protected;
- Establishing appropriate EQC required to sustain each EQO; and
- Providing a high level of ecological protection to waters in the region of Cape Preston, except for the mixing zone surrounding the brine discharge and the moderate protection zone within the proposed port and surrounding operational areas.

Application of EVs, EQOs and EQC to the Cape Preston Area

The EVs and their associated EQOs as endorsed by the EPA are as follows:

- Ecosystem Health (ecological value)
    - Maintain ecosystem integrity.
- Recreation and Aesthetics (social use value)
    - Water quality is safe for recreational activities in the water (e.g. swimming)
    - Water quality is safe for recreational activities on the water (e.g. boating)
    - Aesthetic values of the marine environment are protected.
- Cultural and spiritual (social use value)
    - Cultural and Spiritual values of the marine environment are protected.
- Fishing and Aquaculture (social use value)
    - Seafood (caught or grown) is of a quality safe for eating
    - Water quality is suitable for aquaculture purposes.
- Industrial Water Supply (social use value)
    - Water quality is suitable for industrial supply purposes.

In developing the ecosystem health EV, different levels of ecological protection have been developed for application to Pilbara coastal waters, as outlined in Table 40. The spatial application of the EVs and EQOs to the waters around Cape Preston is outlined in Figure 6 .

Table 40: Levels of Ecological Protection for Maintenance of Ecosystem Integrity

Level of Ecological Protection	Environmental Quality Condition (Limit of acceptable change)	
	Contaminant concentration indicators	Biological indicators
Maximum	no contaminants - pristine	no detectable change from natural variation
High	very low levels of contaminants	no detectable change from natural variation
Moderate	elevated levels of contaminants	moderate change from natural variation
Low	high levels of contaminants	large change from natural variation

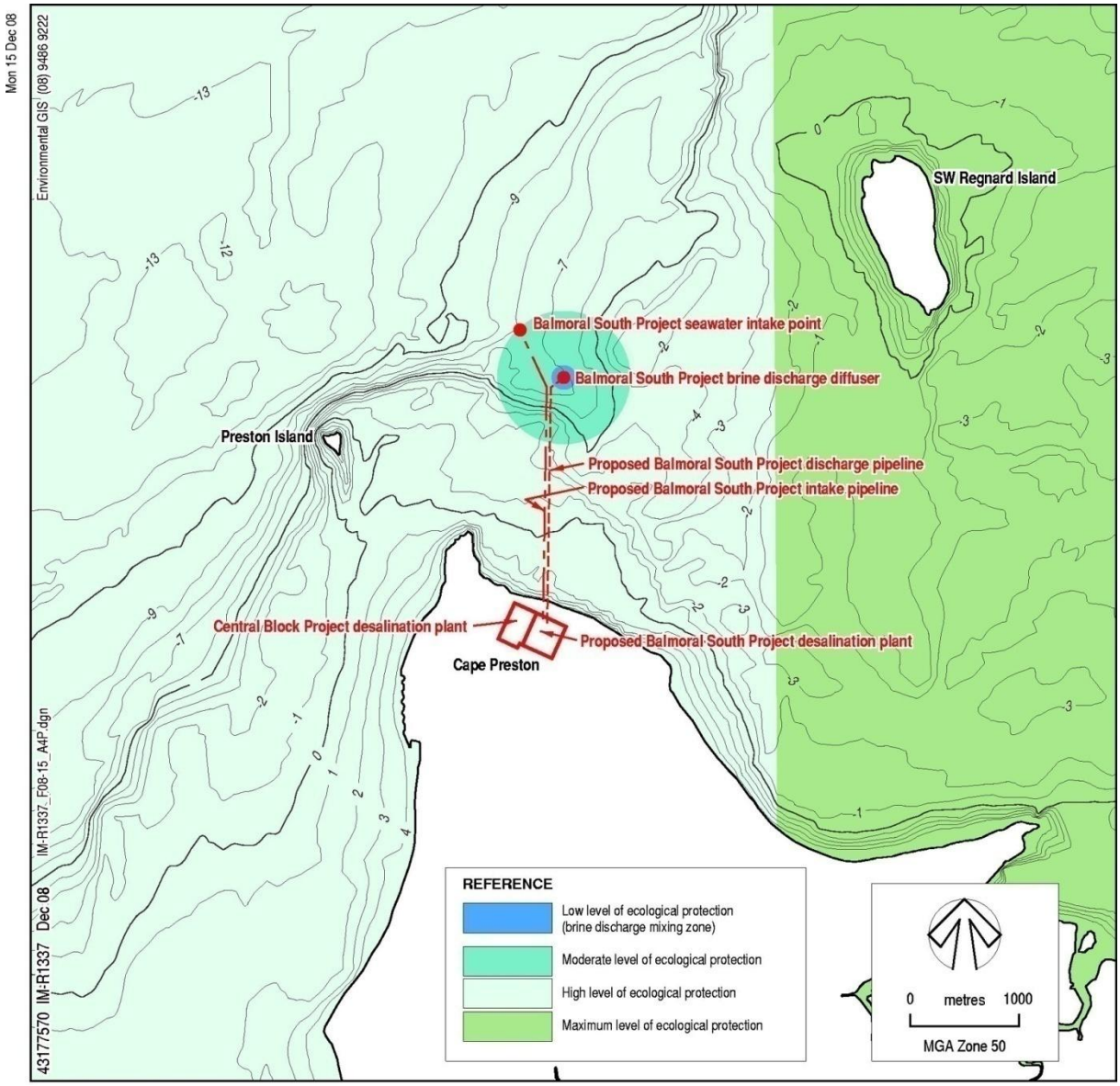

Figure 6: Zones of Ecological Protection

EVs and EQOs have been applied in order to maintain an adequate level of water quality in waters surrounding the Port. Figure 7 delineates the levels of ecological protection and where they apply for the waters of the proposal area and the broader Cape Preston region. The levels of protection and application are also discussed briefly below.

Ecological Values

A high level of ecological protection will apply to all waters of Cape Preston outside of the brine mixing zone and the port operational area. This will ensure adequate water quality in the surrounding port waters and that the maximum level of ecological protection applied by the EPA is maintained for waters east of Cape Preston, in the vicinity of SW Regnard Island.

A moderate level of ecological protection will be applied to all inside harbour waters and surrounding port operational waters, excluding the 4 ha mixing zone around the desalination plant's brine discharge, where a low level of ecological protection is applied. The application of a moderate protection area to the port waters is consistent with protection levels applied by the EPA to other operational ports and wharfs in the Pilbara region.

Social Use Values

Consistent with the EPA's objectives, social use values apply to all waters of the port area and the broader Cape Preston area.

Environmental Quality Criteria

In the interim, EQC applicable to the WQMF will be those published in the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC & ARMCANZ 2000). Reference is also made to the EQC Reference Document for Cockburn Sound (2003-2004) (EPA 2005). Table 42 outlines the EVs, EQOs and interim EQC to be applied to the Balmoral South Project Area and the broader Cape Preston region.

As the monitoring programmes become established, locally specific EQC may be developed in consultation with the DEC. These EQC will be derived from suitable reference sites according to the recommended approach in ANZECC and ARMCANZ (2000) (i.e. 20^{th} and/or 80^{th} percentiles of reference distribution for high ecological protection and 5^{th} and/or 95^{th} percentiles for moderate ecological protection).

To avoid and reduce the potential impact of activities relevant to wastewater outfall, key management actions that will be carried out to achieve management objectives shown in Table 41... This table also details at what stage of the Balmoral South Project the actions shall be implemented and the responsible person(s) for ensuring operational compliance with the management actions.

Table 41: Management Actions for Wastewater Outfall

Item	Management Actions	Timing	Responsibility
41.1	Water samples will be analysed for toxicants at the intake and outfall sites.	During operation	SEO.
41.2	Monitoring programme for salinity will be completed around the brine discharge diffusers.	Immediately after commencement of operations.	SEO.
41.3	Diffuser compliance monitoring to be undertaken. Real-time, in-line monitoring of both ambient and discharge physical seawater parameters will enable data verification of compliance. Any exceedance will be quickly acted upon (subject to parameter and specifics to be developed) to ensure the 5% limit is not exceeded.	During operations.	SEO.
41.4	Automated system will be installed for withdrawing and maintaining samples from both the desalination intake and discharge for later analysis of toxicants including metals, metalloids and desalination.	During operations.	SEO.
41.5	Ecosystem health monitoring at sites within the moderate and high ecological protection zones in the vicinity of Cape Preston to ensure compliance with EQC and the maintenance of EVs and EQOs. Sampling will also be undertaken for comparison purposes at a suitable reference site located to the east of SW Regnard Island, within the maximum ecological protection zone.	Annually during operations.	SEO.

Table 42: Interim EVs, EQOs and EQC for Cape Preston Waters

Environmental Value	EQO No.	Environmental Quality Objective	Level of Protection	Where Protected	Interim EQC (as per: ANZECC & ARMCANZ 2000)
Ecosystem Health	EQO 1	Maintenance of ecosystem integrity. This means maintaining the structure (e.g. the variety and quantity of life forms) and function biodiversity, biomass and abundance of biota) and functions (e.g. the food chains and nutrient cycles) of marine ecosystems. Three levels of ecological protection shall apply to Cape Preston: High, Moderate, and Low.	High	All waters outside port operational area.	Physical and Chemical Stressors – not to deviate beyond the 5th and 95th percentile of reference distribution. Salinity – Not to exceed 5% of ambient for 1% of the time. Toxicants in Water – Table 3.4.1* (99% species protection). Toxicants in Sediment – Table 3.5.1*.
			Moderate	Harbour and port operational area (excluding brine discharge mixing zone).	Physical and Chemical Stressors – not to deviate beyond the 20th and 80th percentile of reference distribution. Salinity – Not to exceed 5% of ambient for 1% of the time. Toxicants in Water – Table 3.4.1* (not to exceed 95% species protection for more than 5% of the time). Toxicants in Sediment – Table 3.5.1*.
			Low	4 ha desalination brine discharge mixing zones.	Toxicants in Water – Table 3.4.1* (not to exceed 90% species protection for more than 5% of the time). Toxicants in Sediment – only for substances that adversely bioaccumulate/biomagnify.
Recreation & Aesthetics	EQO 2	Water quality is safe for recreational activities in the water (e.g. swimming)	N/A	All waters	Table 5.2.2*
	EQO 3	Water quality is safe for recreational activities on the water (e.g. boating)			Table 5.2.2*
	EQO 4	Aesthetic values of the marine environment are protected.			Table 5.2.2*
Cultural and Spiritual	EQO 5	Cultural and Spiritual values of the marine environment are protected			Maintenance of other EQOs should provide adequate level of protection for EQO5.
Fishing & Aquaculture	EQO 6	Seafood (caught or grown) is of a quality safe for eating			Table 4.4.4*, Table 4.4.5* & Table 9.4.46*. Refer EPA 2005, Table 4^ for metals in Seafood.
	EQO 7	Water quality is suitable for aquaculture purposes			Table 4.4.2* & Table 4.4.3*
Industrial Water Supply	EQO 8	Water quality is suitable for industrial supply purposes			Maintenance of other EQOs should provide adequate level of protection for EQO 8.

*as per: ANZECC & ARMCANZ 2000

17.5 ENVIRONMENTAL TARGETS AND PERFORMANCE INDICATORS

The key environmental targets and performance indicators will be used to assess performance against the environmental objectives listed in the Section 17.3. Table 43 details environmental targets based on management objectives for wastewater outfall and performance criteria to assist in assessing the achievement of these targets.

Table 43: Environmental Targets and Performance Indicators for Wastewater Outfall

Management objective	Environmental Target	Performance Indicator
To provide a high level of protection to the waters in the region of Cape Preston, except for the mixing zone surrounding the outfalls.	Compliance Table 46 Interim Environmental Values (EVs), Environmental Quality Objectives (EQOs) and Environmental Quality Criteria (EQC) for Cape Preston Waters.	Monitoring programme demonstrates non-compliance with established with Table 46 Interim EVs, EQOs and EQC for Cape Preston Waters.
To protect sensitive habitats from the operation of the pipeline outfall.	Restrict the size of the mixing zone surrounding the diffusers to 4 ha "Moderate Protection Mixing Zone".	Water sampling indicates mixing zone is not contained with the Moderate Protection Mixing Zone.
To all social values will be protected (swimming and fishing).	Salinity variation resulting from the discharge is no greater than 5% above the ambient level for more than 1% of the time anywhere around Cape Preston (except within the Moderate Protection Zone). Toxicant concentrations do not exceed the 90% species protection levels at the end of the outfall pipe for more than 5% of the time, not exceed the 99% species protection levels at the edge of the Moderate Protection Zone.	Water sampling indicates salinity variation resulting from the discharge is greater than 5% above the ambient level for more than 1% of the time. Water sampling indicates toxicant concentrations do not exceed the 90% species protection levels at the end of the outfall pipe for more than 5% of the time, not exceed the 99% species protection levels at the edge of the Moderate Protection Zone.
To protect sensitive habitats from construction and layout of the pipeline.	Minimal loss to sensitive habitats from construction and layout of the pipeline.	Environmental Incident Reports show loss to sensitive habitats from construction and layout of the pipeline.
To develop monitoring and feedback programmes for the wastewater stream within the outfall.	Provide early warning of potential risks to environmental quality.	Monitoring results show impact to water quality.
To develop monitoring of ecosystem health indicators in the receiving marine environment and select appropriate control sites for inclusion in the monitoring programme.	Provide early warning of potential risks to marine ecosystems.	Monitoring results show impact to marine ecosystems.
To monitor the effectiveness of wastewater outfall management measures.	Above targets are met.	Estimate of overall effectiveness through occasional assessment of performance of controls.
To adaptively respond to inadequacies in controls through preventative action.	PEMP and procedures updated as required.	Extent to which updated PEMP addresses all issues.

17.6 MONITORING AND CORRECTIVE ACTIONS

A monitoring program will be implemented as part of the WQMF. The established EQC will be the benchmarks against which the level of achievement of the EQOs is measured. If EQCs are being met it will be deemed that the EQOs, and by extension the EVs, are being maintained.

If monitoring identifies a breach of an established EQC further investigations will be undertaken to assess the status of the relevant EQO. If investigations determine that an EQO is not being met, then an appropriate management response will be implemented.

Diffuser performance monitoring

Once fully operational, a routine monitoring program for salinity will be completed around the brine discharge diffusers. This monitoring will be undertaken to validate the modelling results and ensure that the adequate level of dilutions is being achieved within the 4 ha mixing zone, and that the salinity criteria are being met at the boundary of the mixing zone and the moderate ecological protection area.

Wastewater stream monitoring

Physical Parameters

In-line sampling is to be installed within the desalination plant intake and outfall to directly measure:

- PH
- Temperature
- Salinity

These data will be used to ensure ongoing compliance with mixing zone requirements, following the completion of the diffuser performance monitoring.

Toxicants

As the seawater contact surfaces will be either concrete, PVC, fibreglass or high grade stainless steel there will be no leaching of trace metals into the brine discharge stream. However, the process of concentrating seawater will lead to increases in concentrations of dissolved metals and metalloids.

An automated system will be installed for withdrawing and maintaining samples from both the desalination intake and discharge for later analysis of toxicants including metals, metalloids and desalination chemicals.

Toxicants to be measured include those likely to be:

- Found in local waters; e.g. metals and metalloids concentrated due to the removal of fresh water in the desalination plant.
- Dosing chemicals discharged from the desalination plant.

Data collected from this monitoring will be used to ensure compliance with established EQ. This includes ensuring that toxicant concentrations do not exceed the ninety percent species protection levels at the end of the outfall pipelines for more than five percent of the time, or if relevant the 20th and/or 80th percentiles of reference distribution.

Ecosystem health monitoring

Yearly monitoring will be undertaken at sites within the moderate and high ecological protection zones in the vicinity of Cape Preston to ensure compliance with EQC and the maintenance of EVs and EQOs. Sampling will also be undertaken for comparison purposes at a suitable reference site located to the east of SW Regnard Island, within the maximum ecological protection zone.

Sampling will be undertaken to determine physical and chemical characteristics of the water column, along with toxicant levels in marine water and sediments.

In the event that this program identifies an exceedance of an EQC, further investigations will be undertaken. If it is determined that an EV may be at risk, appropriate management action will be taken. This process is conceptualised in Figure 7 below.

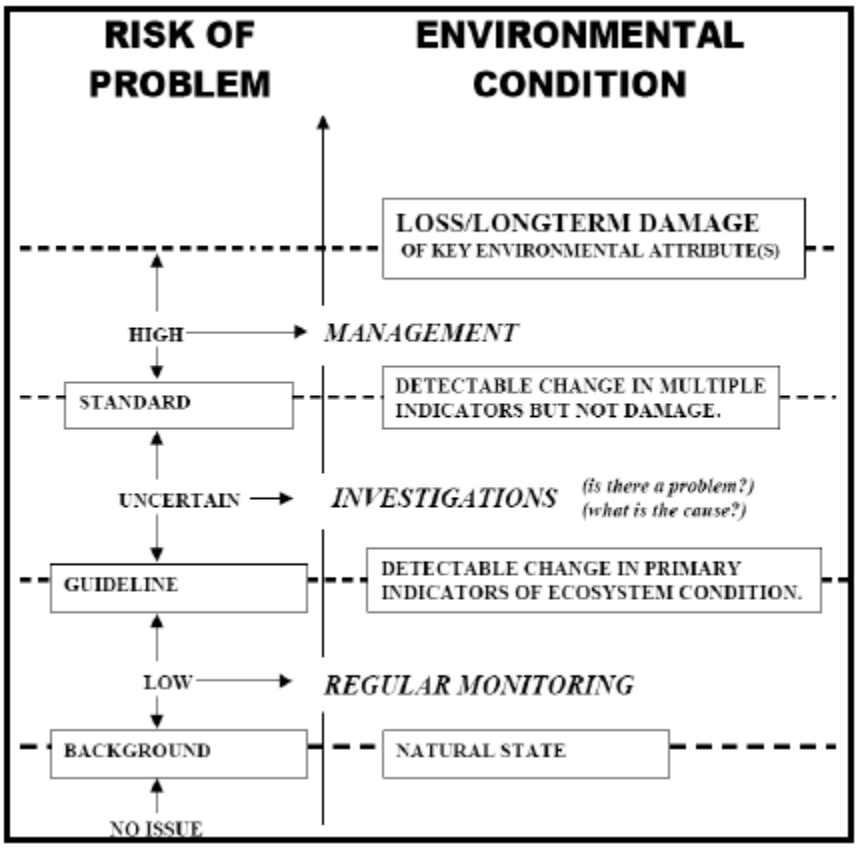

Figure 7: Conceptual Diagram Providing Guidance for Maintenance of Environmental Quality (EPA, 2005)

In order to ensure progress toward the achievement of the management objectives outline in Section 17.3 of this PEMP, the monitoring program for wastewater outfall includes activities to be performed throughout the life of the Balmoral South Project and which, if the target is not achieved, will result in corrective action Table 44 details the monitoring programme for surface water protection of the Balmoral South Project. Construction Inspection Checklists shall be used and shall include assessment of surface water management actions as listed in Table 41.

Relevant documentation to be inspected includes the Environmental Incident Reports and previous week's inspection sheets to check whether problems or non-adherences to surface water management procedures have been rectified.

Table 44: Monitoring and Corrective Action Programme for Wastewater Outfall

Item	Activity	Performance Indicator	Corrective Action	Frequency	Responsibility
44.1	Real-time physical parameters will be measured on-line within the outfall stream to ensure that percentile deviations from intake water are not exceeded. Water samples will be analysed for toxicants at the intake and outfall sites.	Monitoring programme demonstrates non-compliance with Table 46 Interim EVs, EQOs and EQC for Cape Preston Waters.	If EQCs are exceeded, then discharge flow rates will be modified to bring the parameters back to within acceptable limits. If necessary, modifications to the diffuser structure will be considered.	During Opeation.	SEO.
44.2	Monitoring programme for salinity will be completed around the brine discharge diffusers. This monitoring will be undertaken to validate the modelling results and ensure that an adequate level of dilution is being achieved within the 4 ha mixing zone, and that the salinity criteria are being met at the boundary of the mixing zone and the moderate ecological protection area.			Immediately after commencement of operations.	SEO.
44.3	Diffuser compliance monitoring to be undertaken. Real-time, in-line monitoring of both ambient and discharge physical seawater parameters (pH, temperature and salinity) will enable data verification of compliance. Any exceedance will be quickly acted upon to ensure the 5% limit is not exceeded.			During operations.	SEO.
44.4	An automated system will be installed for withdrawing and maintaining samples from both the desalination intake and discharge for later analysis of toxicants including metals, metalloids and desalination chemical.			During operations.	SEO.
44.5	An annual monitoring program will be conducted to verify the compliance with established EVs and EQOs.			Annually.	SEO.

Essentially any exceedence can be overcome by reducing discharge volumes at times when tidal conditions are inadequate to dilute the wastewater sufficiently In the (probably unlikely) event that exceedences occur, then it may be necessary to vary discharge rates during various states of the tide, to maximise tidal flushing. The total daily volume discharged is unlikely to have to change - discharge rates can be higher around High Water and when tidal currents are strongest, to compensate for Low Water (and low current) periods when discharge rate may need to be decreased. From an engineering perspective, it means that the plant design will need to be able to cope with variable wastewater discharge rates, rather than a constant rate 24/7.

17.7 CONTINGENCY ACTIONS

Triggers, like spill incident, for identifying actual and potential non-conformances with the objectives of this plan will be determined for wastewater outfall of the Balmoral South Project.

Contingency actions will be initiated if the monitoring programme demonstrates non-compliance with Table 42 Interim EVs, EQOs and EQC for Cape Preston Waters. These contingency actions shall be implemented concurrently with environmental incident procedures

Contingency actions for potential triggers that may be used are described below:

- Investigate cause;
- Implement management actions as appropriate to isolate or reduce causes;
- Monitor the impact to determine adequacy of control;
- Consult with relevant government agencies/pastoralist on improving the control actions; and
- Complete an Environmental Incident Report.

17.8 REPORTING

In the event of a non-compliance with Table 42 Interim EVs, EQOs and EQC for Cape Preston Waters an Environmental Incident Report will be completed.

The procedures relating to environmental incidents as listed in Section 3.7 shall also be followed. The Environmental Incident Report system can be used as a mechanism for reporting contractor non-conformance to this plan to IM or regulatory authorities as required.

18. ACID SULPHATE SOIL MANAGEMENT

18.1 CONTEXT

This section outlines the strategies to manage potential impacts of development works that are likely to disturb acid sulphate soils (ASS) and specifies all potential environmental impacts, performance criteria, and mitigation strategies together with relevant monitoring and reporting requirements.

It is generally acknowledged that mangrove environments contain potentially acid generating soils. In its natural environment, some disturbance of ASS in mangroves may be considered low risk due to the surrounding highly alkaline environment and the continual neutralising effect of tidal flushing. However, excavation activities, if not properly managed, may play its part in the generation of a highly acid environment and the mobilisation of iron, aluminium and other heavy metals such as chromium and nickel, which may then flush into surrounding waterways.

The service corridor between Balmoral South Project mine and Cape Preston will be extending the currently approved Mineralogy Central Block's corridor (see Ministerial Statement 635).

Legislations and Relevant Standards

- *Western Australian Planning Commission (WAPC) Planning Bulletin No. 64*
- *Department of Environment and Conservation 2004, Acid Sulphate Soils Guidelines Series*

Stakeholders Consultations

As required IM, or its contractors, will notify and consult relevant authorities in the event that inappropriate management of ASS causes a potentially significant environmental impact. If necessary, IM shall seek advice on proper environmental remediation procedures from the relevant authorities.

18.2 POTENTIAL SOURCES AND IMPACTS

Potential Sources

The viable disposal and treatment options of the acid generating material are given to risk to the environment of the activity.

Potential Impacts

Potential impacts to the environment relevant to ASS include:

- Surface water;
- Groundwater;
- Marine flora and fauna; and
- Soil structure and subsequent affect infrastructure stability and integrity.

18.3 ENVIRONMENTAL MANAGEMENT OBJECTIVES

EPA Objective

The following objective is considered relevant to ASS:

- To avoid adverse effects on the natural and built environment and human health and activities.

Balmoral South Project Management Objectives

The primary objective relevant to ASS management for the Balmoral South Project is:

- To control any acid generation from the *in-situ* materials; and
- To restrict to acceptable levels any potential on-site and off-site environmental impacts; and

Objectives will be met by implementing the key management actions listed in Table 45.

18.4 MANAGEMENT ACTIONS

In order to avoid and reduce the potential impact of activities relevant to ASS management, the key actions that will be carried out to achieve the management objectives have been compiled in Table 45.This table also details at what stage of the development the actions will be implemented and the responsible person(s) for ensuring operational compliance with the management actions.

Table 45: Management Actions for ASS

Item	Management Actions	Timing	Responsibility
45.1	Identification of Potential Acid Sulphate Soil (PASS) Material: • Identification and delineation of PASS material will be conducted with the assistance of aerial photography and soil landscape maps. • All material classified as alluvial/colluvial and estuarine mud, as located within the tidal inlets, will be classified as PASS. • Calculate total volume of material to be excavated.	At time of planning excavation	SEO
45.2	Classification of PASS Material: • Laboratory assessment using the chromium reducible (Scr) method of 10-15 representative soil samples to a suitably qualified analytical laboratory (NATA accredited for methodology); and • Approximate one week (7 days) turnaround to determine liming requirements of proposed excavation material	During construction of causeway.	SEO, Construction Manager
45.3	Calculate Liming Requirements: • Liming requirements for the neutralisation and treatment of PASS material will be calculated using the highest % oxidisable S value reported from the PASS laboratory analysis.	Can be calculated at The conclusion of laboratory analysis so sufficient lime can be purchased.	SEO, Construction Manager
45.4	Disposal cell location and construction: • An earthworks strategy should be formulated to ensure that sufficient space is available to accommodate the number of treatment pads/and or disposal cells available to allow adequate drying and treatment of the PASS material. • Size of cell may vary based on the final excavated volume, accessibility to viable locations and machinery availability. • Excavated material should be stockpiled to use in capping of treated material.	Prior to excavation and during planning.	SEO, Construction Manager

Item	Management Actions	Timing	Responsibility
45.5	PASS neutralisation with Aglime: • Neutralisation of PASS material will be conducted on the preformed disposal cell with treatment pad, guard layer and drainage lines. • PASS material can be allowed to drain prior to treatment however drying out of PASS is not recommended if possible due to additional management costs associated with treating drainage waters due to the length of time required to dry the material. • A pre-calculated amount of Aglime will be applied and mixed mechanically using a tractor (preferably) or backhoe.	During the dry season to reduce runoff of PASS material.	SEO, Construction Manager.
45.6	Containment and monitoring of runoff from disposal cell: • Contain runoff from treatment pad and/or disposal cell with appropriate bunds, diversion drains and collect in a sump or collection pond. • Diversion drains should be constructed with non-ASS material and/or preferably impermeable. Further, drainage lines and collection ponds should be surface limed using Aglime . • In-situ field pH and total acidity testing of collected runoff water samples will be conducted weekly to ensure pH levels do not drop below the predetermined trigger value of 6.0 and exceed total acidity above 40 mg/L CaCO3.	During treatment of PASS material on treatment pad and/or disposal cell on a weekly basis	SEO, Construction Manager, Operations Manager.

18.5 ENVIRONMENTAL TARGETS AND PERFORMANCE INDICATORS

The key environmental targets and performance indicators will be used to assess performance against the environmental objectives listed in the Section 18.3. Table 46 details environmental targets based on management objectives for ASS and performance criteria to assist in assessing the achievement of these targets.

Table 46: Environmental Targets and Performance Indicators for ASS

Management objective	Environmental Target	Performance Indicator
To control any acid generation from the *in-situ* materials	No acid generation from the *in-situ* materials.	Developed equate to there being no net acidity of the PASS material. Verification testing (in the form of laboratory analysis) will be conducted on treated PASS material prior to capping. Treated material that does not meet these criteria will require additional treatment as calculated using the verification test analytical results to determine the required liming rates.
To restrict to acceptable levels any potential on-site and off-site environmental impacts	No potential on-site and off-site environmental impacts.	Runoff collected in an end sump (collection pond) will be required to comply with predetermined performance criteria prior to disposal into surrounding waterways. Verification testing, in the form of laboratory analysis, will be required for drainage water prior to discharge if field monitoring results indicate degradation of water quality. If verification testing confirms drainage water does not meet these set criteria, then procedures for the addition of Aglime will be required.

18.6 MONITORING AND CORRECTIVE ACTIONS

Based on the approved *Sino Ore Project Causeway to Cape Preston EMP – Acid Sulphate Soil Management Plan* of the Mineralogy Central Block, IM prepared the ASS Management Plan of Balmoral South Project to comply with DEC requirements for the management of the potentially acid generating material. In order to ensure progress toward the achievement of the management objectives outline in Section 18.3 of this PEMP, the performance indicators listed will be monitored as listed below:

- Treated PASS material will be sampled and resulted reviewed prior to final encapsulation
- Surface water runoff from PASS treatment area collection sumps will be sampled and resulted reviewed to ensure compliance with determined criteria prior to discharge.

Where monitoring indicates that the determined criteria for PASS material are not being attained, treatment methodologies will be revised.

18.7 CONTINGENCY ACTIONS

Triggers will be monitored through the monitoring program. The potential triggers might be:

- Low pH or high metals content in pre-encapsulation tests indicating failure of PASS treatment.
- Low pH, high sulphate or high dissolved metals concentrations in discharge catchments indicating failure to adequately contain PASS treatment area runoff.
- Formation of acid-related by-products in soils surrounding PASS excavations indicating failure to adequately identify and excavate all PASS during construction works.

In the event that monitoring indicates that a trigger is exceeded or is at risk of being exceeded an investigation will be undertaken to determine the root cause and contingency actions to remediate and avoid further breaches will be determined and completed. Contingency actions will be developed in consultation with the Construction/Operations Manager and Environmental Manager.

The contingency actions for the potential trigger might be used:

- Investigate cause
- Rectify immediately if the cause is non-compliance with ASS management actions;
- Revise ASS management actions to undertake necessary modifications if activities are in compliance with management actions; and

18.8 COMPLETE AN ENVIRONMENTAL INCIDENT REPORT

Reporting on the effectiveness of the management strategies, problems with implementing and effectiveness of any corrective action adopted; and

At the conclusion of treatment and disposal of the PASS material as per ASSMP a report will be submitted to the DEC. The report will be based on the objectives and outcomes of the ASSMP, including any breaches and the implementation of any contingency plans. The report will be produced by IM personnel or a delegated person who has experience in the management of ASS.

19. NOISE MANAGEMENT

19.1 CONTEXT

Project development activities will produce noise emissions which will extend into the surrounding environment.

The Mining Leases encompassing the Cape Preston Project Area are within the boundaries of the Mardie pastoral station and accordingly, the Balmoral South Project Area is isolated from any substantial human development and is a low noise environment.

There are two established camp sites adjacent to the mouth of the Fortescue River that could potentially be affected by noise emissions associated with the Balmoral South Project, one a public site, the other servicing an offshore pearling lease.

Legislations and Relevant Standards

- *Environmental Protection (Noise) Regulations 1997;*
- *EPA (2007). Draft Guidance for the Assessment of Environmental Factors No 8: Environmental Noise).*

Stakeholders Consultations

As required IM, or its contractors, will notify and consult relevant authorities in the event that inappropriate management of noise causes a potentially significant environmental impact. If necessary, IM shall seek advice on proper environmental remediation procedures from the relevant authorities.

19.2 POTENTIAL SOURCES AND IMPACTS

Potential Sources

The main sources of noise emissions from the Balmoral South Project will be as follows:

- Construction noise – Construction noise emissions will be associated with clearing, topsoil stripping, overburden removal and sample mining;
- Operational noise – Operational noise emissions will primarily result from mining, pit dewatering, waste rock disposal, tailings storage, ore processing, material stockpiling and the gas fired power station; and
- Blasting noise – Blasting noise will occur during construction and mining activities.

Potential Impacts

Potential environmental impacts relevant to noise include:

- Disturbance to fauna;
- Risk to human health; and
- Nuisance to personnel and the public.
- Impact on public camp and Balmoral South camp

19.3 ENVIRONMENTAL MANAGEMENT OBJECTIVES

EPA Objective

The objective is considered relevant to noise:

- To protect the amenity of nearby residents from noise impacts resulting from activities associated with the proposal by ensuring the noise levels meet statutory requirements and acceptable standards.

Balmoral South Project Management Objectives

The primary objective for the Balmoral South Project is:

- To ensure that noise emissions, both individually and cumulatively, do not adversely impact on local amenity.

Objectives will be met by implementing the key management actions listed in Table 47.

19.4 MANAGEMENT ACTIONS

In order to avoid and reduce the potential impact of activities relevant to noise, the key management actions that will be carried out to achieve the management objectives have been compiled in Table 47. This table also details at what stage of the development the actions will be implemented and the responsible person(s) for ensuring operational compliance with the management actions.

Table 47: Management Actions for Noise

Item	Management Actions	Timing	Responsibility
47.1	All construction work will be carried out in accordance with Section 6 of AS 2436-1981 Guide to Noise Control on Construction, Maintenance and Demolition Sites.	Construction phase.	SEO, Construction Manager.
47.2	All equipment, machines and vehicles to be used on site during Project activities will be the quietest reasonably available consistent with operational requirements, and will be routinely maintained to ensure the effectiveness of noise suppression systems and equipment.	Construction and operation phase.	SEO, Construction Manager, Operations Manager.
47.3	Consider modification on the waste disposal facilities if operations result in exceedances of the environmental noise criteria	Construction and operation phase.	SEO, Construction Manager, Operations Manager.
47.4	Implementation of a monitoring programme to quantify noise levels to ensure the Balmoral South Project construction and operations noise levels comply with environmental objectives.	Construction and operation phase.	SEO, Construction Manager, Operations Manager.
47.5	In the event that any blasting is required to facilitate construction, initial blasts will minimized and measurements will be undertaken near both the river mouth camps and the accommodation camp site as a basis for determining the typical maximum permissible charge size to ensure compliance with Regulation 11 of the Environmental Protection (Noise) Regulations 1997.	Initial blasting.	SEO, Construction Manager.
47.6	Through site induction programmes, all construction personnel (including contractors) will be informed of their responsibilities and the importance of managing noise levels during the construction phase of the Balmoral South Project.	Construction phase.	SEO, Construction Manager, Operations Manager.
47.7	Any noise-related complaints received during the construction phase will be registered and will trigger a review of the relevant operational/ management procedure(s) by the SEO as a basis for development and implementation of appropriate modified practice(s).	Construction phase.	SEO, Construction Manager, Operations Manager.

19.5 ENVIRONMENTAL TARGETS AND PERFORMANCE INDICATORS

The key environmental targets and performance indicators will be used to assess performance against the environmental objectives listed in the Section 19.3. Table 48 details environmental targets based on management objectives for rehabilitation and decommissioning and performance criteria to assist in assessing the achievement of these targets.

Table 48: Environmental Targets and Performance Indicators for Noise

Management objective	Environmental Targets	Performance Indicator
To ensure that noise emissions, both individually and cumulatively, do not	No adversely impact on local amenity from noise emissions both individually and cumulatively	As this objective is regulated, the specific Project objectives are to comply with: • *Environmental Protection (Noise) Regulations 1997 and any amendments;* • *EPA (2007b).Draft Guidance for the Assessment of Environmental Factors No 8: Environmental Noise and any amendments.*

19.6 MONITORING AND CORRECTIVE ACTIONS

In order to ensure progress toward the achievement of the management objectives outline in Section 19.3 of this PEMP, the monitoring program for noise includes activities to be performed throughout the life of the Balmoral South Project. IM will monitor noise levels at noise sensitive sites during Project development in order to ensure compliance with the Environmental Protection (Noise) Regulations 1997. The monitoring sites will include the Fortescue River mouth camping area, Mardie Homestead and village.

19.7 CONTINGENCY ACTIONS

Triggers will be monitored through the monitoring program. The potential triggers might be:

- Non compliance with Noise Criteria (as per environmental objectives in Table 48).
- Equipment is not quietest reasonably available.
- Noise control measures not in good working order.

In the event that monitoring indicates that a trigger is exceeded or is at risk of being exceeded an investigation will be undertaken to determine the root cause and contingency actions to remediate and avoid further breaches will be determined and completed. Contingency actions will be developed in consultation with the Construction/Operations Manager and Environmental Manager.

The contingency actions for the potential trigger might be used:

- Investigate cause
- Rectify immediately if the cause is non-compliance with noise management actions;
- Revise noise management actions to undertake necessary modifications if activities are in compliance with management actions; and
- Complete an Environmental Incident Report.

19.8 REPORTING

All data collected through the noise monitoring programme will be collated and summarised in the Annual Environmental Review, which will be submitted to the EPA. Records will be maintained in accordance with the Balmoral South Project EMS. The regulatory bodies will be immediately notified of any exceedance of the performance indicators.

20. SOLID AND LIQUID WASTE MANAGEMENT

20.1 CONTEXT

Waste and rubbish generation (e.g. general solid waste) from the construction phase of the Balmoral South Project has the potential to adversely affect the environmental values of the area.

The following waste management procedures contain the controls proposed to minimise the environmental impacts due to solid waste and rubbish generation during development of the Balmoral South Project.

Spills management has been addressed specifically in Section 19.

Legislations and Relevant Standards

- *Health Act 1911 – Health (Treatment of Sewage and Disposal of Effluent and Liquid Waste Regulations) 1974;*
- *Environmental Protection (Controlled Waste) Regulations 2001;*
- *Environmental Protection (Rural Landfill) Regulations 2002;*
- *Department of Environment Guidelines for Acceptance of Solid Waste to Landfill (2002); and*
- *Department of Environment Contaminated Sites Management Series Bioremediation of Hydrocarbon-Contaminated Soils in Western Australia (2004).*

Stakeholders Consultations

As required IM, or its contractors, will notify and consult relevant authorities in the event that inappropriate management of noise causes a potentially significant environmental impact. If necessary, IM shall seek advice on proper environmental remediation procedures from the relevant authorities.

20.2 POTENTIAL SOURCES AND IMPACTS

Potential Sources

Wastes generated during construction and operation of the Balmoral South Project include:

- Dewatered tailings produced during ore concentration. These are inert;
- Industrial waste including oil filters, hydraulic hose, workshop waste, waste oil, tyres, etc;
- Putrescibles (general domestic waste);
- Inert waste including asphalt, concrete, etc;
- Wastewater including sewage, grey water and washdown water;
- Hazardous waste including hydrocarbons; and
- Recyclable waste including aluminium products, scrap metals, wire, etc.

Potential Impacts

Potential impacts to the environment as a result of the generation and/or incorrect management of wastes include:

- Loss of flora and vegetation through contamination of soil, surface water or groundwater;
- Attraction of feral animals through inadequate waste management procedures or workforce behaviour;

- Loss of fauna habitat through contamination, leading to the disturbance, direct loss, reduced abundance and/or reduced diversity of fauna species;
- Contamination of surface water and groundwater through the use of materials in surface operations, such as waste oils or accidental spills, and through the operation of a Contaminated Soil Bioremediation Landform.
- Reduced air quality through volatile emissions and odours from the operation of the Contaminated Soil Bioremediation Landform.

In addition to the above, an untidy site sets the standard for the behaviour of personnel.

20.3 ENVIRONMENTAL MANAGEMENT OBJECTIVES

EPA Objective

The objective is considered relevant to noise:

- To integrate a waste hierarchy (i.e. avoid, reuse, reduce, recycle, treat, dispose) for waste minimisation and establish a 'closed loop' within as many waste streams as possible.
- To ensure no release of hydrocarbons to the environment, either as a result of storage or handling incidents.

Balmoral South Project Management Objectives

The primary objective relevant to waste management for the Balmoral South Project is:

- To maximise the recycling and reuse of wastes wherever practicable
- To avoid the unnecessary creation of waste.
- To dispose of waste in an environmentally acceptable manner.
- To minimise any solid and liquid wastes produced as a result of the mining process.
- Monitor the effectiveness of waste management measures.
- Adaptively respond to results of the monitoring programme.

Objectives will be met by implementing the key management actions listed in Table 49.

20.4 MANAGEMENT ACTIONS

In order to avoid and reduce the potential impact of activities relevant to solid and liquid waste, the key management actions that will be carried out to achieve the management objectives have been compiled in Table 49.This table also details at what stage of the development the actions will be implemented and the responsible person(s) for ensuring operational compliance with the management actions.

Table 49: Management Actions for Solid and Liquid Waste

Item #	Management Actions	Timing	Responsibility
49.1	Instruct all personnel in individual responsibilities in regards to waste management with emphasis on avoidance, re-use and recycling, such that all personal rubbish and incidental construction rubbish generated is properly disposed of in designated disposal facilities.	Construction and operation phase.	SEO.
49.2	Instruct all personnel in the location of waste segregation, recycling and disposal facilities. As the location of these facilities changes during construction personnel shall be promptly informed.	Construction and operation phase.	SEO.

Item #	Management Actions	Timing	Responsibility
49.3	Provide appropriate waste collection and disposal facilities (e.g. bins, landfill, landform, segregation facility) in strategic locations on site. Facilities shall contain waste, provide for recycling and prevent waste from blowing out.	Construction and operation phase.	Project Engineer, Construction and Operations Manager.
49.4	Prepare a Works Approval application for an appropriate landfill facility.	Prior to construction.	Environmental Manager.
49.5	Collect and empty waste disposal facilities regularly.	Construction and operation phase.	Construction and Operations Manager.
49.6	Putrescibles, non-recyclable domestic and industrial waste will be collected and disposed to an onsite landfill which will be constructed in accordance with the Environmental Protection (Rural Landfill) Regulations 2002. Provide a recycling area for onsite storage of recyclable materials prior to transferring material off site. Recyclable materials storage on-site will include: • High grade metals to be stored in skip bins; • Low grade metals to be stored in drums; • Batteries on bunded pallets; • Waste oil and fuel and other oily materials such as rags, filters, etc to be stored in bunded tanks; • Aluminium cans; and • Recyclable plastics. Regular inspections of the landfill site will be undertaken to ensure the guidelines are being met and that recyclable materials are not entering the waste stream. Details of quantities of waste materials recycled will be kept for reporting purposes.	Construction and operation phase.	Project Engineer, Construction and Operations Manager.
49.7	The landfill site shall include the following features: • Excavated cell (trench) method of operation (or similar waste cell created in the mine WDFs), using a working tip face up to 100 m long, 2-5 m deep and 3-5 m wide. • Tipping face of no greater than 30 m. • 10 m firebreak. • Readily-available fire fighting equipment and prohibition of burning of any material within the landfill. • Safe access to the working face of the cell (trench), with directions to the tip face demarcated with bunding. • At least 1.8 m high cyclone mesh litter control fence with gates. • Drainage control measures. • Progressive rehabilitation of each completed cell (trench) section. • Cells (trench) will be ramped at one end to allow fauna egress.	Construction and operation phase.	Project Engineer, Construction and Operations Manager.
49.8	Operate the landfill facility in accordance with Works Approval and licence conditions.	Construction and operation phase.	Construction and Operations Manager.
49.9	Sewage and grey water will be treated via package treatment plants which will be established to service the mine, processing plant and camp. Treated wastewater will be used for irrigation.	Construction and operation phase.	Project Engineer, Construction and Operations Manager.
49.10	Tailings from ore processing will be filtered and conveyed to the WDFs for co-disposal with the mine waste.	Operation phase.	Project Engineer, Construction and Operations Manager.
49.11	Process water from the processing plant will be discharged to a process water pond for recycling (to the process water circuit).	Operation phase.	Project Engineer, Construction and Operations Manager.

Item #	Management Actions	Timing	Responsibility
49.12	Waste rock will be hauled to dumps for disposal in accordance with a materials handling schedule to ensure that potentially problematic waste can be isolated or blended as planned and is transported to the correct location to avoid unplanned mixing of Potentially Acid Forming (PAF) and Non-Acid Forming (NAF) materials	Operation phase.	Project Engineer, Construction and Operations Manager.
49.13	Identify Potentially Acid Forming (PAF) materials, which can give rise to Acid and Metaliferous Drainage (AMD), and fibrous forming minerals during drilling. Drilling results will be used to develop a detailed waste rock block model which includes the estimated volumes and types of waste that will be mined according to the mine plan. In the event that pyritic shales or fibrous forming minerals are identified, it will be necessary to: • Identify areas in advance that may contain pyritic shales or fibrous mineralisation; • Use protective equipment in areas where fibrous material is encountered; • Use water to wet down potentially affected areas; • Inject water during drilling to suppress dust liberation in areas where fibrous material has been identified; • Wet affected areas during blasting; and • Seal the pyritic shales or fibrous materials within waste stockpiles.	Construction and operation phase	SEO, Construction and Operations Manager.
49.14	Hydrocarbon contaminated soil will be collected and transferred to a Contaminated Soil Bioremediation Landform.	Construction and Operation phase.	SEO, Construction and Operations Manager.
49.15	The Landform site design and operation will: • Include two cells: one active (in use) and the other remediating, which will be alternated as required and bunded to restrict water ingress and define the landfarm area. • Be appropriately sized to accommodate the operations of a grader and water cart. • Be utilised only for the remediation of soils contaminated by hydrocarbons and biodegradable chemical spills and leaks. • Include spreading of contaminated material within the active cell to a maximum depth of 200 mm, with appropriate control of moisture levels and tillage to facilitate micro-organism activity. • Include appropriate control of operation of the landfarm throughout the operational and decommissioning phases of the Balmoral South Project.	Construction and operation phase.	Project Engineer, Construction and Operations Manager.

Item #	Management Actions	Timing	Responsibility
49.16	Environmental management actions of the Landform will consider: • Licensing of the landform under the *Environmental Protection Act 1986* in the event that the quantity of contaminated soil exceeds the anticipated 1000 tonnes per year. • Recording the details of contaminated soil deposited at the landform (including date deposited, type of material deposited and volume [cubic metres] of material) in a Landform Register. • Regular aeration and spreading of the contaminated soil to facilitate remediation. • Fortnightly watering of the emplaced contaminated soil with clean or approved waste water to minimise dust lift and maintain moisture content to sustain active micro-organisms. • Bi-annual sampling to assess the level of contamination within the emplaced soils. Soil will be considered remediated when hydrocarbon concentration falls below 200 mg/kg.	Construction and operation phase.	Project Engineer, Construction and Operations Manager.
49.17	Hydrocarbon products will be stored in approved bunded facilities located in the workshop compound at the mine site. Should a spill occur, any hydrocarbon contaminated soils will be bioremediated on site. The bioremediation of the contaminated area would be undertaken in accordance with the Contaminated Sites Management Series Bioremediation of Hydrocarbon - Contaminated Soils in Western Australia (DEC 2004). All waste oils will be collected by a contractor and recycled. Oily rags and filters will be recycled or disposed of at an appropriate hydrocarbon disposal facility.	Prior to and during construction.	Project Engineer, Construction and Operations Manager.
49.18	Insert clauses in supply contracts to minimise packaging waste.	Prior to and during construction.	Project Engineer, Construction and Operations Manager.
49.19	Liaise with the Shire of Roebourne regarding waste generation and disposal in public access areas within the Balmoral South Project Area. Assist with waste management as practicable.	Ongoing.	Environmental Manager.
49.20	Separate solid waste for re-use or recycling and disposal in accordance with the site waste management plan.	During construction.	All personnel.
49.21	Contractors must advise IM of the presence of Low Hazard, Hazardous, Special and Intractable Wastes at the site. Contractors shall maintain records (chain of custody) regarding the disposal of such materials and these records shall be available to IM.	Prior to and during construction.	Contractor, SEO.
49.22	Collect by a licensed waste operator waste hydrocarbons or chemicals. Dispose of the waste at a waste management facility licensed to accept the waste.	During construction.	Contractor, SEO.
49.23	Handle chemicals/fuels in areas where there is no potential for runoff to reach the marine environment, undisturbed areas or to contaminate groundwater.	During construction.	Contractor.
49.24	Equip all fuel tanks or tankers with an auto-shut-off valve or other appropriate device to prevent overfilling.	Prior to construction.	Project Engineer, Contractor.
49.25	Fit emergency shut-off valves to all pumps.	Prior to construction.	Project Engineer, Contractor.

20.5 ENVIRONMENTAL TARGETS AND PERFORMANCE INDICATORS

The key environmental targets and performance indicators will be used to assess performance against the environmental objectives listed in the Section 20.3. Table 50 details environmental targets based on management objectives for solid and liquid waste and performance criteria to assist in assessing the achievement of these targets.

Table 50: Environmental Targets and Performance Indicators for Solid and Liquid Waste

Management objective	Environmental Targets	Performance Indicator
To maximise the recycling and reuse of wastes wherever practicable.	All recyclable waste segregated at the central waste reception facility and transported off site for recycling.	Low quantities of recyclable waste going to landfill as recorded in waste disposal records. Continuous improvement in waste segregation and recycling.
To avoid the unnecessary creation of waste.	Minimal packaging.	Clauses in supply contracts to minimise packaging or take back wastes. Low quantities of packaging waste going to landfill as recorded in waste disposal records.
To dispose of waste in an environmentally acceptable manner.	No waste or rubbish from construction activities is detected off site.	Quantity of litter collected and number of occurrences of overflowing bins/skips observed during construction site inspections. Environmental incidents arising from inappropriate waste disposal. Complaints received.
To minimise any solid and liquid wastes produced as a result of the mining process.	All liquid and solid waste is disposed of in designated disposal facilities.	Liquid and solid wastes should be treated on site or disposed of off site at an appropriate landfill facility. Where this is not feasible, contaminated material should be managed on site to prevent groundwater and surface water contamination or risk to public health.
To monitor the effectiveness of controls.	Above targets are met.	Estimate of overall effectiveness through occasional assessment of performance of controls.
To adaptively respond to inadequacies in controls.	PEMP and procedures updated as required.	Extent to which updated PEMP addresses all issues.

20.6 MONITORING AND CORRECTIVE ACTIONS

In order to ensure progress toward the achievement of the management objectives outline in Section 20.3 of this PEMP, the monitoring program for solid and liquid waste includes activities to be performed throughout the life of the Balmoral South Project. A monitoring programme that examines the performance of the waste management actions for the construction phase of the development is detailed in Table 51.

Construction areas shall be subject to fortnightly (or as required by IM in consultation with its environmental consultants) inspections during earthworks and construction. The SEO shall conduct these inspections. Construction Inspection Checklists shall be used and shall include assessment of waste management actions as listed in Table 49.

Relevant documentation to be inspected includes the Environmental Incident Reports and previous week's inspection sheets to check whether problems or non-conformances to the waste management procedures have been rectified.

Table 51: Monitoring and Corrective Action Programme for Solid and Liquid Waste Management

Item	Activity	Performance Indicator	Corrective Action	Frequency	Responsibility
51.1	Check site for solid waste.	All waste is being disposed of in designated disposal facilities.	Inappropriately disposed waste to be collected.	Continue	SEO, Contractor.
51.2	Monitor creation of waste streams.	Registers of recycled material, waste disposed, landform quantities, wastewater quantities and hazardous materials disposed.	Programmes to reduce waste stream or improve management.	Annual	SEO.
51.3	Inspect waste disposal facilities (bins, skips etc.).	Waste disposal facilities are properly containing waste and that frequency of collection/emptying is sufficient.	Provide additional waste bins/skips as necessary.	Fortnightly.	SEO, Contractor.
		Waste disposal facilities provide for and encourage recycling.	Provide additional waste bins/skips as necessary. Provide/improve recycling signage.	Fortnightly.	SEO, Contractor.
51.4	Confirm re-location of waste disposal facilities.	Waste disposal facilities are relocated as construction progresses to ensure easy access for personnel.	Relocate or provide additional bins/skips.	As necessary.	SEO, Contractor.
51.5	Inspect adjacent areas beyond construction activity.	To ensure waste generated from the construction site is not accumulating off site.	Wind-blown or inappropriately disposed waste to be collected.	Monthly or in response to reported incident.	SEO, Contractor.

20.7 CONTINGENCY ACTIONS

Triggers will be monitored through the monitoring program. The potential triggers might be:

- Waste not being disposed of in designated disposal facilities.
- Disposal facilities not properly containing waste.
- Frequency of collection/emptying of disposal facilities not sufficient.
- Construction activities progressed away from waste disposal facilities
- Contamination of soil, surface water or groundwater; and
- Off site waste accumulation or dumping.

Contingency actions will be initiated if monitoring shows that triggers may have been exceeded and may result in a level of environmental impact that requires mitigation. These contingency actions shall be implemented concurrently with environmental incident procedures.

The contingency actions for the potential trigger might be used:

- Investigate cause
- Rectify immediately if the cause is non-compliance with solid and liquid waste management actions;
- Determine appropriate the frequency of the management actions and arrange for facilities to be promptly moved;
- Conduct a review of procedures and/or implement further education of staff/contractors to ensure that all possible steps are taken to prevent any reoccurrence; and
- Complete an Environmental Incident Report.

20.8 REPORTING

In the event of an incident relating to waste generation and/or disposal the personnel involved (or witnesses to) shall complete an Environmental Incident Report.

The procedures relating to environmental incidents as listed in Section 3.7 shall also be followed. The Environmental Incident Report system can be used as a mechanism for reporting contractor non-conformance to this plan to IM or regulatory authorities as required.

21. SPILL MANAGEMENT

21.1 CONTEXT

The use and storage of hydrocarbons and chemicals on the site during construction of the Balmoral South Project poses a risk to the environment in the vicinity of the site.

The following spill management procedures are proposed to minimise the environmental impacts and public risk due to hydrocarbons and other hazardous materials utilised during Project construction and operations.

Legislations and Relevant Standards

- *Health Act 1911 – Health (Treatment of Sewage and Disposal of Effluent and Liquid Waste Regulations) 1974;*
- *Environmental Protection (Controlled Waste) Regulations 2001;*
- *Environmental Protection (Rural Landfill) Regulations 2002;*
- *Department of Environment Guidelines for Acceptance of Solid Waste to Landfill (2002); and*
- *Department of Environment Contaminated Sites Management Series Bioremediation of Hydrocarbon-Contaminated Soils in Western Australia (2004).*

Stakeholders Consultations

As required IM, or its contractors, will notify and consult relevant authorities in the event of a spill incident as required under environmental incident procedures. If necessary, IM shall seek advice on clean-up procedures from the relevant authorities.

21.2 POTENTIAL SOURCES AND IMPACTS

Potential Sources

During the early stages of construction there will be no reticulated power supply. Power will be supplied by a number of mobile generators fuelled by diesel. Diesel will also be used to fuel vehicles and thus will be the main risk for spillage. Spills of hydrocarbons and chemicals can result from:

- Transfer of liquids such as in refuelling;
- Leaks from storage tanks, pipes and valves;
- Rupture of storage tanks or pipes; and
- Overflow of storage tanks or bunds.

Potential Impacts

Potential impacts to the environment as a result of the generation and/or incorrect management of spill include:

- Contamination of soil, surface water or groundwater; and
- Damage or destruction of vegetation.

In addition to the above, an untidy site sets the standard for the behaviour of personnel.

21.3 ENVIRONMENTAL MANAGEMENT OBJECTIVES

EPA Objective

The objective is considered relevant to spill management:

- To ensure no release of hydrocarbons to the environment, either as a result of storage or handling incidents.

Balmoral South Project Management Objectives

The primary objective relevant to spill management for the Balmoral South Project is:

- To minimise the risk of spillage or escape of fuels or chemicals;
- To ensure storage and handling of fuels and chemicals at the site does not pose a threat to the environment;
- To ensure that any spill or incident associated with fuels and chemicals will be cleaned up quickly and effectively;
- To monitor the effectiveness of spill management measures; and
- To adaptively respond to inadequacies in controls through preventative action.

Objectives will be met by implementing the key management actions listed in Table 52.

21.4 MANAGEMENT ACTIONS

In order to avoid and reduce the potential impact of activities relevant to spillage, the key management actions that will be carried out to achieve the management objectives have been compiled in Table 52. Table 52 details the management actions that shall be implemented to minimise the risk of spills during the:

- Storage and handling of hydrocarbons and chemicals;
- Disposal of waste storage containers, hydrocarbons and chemicals;
- Transfer of fuel to mobile fuel tankers (if local storage tank is established by contractors);
- Refuelling of vehicles and machinery from mobile tanker; and
- Maintenance of vehicles and machinery.

This table also details at what stage of the development the actions will be implemented and the responsible person(s) for ensuring operational compliance with the management actions.

Table 52: Management Actions for Spill

Item	Management Actions	Timing	Responsibility
52.1	Prepare and maintain a Hazardous Materials Register, and standards and procedures for all hazardous materials kept on site. Include in the Register descriptions of materials and their uses, handling procedures, storage regulations and standards, quantities stored on site and Material Safety Data Sheets (MSDSs) for all materials. Locate the Register on site and accessible to all personnel.	Prior to and during construction and operation	Construction Manager, Project Engineer, SEO.
52.2	Maintain a fuel register to record fuel deliveries to the site.	Prior to and during construction.	Project Engineer, Contractor, SEO.
52.3	Design work shop buildings to incorporate closed drainage systems routed through oil-water separators.	Prior to construction.	Construction Manager.

Item	Management Actions	Timing	Responsibility
52.4	Include in inductions for all site construction personnel information on: • Procedures for handling and storage of fuels and chemicals. • Transferring of fuel and the refuelling of vehicles and machinery. • Vehicle maintenance. • Spill response. • Use and location of the Hazardous Materials Register.	Prior to construction.	SEO.
52.5	Comply with the relevant legislation, regulations and Australian Standards for the storage and handling of fuels and chemicals: • *Explosives and Dangerous Goods Act 1961.* • Explosive and Dangerous Goods (Explosives) Regulations 1963. • Explosive and Dangerous Goods (Dangerous Goods Handling and Storage) Regulations 1992. • Dangerous Goods (Transport Road & Rail) Regulations 1999. • AS 1940 - The storage and handling of flammable and combustible liquids. • AS 3780 - The Storage and Handling of Corrosive Substances. • AS 4452 - The Storage and Handling of Toxic Substances. • AS 4681 - The Storage and Handling of Class 9 (miscellaneous) Dangerous Goods and Articles.	During construction.	Project Engineer, Contractor, SEO.
52.6	Use self-bunded storage vessels and pallets wherever practicable.	At all times.	Project engineer, Contractor, Contract Coordinator.
52.7	Construct containment facilities in fuel storage and handling areas (e.g. bunded areas, leak proof trays) to prevent the escape of spills or leaks. The volume of the containment of liquid materials shall be as per Australian standards AS 1940	Prior to and during construction.	Project Engineer, Contractor.
52.8	Drain accumulated water from containment facilities whenever present. Collect water that is visibly contaminated or suspected to be contaminated for treatment through an oil-water separator or disposal at a waste management facility licensed to accept the waste.	During construction.	Project Engineer, Contractor, SEO.
52.9	Construct storage tanks aboveground within appropriately bunded or contained areas, or with bases designed to minimise corrosion. Construct all piping above ground (rather than in-ground).	Prior to and during construction.	Project Engineer, Contractor.
52.10	All storage vessels shall be tested and labelled as required by legislation.	Prior to and during construction.	Project Engineer, Contractor.
52.11	Store all hydrocarbon and liquid chemicals drums upright and within bunds that comply with AS 1940.	During construction.	Project Engineer, Contractor.
52.12	Protect fuel and chemical storage tanks from accidental dislodgement by plant vehicles or natural causes.	During construction.	Project Engineer, Contractor.
52.13	Classify all hazardous waste materials prior to disposal.	During construction.	Project Engineer, Contractor, SEO.
52.14	Ensure that spill response materials are available at defined locations and that personnel are informed of these locations and instructed in their use.	During construction.	Construction Manager, Environmental Manager.
52.15	All equipment and vehicle maintenance on site should be contained within an area to prevent runoff. Dispose and treat liquid and solid wastes from the maintenance facility in accordance with the waste management actions in this PEMP.	During construction.	Project Engineer, Contractor.
52.16	Conduct regular preventative maintenance of vehicles and machinery.	During construction.	Project Engineer, Contractor.

21.5 ENVIRONMENTAL TARGETS AND PERFORMANCE INDICATORS

The key environmental targets and performance indicators will be used to assess performance against the environmental objectives listed in the Section 21.3. Table 53 details environmental targets based on management objectives for spill and performance criteria to assist in assessing the achievement of these targets.

Table 53: Environmental Targets and Performance Indicators for Spill Management

Management objective	Environmental Target	Performance Indicator
To minimise the risk of spillage or escape of hazardous materials.	No spills or escape of hazardous materials. Integrity of equipment and bunds is maintained.	Detection of spills or escape of hazardous materials during construction site inspections. Environmental incidents arising from spills.
		Equipment and bund integrity and bund water accumulation as determined during construction site inspections.
To ensure storage and handling of hazardous materials do not pose a public or environmental risk.	Compliance with Storage of Dangerous Goods Regulations and internal standards.	Breaches of regulatory requirements and internal standards determined during construction site inspections and audits. Environmental incidents arising from breaches.
To ensure that any spill or incident associated with fuels and chemicals will be cleaned up quickly and effectively;	Spills are quickly and effectively cleaned up.	Elapsed time from report to completion of cleanup as shown in Environmental Incident Reports.
Monitor the effectiveness of controls.	Above targets are met.	Estimate of overall effectiveness through occasional assessment of performance of controls.
Adaptively respond to inadequacies in controls through preventative action.	PEMP and procedures updated as required.	Extent to which updated PEMP addresses all issues.

21.6 MONITORING AND CORRECTIVE ACTIONS

In order to ensure progress toward the achievement of the management objectives outline in Section 21.3 of this PEMP, the monitoring program for spill management includes activities to be performed throughout the life of the Balmoral South Project. Construction spills are not expected to pose a severe environmental risk on site, however only through effective work practices will the objectives be achieved. A monitoring programme that examines the performance of the waste management actions for the construction phase of the development is detailed in Table 54.

Construction areas shall be subject to regular (or as required by IM in consultation with its environmental consultants) inspections during earthworks and construction. The SEO shall conduct these inspections. Construction Inspection Checklists shall be used and shall include assessment of waste management actions as listed in Table 52.

Relevant documentation to be inspected includes the Environmental Incident Reports and previous week's inspection sheets to check whether problems or non-conformances to the waste management procedures have been rectified.

Table 54: Monitoring and Corrective Action Programme for Spill Management

Item #	Activity	Performance Indicator	Corrective Action	Frequency	Responsibility
54.1	Inspect hazardous materials register.	All hazardous materials stored and used on site along with procedures for handling, storage and emergency response procedures are recorded.	Update the register and procedures. Undertake site audit if there is reason to suspect persistent spills.	Whenever new material is brought on site.	SEO, Contractor.
54.2	Check integrity of valve, pumps and connections used in the transport of fuels and chemicals.	Equipment is free from faults and leaks.	Leaking valves, pumps and connections to be repaired within 24 hr. Contaminated soil to be removed for appropriate disposal/ treatment immediately after completion of repair.	Monthly	SEO, Contractor.
54.3	Check integrity of storage vessels and containers.	Vessels and containers are in good condition and continue to meet applicable standards and regulations.	Storage vessel/container to be emptied immediately and repaired/replaced. Contaminated soil to be removed for appropriate disposal/ treatment immediately after completion of repair/replacement.	Monthly	SEO, Project Engineer, Contractor.
54.4	Check integrity and capacity of bunds and other containment facilities.	Bunds and other containment facilities are in good condition and continue to meet applicable standards and regulations.	Bund to be repaired within 24 hr.	Fortnightly and in response to reported incident.	SEO, Project Engineer, Contractor.
		Accumulated water is not present.	Water to be removed or cause of water accumulation to be rectified within 24 hr.		
54.5	Check provision and maintenance of spill containment facilities.	Spill containment stations located near all major hydrocarbon facilities.	Raise incident report. Provide suitable spill containment facility.	Monthly	SEO, Contractor.
54.6	Fuel register.	Record of all fuel deliveries and fuel dispensed to detect unaccounted loss.	Update the register. Undertake audit of storage if persistent unaccounted loss.	Whenever fuel is delivered on site.	SEO, Contractor.

21.7 CONTINGENCY ACTIONS

Triggers as spill incident will be monitored through the monitoring program. Contingency actions will be initiated if monitoring shows that triggers may have been exceeded and may result in a level of environmental impact that requires mitigation. These contingency actions shall be implemented concurrently with environmental incident procedures.

The contingency actions for the potential trigger might be used:

- Investigate cause
- Locate spill response equipment such that it is available for immediate use.
- Prevent further loss of material either by addressing the process control problem or by undertaking repair of faulty pipe, valve or other components.
- Contain spillages immediately by constructing earthen bunds or using other containment methods.
- Remove ponded material as soon as practicable by pumping into a storage facility, or withdrawing using an absorbent material.
- Remove contaminated soil or material for treatment on site in accordance with site contamination management procedures or off site for disposal in an approved landfill facility.
- Person(s) involved in the incident (or witness to) shall notify the Construction Supervisor/Foreman who shall notify the Contractor Environmental Control Officer if not already aware of the incident.
- Provide additional training if investigation indicates lack of training or understanding by workforce.
- Complete Environmental Incident Report for fuel spills greater than 20 L and for any spills of more hazardous materials.

21.8 REPORTING

In the event of a fuel spill greater than 20 L or any spill of a hazardous material the personnel involved (or witnesses to) shall complete an Environmental Incident Report and participate in any investigation as required.

The procedures relating to environmental incidents as listed in Section 3.7 shall also be followed. The Environmental Incident Report system can be used as a mechanism for reporting contractor non-conformance to this plan to IM or regulatory authorities as required.

22. ACID ROCK MANAGEMENT

22.1 CONTEXT

The Balmoral South magnetite resources are contained within a Brockman Iron formation known as the Susan Palmer Deposit. This formation is overlain with a banded iron formation known as the Weeli Wolli, and underlain by Mount McCrae Shale. The Brockman Iron Formation consists of an alternating sequence of Banded Iron (BIF), shale and chert, with the iron rich bearing units being the Joffre and Dales Gorge members.

Analysis of these formations indicates that on a 0.5% total Sulphur cut-off, approximately 1% of the BIF, 21% of the Shale and 6% of the remaining material has acid generating potential. Taking the total volumes of each of these units into account, this equates to approximately 5% of total material moved having some Acid and Metaliferous Drainage (AMD) potential.

Legislations and Relevant Standards

- *Department of Industry and Resources (2006), Mining Environmental Management Guidelines, Mining in Arid Environments*
- *Water Quality Protection Guidelines No. 9 Mining and Mineral Processing, Acid Mine Drainage (WRC, 2000)*
- *Water Quality Protection Guidelines No. 5 Mining and Mineral Processing, Minesite Water Quality Monitoring (WRC, 2000)*
- *Department of Industry and Resources, (2001), Environment Division, Environmental Notes on Mining, Waste Rock Landforms*
- *Relevant approved Environmental Management Plans (EMPs) prepared and submitted in accordance with Ministerial Statement 635 by Mineralogy (2005, 2006, 2007, 2008).*

Stakeholders Consultations

As required IM, or its contractors, will notify and consult relevant authorities in the event that inappropriate management of acid rock causes a potentially significant environmental impact. If necessary, IM shall seek advice on proper environmental remediation procedures from the relevant authorities.

22.2 POTENTIAL SOURCES AND IMPACTS

Potential Sources

The potential issues that may impacts relevant to acid rock include:

- Potentially Acid Forming (PAF) material incorrectly identified and placed;
- Insufficient cover over PAF material allowing uncontrolled oxidation; and
- Exposure of PAF material within final void design

Potential Impacts

The potential impacts relevant to acid rock:

- Discharge of low pH runoff from storage areas impacting on soil and vegetation growth;
- Mobilisation of metals in concentrations greater than ANZECC guidelines;
- Contamination of surface or groundwater supplies; and
- Failure of rehabilitation due to unstable landforms or uncontrolled emissions

22.3 ENVIRONMENTAL MANAGEMENT OBJECTIVES

EPA Objective

The objective is considered relevant to acid rock:

- To avoid, where practicable, serious or irreversible damages to the environment.

Balmoral South Project Management Objectives

The objective for the Balmoral South Project in relation to acid rock is to minimise any direct or indirect impact from the operations, including:

- To characterise waste rock prior to mining;
- To recognise and appropriately manage any potentially acid forming materials during mining operations;
- To control erosion/sedimentation from waste rock landform areas;
- To minimise the area of vegetation cleared;
- To monitor the effectiveness of controls; and
- To adaptively respond to inadequacies in controls.

Objectives will be met by implementing the key management actions listed in Table 58.

22.4 MANAGEMENT ACTIONS

In order to avoid and reduce the potential impact of activities relevant to acid rock drainage, the key management actions that will be carried out to achieve the management objectives have been compiled in Table 55. This table also details at what stage of the development the actions will be implemented and the responsible person(s) for ensuring operational compliance with the management actions.

Table 55: Management Actions for Acid Rock

Item	Action	Timing	Responsibility
55.1	Induction procedures shall be conducted to notify third parties of the formation of Acid Rock Drainage (ARD) and the mitigation measures in place.	On-going	Mine Manager, SEO.
55.2	Conduct environmental training, as necessary ensuring compliance with acid rock management requirements.	On-going	Environmental Manager, SEO
55.3	Obtain Acid Base Accounting (ABA) data for underrepresented strata, or strata with significant compositional variability and undertake ongoing sampling to confirm the assumed correlation with AMD characteristics of the Central Block Project	Design and operations	Mine Manager, Project Engineer
55.4	Develop and implement water management plans, including monitoring programs for surface and groundwater, which includes: • Monitor groundwater quality to assess potential occurrence of seepage from WDFs • Monitor surface water run-off to ensure no AMD is generated • Establishment of discharge criteria • Combine water balance and quality to obtain salt balance	Design and operations	Mine Manager, Environmental Manager, SEO

Item	Action	Timing	Responsibility
55.5	Development of a detailed waste rock block model that includes the estimated volumes and types of waste that will be mined according to the mine plan. This will include waste management in the material handling schedule to ensure that potentially problematic waste can be isolated or blended as planned and is transported to the correct location to avoid unplanned mixing of PAF and NAF materials	Prior to mining	Mine Manager
55.6	Consideration will be given to separate and encapsulate high sulphur PAF and Acid Forming (AF) waste to minimise risk of acidic seepage.	Prior to mining	Mine Manager, Project Engineer, Contractor, SEO
55.7	Place and encapsulate / co-mingle AF and PAF waste (with Non Acid Forming (NAF)) as soon as possible at the Waste disposal facilities.	On-going	Mine Manager, Project Engineer, Contractor, SEO
55.8	Place NAF waste on top of any PAF waste to reduce the risk of plant toxicity and potentially increased volumes of AMD effected materials.	Operations, closure	Mine Manager, Project Engineer, Contractor, SEO.

22.5 ENVIRONMENTAL TARGETS AND PERFORMANCE INDICATORS

The key environmental targets and performance indicators will be used to assess performance against the environmental objectives listed in the Section 22.3. Table 56 details environmental targets based on management objectives for acid rock and performance criteria to assist in assessing the achievement of these targets.

Table 56: Environmental Targets and Performance Indicators for Acid Rock Drainage

Management objective	Environmental Targets	Performance Indicator
To characterise waste rock prior to mining.	Problematic materials identified prior to mining.	Acid Base Accounting completed on representative samples of waste rock. Block model identifies problematic materials. Assessment of rehabilitation materials completed prior to mining.
To recognise and appropriately manage any potentially acid forming materials during mining operations.	Water quality of leachates and runoff such that livestock water quality guidelines are met in surface runoff and groundwater.	Identification and management procedures in place for McCrae and Whaleback Shales. Audit of procedure implementation. Water control structures in place as landform is being constructed. Water monitoring shows acceptable water quality from site runoff.
To control erosion/sedimentation from waste rock landform areas.	No erosion or sedimentation effects beyond clearing perimeters.	Water control structures in place as landform is being constructed. Water monitoring shows acceptable water quality from site runoff. Environmental Incident Reports show no erosion or sedimentation effects beyond clearing perimeter. Waste rock rehabilitation surfaces constructed to be resilient to rainfall and grazing.
To monitor the effectiveness of controls.	Above targets are met.	Estimate of overall effectiveness through occasional assessment of performance of controls.
To adaptively respond to inadequacies in controls.	Acid rock management actions and procedures updated as required.	Extent to which updated WRMP addresses all issues.

22.6 MONITORING AND CORRECTIVE ACTIONS

In order to ensure progress toward the achievement of the management objectives outline in Section 22.3 of this PEMP, a monitoring programme that examines the performance of acid rock management actions for the construction phase of the development is detailed in Table 57.

Construction areas shall be subject to regular (or as required by IM in consultation with its environmental consultants) inspections during earthworks and construction. The SEO shall conduct these inspections. Construction Inspection Checklists shall be used and shall include assessment of waste management actions as listed in Table 55

Relevant documentation to be inspected includes the Environmental Incident Reports and previous inspection sheets to check whether problems or non-conformances to the waste management procedures have been rectified.

Table 57: Monitoring and Corrective Action Programme for Acid Rock Drainage

Item	Activity	Performance Indicator	Corrective Action	Frequency	Responsibility
57.1	Static testing of waste material	Confirm preliminary classifications and refine waste plans for optimisation of waste material handling.	Use additional testing data to update identified PAF waste Isolate and transport to the correct location Prevent mixing of PAF and NAF materials.	As required (e.g. based on visual observation and/or when insufficient data is available)	Project Engineer
57.2	Surface monitoring	Surface water quality does not exceed Water Quality Protection Guidelines (WRC, 2000) for Mining and Mineral Processing - Minesite water quality monitoring prior to disposal.	Storing and evaporating the water, then removal and disposal of the solids. Separating the affected water from other mine water and treating it separately Diluting prior to discharge.	Quarterly for the first year, then annually unless quality target levels are exceeded	SEO
57.3	Groundwater monitoring	Groundwater quality does not exceed Water Quality Protection Guidelines (WRC, 2000) for Mining and Mineral Processing - Minesite water quality monitoring.	Re-run of groundwater model Increase monitoring frequency Assess options to alter waste rock dump	Quarterly for the first year, then annually unless quality target levels are exceeded	SEO

22.7 CONTINGENCY ACTIONS

Triggers will be monitored through the monitoring program.

The potential triggers are:

- AMD is identified from materials not classified or managed as PAF;
- Seepage pH is below six from NAF materials;
- Visible pyrite is observed in materials that are classified as NAF;
- An increased potential for AF and PAF waste rock is measured within major stratigrahic units;
- Changes in estimated volumes of AF, PAF, NAF waste are observed in the waste inventory;
- Decreasing pH or increasing metal concentrations are observed in analytical data for water containment infrastructure.

Contingency actions will be initiated if monitoring shows that triggers may have been exceeded and may result in a level of environmental impact that requires mitigation. The contingency actions shall be implemented concurrently with environmental incident procedures.

The contingency actions for the potential trigger might be used:

- Investigate cause
- Rectify immediately if the cause is non-compliance with acid rock management actions;
- Conduct a review of procedures and/or implement further education of staff/contractors to ensure that all possible steps are taken to prevent any reoccurrence; and
- Complete an Environmental Incident Report.

22.8 REPORTING

The presence and location of Potentially Acid Forming (PAF) material will be reported to the Department of Industry and Resources and Department of Environment and Conservation through the site Annual Environmental Report. Activities undertaken to prevent acid generation (such as encapsulation of PAF material) will be outlined. Where AMD has the potential to cause off-site environmental impacts, the relevant Department will be consulted to ensure adequate control measures are implemented.

23. ADJACENT LAND USERS MANAGEMENT

This section outlines IM's management actions to minimise the impact on the adjacent land users, and for recreational use management.

The Balmoral South Project is being developed on an active pastoral lease. Although remote, Cape Preston and the Fortescue River mouth are also widely used by Pilbara residents and tourists for recreational pursuits, particularly fishing.

Legislations and Relevant Standards

- Environmental Protection Act 1986

Stakeholders Consultations

As required IM, or its contractors, will notify and consult relevant authorities in the event of a spill incident as required under environmental incident procedures. If necessary, IM shall seek advice on clean-up procedures from the relevant authorities.

23.1 POTENTIAL SOURCES AND IMPACTS

Potential Sources

Pastoral grazing is the most significant activity in the Balmoral South Project Area. The potential issues that may impact upon this land use include:

- Disruption to cattle mustering operations;
- Damage or removal of fencing;
- Interruption to the water supply for cattle;
- Access to sites within the Pastoral Lease and possible interference with pastoral infrastructure.

Potential Impacts

Potential impacts on recreation users are discussed in Section 24.2.

23.2 ENVIRONMENTAL MANAGEMENT OBJECTIVES

EPA Objective

The objective is considered relevant to adjacent land users:

- To ensure the effective land-use planning and development for the prevention of future environmental problems.

Balmoral South Project Management Objectives

The objective for the Balmoral South Project in relation to adjacent land users is to minimise any direct or indirect impact from the operations, including to:

- minimise disruption to cattle mustering operations;
- control damage or removal of fencing;
- maintain the quantity and quality of water supply to existing pastoral users;
- maintain access to the Pastoral Lease and minimise interference with Pastoral infrastructure;
- monitor the effectiveness of adjacent land users management measures; and
- To adaptively respond to inadequacies in controls through preventative action.

Objectives will be met by implementing the key management actions listed in Table 58.

23.3 MANAGEMENT ACTIONS

In order to avoid and reduce the potential impact of activities relevant to adjacent land users, the key management actions that will be carried out to achieve the management objectives have been compiled in Table 58.

This table also details at what stage of the development the actions will be implemented and the responsible person(s) for ensuring operational compliance with the management actions.

Table 58: Management Actions for Adjacent Land Users

Item	Management Actions	Timing	Responsibility
58.1	Liaise with the pastoralist to determine the most appropriate actions to be taken during any mustering activity.	Prior to construction and ongoing.	SEO.
58.2	Implement a fence removal permit, where pastoralist must be notified prior to removal of any existing fencing. If the fencing is determined to be of importance to the pastoralist activities, alternative fencing will be provided.	Prior to construction and ongoing.	SEO.
58.3	Educate the employees of the importance of the existing fencing to the operation of the pastoral station and their obligation to comply with Management Action 20.5.2.	Prior to construction and ongoing.	SEO.
58.4	Liaise with the pastoralist to determine the most appropriate actions to be taken to maintain access to sites within the Pastoral Lease.	Prior to construction and ongoing.	SEO.
58.5	Monitor the effectiveness of adjacent land users management measures.	Annually.	SEO.

23.4 ENVIRONMENTAL TARGETS AND PERFORMANCE INDICATORS

The key environmental targets and performance indicators will be used to assess performance against the environmental objectives listed in the Section 23.2. Table 59: Environmental Targets and Performance Indicators for Adjacent Land Users details environmental targets based on management objectives for adjacent land users, and performance criteria to assist in assessing the achievement of these targets.

Table 59: Environmental Targets and Performance Indicators for Adjacent Land Users

Management objective	Environmental Targets	Performance Indicator
To minimise disruption to cattle mustering operations.	No disruption to cattle mustering activities.	Complaints from Pastoralist
To control damage or removal of fencing.	No unauthorised damage or removal of fences.	Complaints from Pastoralist
To maintain the quantity and quality of water supply to existing pastoral users.	See Section 13 (Groundwater Management) of this PEMP which specifically addresses this management objective.	
To maintain access to sites within the Pastoral Lease and minimise interference with pastoral infrastructure.	Where possible in consideration of mine site safety provisions, access to existing locations within the Pastoral Lease will be maintained.	Complaints from Pastoralist.
To monitor the effectiveness of adjacent land users management measures.	Above targets are met.	Estimate of overall effectiveness through occasional assessment of performance of controls.
To adaptively respond to inadequacies in controls through preventative action.	PEMP and procedures updated as required.	Extent to which updated PEMP addresses all issues.

23.5 MONITORING AND CORRECTIVE ACTIONS

In order to ensure progress toward the achievement of the management objectives outline in Section 23.3 of this PEMP, a monitoring programme that examines the performance of the adjacent land users management actions for the construction phase of the development is detailed in Table 60.

Construction areas shall be subject to regular (or as required by IM in consultation with its environmental consultants) inspections during earthworks and construction. The SEO shall conduct these inspections. Construction Inspection Checklists shall be used and shall include assessment of waste management actions as listed in Table 58.

Relevant documentation to be inspected includes the Environmental Incident Reports and previous week's inspection sheets to check whether problems or non-conformances to the waste management procedures have been rectified.

Table 60: Monitoring and Corrective Action Programme for Adjacent Land Users

Item	Activity	Performance Indicator	Corrective Action	Frequency	Responsibility
60.1	To monitor the effectiveness of adjacent land users management measures.	Complaints from Pastoralist	Restore fencing or provide alternative fencing. Restore access to pastoral lease areas or provide alternative access where possible.	Prior to construction and ongoing.	SEO.

23.6 CONTINGENCY ACTIONS

Triggers will be monitored through the monitoring program. Contingency actions will be initiated if monitoring shows that triggers may have been exceeded and may result in a level of environmental impact that requires mitigation. The contingency actions shall be implemented concurrently with environmental incident procedures.

23.7 REPORTING

All records created for the adjacent land users management will be collated and reported on a regular basis to the relevant regulatory agencies. Records will be maintained in accordance with the Balmoral South Project EMS.

24. INDIGENOUS HERITAGE MANAGEMENT

Sites of Aboriginal heritage significance have been identified in the Balmoral South Project development area. It is possible that additional sites of Aboriginal heritage significance may be revealed during further survey, clearing and earthmoving activities associated with construction.

Legislations and Relevant Standards

- *Aboriginal Heritage Act 1972; and*
- *EPA (2004e). Guidance for the Assessment of Environmental Factors No. 41: Assessment of Aboriginal Heritage.*

Stakeholders Consultations

As required, IM, or its contractors, will notify and consult relevant authorities in the event of inappropriate management of Aboriginal heritage. If necessary, IM shall seek advice on proper remediation procedures from the relevant authorities.

IM will maintain a mechanism for ongoing communication with the local Aboriginal representatives, either directly or through the contracted archaeologist, in relation to Aboriginal heritage values at the development site.

24.1 POTENTIAL SOURCES AND IMPACTS

Potential Sources

Impacts on Aboriginal heritage can arise from:

- Lack of recognition of the presence and importance of Aboriginal heritage material;
- Uncontrolled movement of vehicles other than on designated roads or tracks; and
- Inadvertent disturbance of Aboriginal heritage material.

Potential Impacts

Potential impacts to the environment as a result of the generation and/or incorrect management of aboriginal sites include:

- Loss or damage to important historical and cultural material;
- Contravention of laws governing the treatment of Aboriginal heritage material; and
- Loss of co-operation of the Aboriginal community.

24.2 ENVIRONMENTAL MANAGEMENT OBJECTIVES

EPA Objective

The objective is considered relevant to Aboriginal heritage management:

- To ensure that changes to the biophysical environment do not adversely affect historical and cultural associations and comply with relevant heritage legislation
- To ensure that the proposal complies with the requirements of the *Aboriginal Heritage Act 1972*
- To ensure that existing and planned recreational uses are not compromised.

Balmoral South Project Management Objectives

The primary objective relevant to Aboriginal heritage management for the Balmoral South Project is:

- To ensure that changes to the biophysical environment comply with relevant heritage legislation;
- To monitor the effectiveness of Aboriginal heritage measures; and
- To adaptively respond to results of the monitoring programme.

24.3 MANAGEMENT ACTIONS

To ensure the preservation of heritage values in the Balmoral South Project Area, IM will implement procedures for the identification and management of any additional sites located during the construction and operational phases of the Balmoral South Project. This may include the use of monitors during ground disturbing activities and the development of specific procedures for the preservation of heritage sites. If required, controlled access to sites for traditional purposes will be negotiated and incorporated into long term heritage management strategies.

In order to avoid and reduce the potential impact of activities relevant to Aboriginal Heritage sites, the key management actions that will be carried out to achieve the management objectives have been compiled in Table 61.

This table also details at what stage of the development the actions will be implemented and the responsible person(s) for ensuring operational compliance with the management actions.

Table 61: Management Actions for Aboriginal Heritage Sites Protection

Item	Action	Timing	Responsibility
61.1	Make personnel aware through inductions of the presence of Aboriginal heritage sites and how to avoid damage to the sites and other material which may be of Aboriginal heritage significance.	On engagement of personnel.	Construction Manager.
61.2	Engage a qualified archaeologist who will obtain an *Aboriginal Heritage Act 1972* section 18 permit to conduct monitoring of ground disturbing works.	Prior to ground-disturbing works.	Construction Manager.
61.3	Implement Aboriginal heritage contingency actions should any potential Aboriginal heritage site, artefact or skeletal remains be discovered.	Prior to ground-disturbing works.	Construction Manager.
61.4	Arrange for Aboriginal monitors from relevant groups to be present during ground disturbing activities.	Prior to ground-disturbing works.	Aboriginal Community Liaison Officer (ACLO).
61.5	Contain construction activities within defined areas and do not encroach on other areas where Aboriginal heritage sites exist.	Prior to ground-disturbing works.	Construction Manager.
61.6	Apply for, arrange and hold permits under Section 18 of the *Aboriginal Heritage Act 1972*.	Prior to ground-disturbing works.	ACLO.
61.7	Develop research, recording and mitigate salvage strategies, which include establishment of: • Excavation, recovery, transportation and temporary storage techniques. • Methods for permanent relocation or storage of cultural material.	Prior to ground-disturbing works.	ACLO.
61.8	Prepare reports on all archaeological duties.	Prior to ground-disturbing works.	ACLO.

Item	Action	Timing	Responsibility
61.9	Areas designated for ground disturbance should be examined through archaeological and ethnographic surveys. If: (a) No further sites are located, and then management strategies for possible under-surface sites can be initiated. (b) Further sites are located, and then management strategies for the 13 sites likely to be disturbed apply.	Prior to ground-disturbing works.	ACLO.
61.10	Establish a cultural awareness programme and carry out appropriate cultural awareness training sessions with all site personnel, informing them: • of their obligations under the *Aboriginal Heritage Act 1972*. • of the broad aspects of Aboriginal culture and traditional land-use in the West Pilbara. • how to recognise human skeletal material. • how to recognise Aboriginal cultural material in the form of stone or wooden artefacts, scarred trees or other visible signs of Aboriginal usage and former presence.	Prior to ground-disturbing works.	ACLO, Construction Manager, Operations Manager.
61.11	If skeletal material is encountered, all work should cease immediately at the site of discovery (required by law).	During construction.	Construction Manager.
61.12	Any person(s) locating skeletal material, or a member of a monitoring team, should: (a) Immediately notify the site manager who will (b) Notify the ACLO of the discovery by telephone, or (c) Immediately notify the Karratha Police Station and the Perth Department of Indigenous Affairs (DIA) office of the discovery and inform them that all work has ceased at the discovery site.	During construction.	All Personnel.
61.13	Work should not recommence at the discovery site until approval has been obtained from the Police and DIA. If the monitors are in agreement and if development plans permit, then, after approval received from the Police and DIA, the disturbed burial site may be refilled and/or the relevant Project component re-sited or another appropriate solution found. If this outcome cannot be achieved, a process of Aboriginal community consultation should be initiated by the ACLO to arrange the reinterment, in a suitable location, of the skeletal material by the Balmoral South Project Archaeologist (PA) and relevant Aboriginal representatives.	During construction.	Construction Manager, ACLO.
61.14	If any further Aboriginal sites (apart from human skeletal remains) are located, work should cease in the area and the Balmoral South Project component re-sited. If this is not feasible, all ground disturbance at the site should cease temporarily. If the PA and Aboriginal monitors decide the site warrants recording and mitigative salvage, they will develop and undertake the required methodology and report to the DIA. If the PA holds a valid Section 18 Permit, providing the Aboriginal monitors are in agreement, the work can continue once the archaeological material has been processed.	During construction.	Construction Manager, ACLO.
61.15	Keep the local Aboriginal groups and the various interest groups informed of the progress of the Balmoral South Project.	During construction.	Construction Manager, ACLO.

24.4 ENVIRONMENTAL TARGETS AND PERFORMANCE INDICATORS

The key environmental targets and performance indicators will be used to assess performance against the environmental objectives listed in the Section 24.3.Table 62 details environmental targets based on management objectives for aboriginal heritage sites protection and performance criteria to assist in assessing the achievement of these targets.

Table 62: Environmental Targets and Performance Indicators for Aboriginal Heritage Sites Protection

Management objective	Target	Performance Indicator
To ensure that changes to the biophysical environment comply with relevant heritage legislation.	No unauthorised disturbance to known Aboriginal sites. All uncovered sites are managed in accordance with the *Aboriginal Heritage Act 1972* and agreements established with local Aboriginal representatives.	Disturbance to known sites observed during construction site inspections. Environmental incidents involving disturbance of known sites. Condition of known Aboriginal sites. Adherence to heritage legislation.
To monitor effective of measures.	Above targets met.	Occasional assessment of performance of controls.
To adaptively respond to inadequacies in measures.	PEMP and procedures updated as required.	Updated version of PEMP and procedures.

24.5 MONITORING AND CORRECTIVE ACTIONS

In order to ensure progress toward the achievement of the management objectives outline in Section 24.3 of this PEMP, a monitoring programme that examines the performance of the Aboriginal Heritage sites protection management actions for the construction phase of the development is detailed in Table 63.

Construction areas shall be subject to regular (or as required by IM in consultation with its environmental consultants) inspections during earthworks and construction. The SEO shall conduct these inspections. Construction Inspection Checklists shall be used and shall include assessment of waste management actions as listed in Table 61.

Relevant documentation to be inspected includes the Environmental Incident Reports and previous week's inspection sheets to check whether problems or non-conformances to the waste management procedures have been rectified.

Table 63: Monitoring and Corrective Action Programme for Aboriginal Heritage Sites Protection

Item	Activity	Performance Indicator	Corrective Action	Frequency	Responsibility
63.1	Pre-disturbance site inspection.	Heritage sites or artefacts are located.	Re-survey.	Prior to disturbance.	Archaeologist, ACLO.
63.2	Site inspections during clearing or earthworks.	Heritage sites or artefacts are not disturbed or destroyed by construction activities in contravention of the *Aboriginal Heritage Act 1972*.	Halt construction activity pending detailed assessment and agreement on further action.	Daily while new ground disturbance continues.	Construction Manager, Project Engineer, Contractor, Archaeologist, ACLO.

24.6 CONTINGENCY ACTIONS

IM will monitor all earthworks and clearing activities and ensure that contractors are aware of the probability of encountering archaeological materials such as Aboriginal skeletal remains and artefacts. Triggers will be monitored through the monitoring program.

The potential triggers might be:

- Location of previously unknown heritage site in area to be disturbed;
- Uncovering of material of potential Aboriginal significance; and
- Disturbance of known Aboriginal heritage site.

Contingency actions will be initiated if monitoring shows that triggers may have been exceeded and may result in a level of environmental impact that requires mitigation. The contingency actions, aim to ensure that any potential heritage sites are protected, the material identified and correct authorities and key Aboriginal groups are notified.

The contingency actions for the potential trigger might be used:

- Investigate the causes (cease all work in the area if necessary);
- Clearly identify and erect markers to delineate the site;
- Implement necessary actions to prevent disturbance from re-occurring (e.g. fencing site or re-informing personnel);
- Determine in a timely manner the authenticity of the site or material in consultation with all stakeholders;
- Do not re-commence construction activities until the material has been dealt with to the satisfaction of affected parties; and
- Complete an Environmental Incident report.

24.7 REPORTING

In the event of the disturbance of a known Aboriginal heritage site the personnel involved (or witnesses to) shall complete an Environmental Incident Report.

The procedures relating to environmental incidents as listed in Section 3.7 shall also be followed. The Environmental Incident Report system can be used as a mechanism for reporting contractor non-conformance to this plan to IM or regulatory authorities as required.

25. RECREATIONAL USE MANAGEMENT

Although remote, Cape Preston and the Fortescue River mouth are widely used by Pilbara residents and tourists for recreational pursuits, particularly fishing. Long term campers regularly stay at the river mouth for periods of up to several months. A boat ramp carved into the river bank is located at the river mouth and is presently maintained by the owners of Indian Ocean Pearls, who have established a permanent camp near the river mouth.

In addition to the mainland visitor points mentioned above, there are several islands located off the Pilbara coast which form the Great Sandy Island Nature Reserve (GSINR). Furthermore, Regnard Marine Management Area (RMMA) will incorporate a number of other islands and marine conservation zones. Special regulations will be applied to control the impact of visitors on these areas.

Legislations and Relevant Standards

- *Conservation and Land Management Act 1984 for the protection and management of land vested for conservation purposes;*
- *Wildlife Conservation Act 1957 which governs human interaction with native wildlife;*
- *Maritime Archaeology Act 1973 which governs human interaction with shipwrecks; and*
- *Aboriginal Heritage Act 1972 for the protection of Aboriginal heritage sites.*

Stakeholders Consultations

As required IM, or its contractors, will notify and consult relevant authorities in the event that inappropriate recreational use causes a potentially significant environmental impact. If necessary, IM shall seek advice on proper environmental remediation procedures from the relevant authorities.

25.1 POTENTIAL SOURCES AND IMPACTS

Potential Sources

The construction and operations workforces will operate on a fly-in / fly-out basis and consequently there will be limited time available for the workforce to significantly increase recreational pressures in the area. Nonetheless, the influx of a sizable construction and operations workforce has the potential to increase recreation activity in the area

Potential Impacts

During the construction and operational phases of the Balmoral South Project, the potential recreational use impacts are as follows:

- Mine staff to encroach on no-take zones;
- Disturbance to nesting birds or turtles;
- Pressures on marine organisms from private vessels;
- Impacts from recreational fishing (excessive fish take and destruction of habitat);
- Impacts on mangrove communities (disturbance from 4WD activities, litter, oil spills, and dust);
- Impacts from 4WD use; and
- Loss of social values (remote values, European and Aboriginal heritage).

25.2 ENVIRONMENTAL MANAGEMENT OBJECTIVES

EPA Objective

The objective is considered relevant to recreational use management:

- To ensure that existing and planned recreational uses are not compromised.

Balmoral South Project Management Objectives

The primary objective relevant to recreational use management for the Balmoral South Project is:

- To limit the impact on the surrounding environment of all recreational activities undertaken by mine employees.
- To ensure that any activities which are deemed to be adversely affecting the surrounding environment are modified and addressed.
- To minimise impact of mine employees and subcontractors on the “visitor locations” within the vicinity of the Balmoral South Project site.
- To ensure that access to popular “visitor sites” is maintained for the use of the general public; and
- To ensure that employees and contractors use appropriate fishing practices.

Objectives will be met by implementing the key management actions listed in Table 52.

25.3 MANAGEMENT ACTIONS

The key management strategy will be education, where all project personnel will be inducted to site and provided with information regarding the responsibilities and expected behaviour of all personnel toward the environment. The induction will also raise awareness of recreational impacts and how those impacts will be managed. Further management requirements are provided in Table 66. With regards to any recreational activities undertaken by site staff, the induction will:

- Provide a map of the marine environment around Cape Preston, indicating no-take zones, conservation status of the various marine management areas and location of other industries and any associated exclusion zones;
- Provide a map of the terrestrial environment, including visitor locations, access tracks and any prohibited areas;
- Provide guidance on appropriate behaviour at visitor nodes and advice regarding minimising impacts;
- Provide advice on appropriate behaviour around large marine organisms including (but not limited to) whales, dugongs and turtles;
- Provide clear guidance on regulations regarding boat handling within nature reserves, such as moorings and anchorages;
- Advise on the rules and regulations governing access to islands within the GSINR and RMMA;
- Advise on ‘good neighbour’ behaviour with regards to other land users, including pastoralism, tourism and aquaculture;
- Provide advice regarding appropriate 4WD behaviour with regard to protection of mangroves and native vegetation;
- Provide clear information regarding bag and size limits for recreational fishing, including netting, spearfishing, coral collecting, shell fishing and aquarium fish collecting;
- Encourage record keeping with regards to fish catches, marine mammal, turtle and bird sightings; and
- Establish guidelines on accessing cultural heritage sites.

In addition to providing employees and contractors with induction guidelines, IM will:

- Realign and maintain any access tracks currently utilised to access visitor nodes that will be disrupted by the Balmoral South Project;
- Rehabilitate any exploration or construction phase tracks no longer required in order to limit vehicular movements in any sensitive areas;
- Sponsor or undertake monitoring of favoured nesting locations of sea birds to assist with advice regarding access to GSINR islands in consultation with DEC Karratha;
- Assist as agreed through consultation with DEC in achieving adopted management objectives for the CPMMA and GSINR; and
- Maintain a register of complaints relating to Project-related recreational activities.

In order to avoid and reduce the potential impact of activities relevant to recreational use, the key management actions that will be carried out to achieve the management objectives have been compiled in Table 64. This table also details at what stage of the development the actions will be implemented and the responsible person(s) for ensuring operational compliance with the management actions.

Table 64: Management Actions for Recreational Use

Item	Impact	Action	Procedure	Action Responsibility
64.1	Potential for mine staff to encroach on no-take zones.	Staff inductions.	No take zones will be indicated on regional maps and will be issued to all staff during inductions.	Environmental Manager.
64.2	Disturbance to nesting birds.	Staff inductions. Inspections. Information from DEC Officers.	All staff will be informed of the impacts that their actions may have on nesting birds and at what times access to islands is prohibited. Monitor island access during nesting seasons. Environmental Manager to seek advice from DEC regarding onset of nesting times.	Environmental Manager.
64.3	Disturbance to nesting turtles.	Staff inductions. Inspections. Minimise light spill.	All staff will be informed of the impacts that their actions may have on nesting turtles. Monitor for onset of nesting activities and make staff aware. Design lighting to ensure that light spill is directed away from nesting locations as much as practicable.	Environmental Manager. Construction/ Design Manager.
64.4	Pressures on marine organisms from private vessels.	Staff inductions.	All staff will be informed of the potential to cause harm to marine organisms through boating activities. Particular emphasis will be placed on behaviour around large marine organisms such as whales, turtles and dugongs.	Environmental Manager.
64.5	Impacts from recreational fishing, excessive fish take and destruction of habitat.	Staff inductions. Liaison with regulatory authorities. Adherence to published guidelines.	Inductions to include information regarding bag limits, no take zones and netting restrictions as applicable under relevant guidelines. Induction to include information regarding potential for damage arising from anchors and moorings and present relevant guidelines. IM to seek information from regulatory authorities regarding impacts on fish stocks.	Environmental Manager.

Item	Impact	Action	Procedure	Action Responsibility
64.6	Impacts on mangrove communities. Disturbance from 4WD activities, litter, oil spills, dust.	Staff inductions.	Inductions to provide: • information regarding sensitivity of mangroves to disturbance. • importance of removing litter. • impacts resulting from oil spills and dust.	Environmental Manager.
64.7	Impacts from 4WD use.	Staff inductions. Inspections.	Inductions to include advice regarding: • importance of remaining on established tracks wherever possible. • respect for popular visitor nodes. • periodic inspections of tourist points by regulatory authorities to determine appropriate behaviour.	Environmental Manager. Regulatory Authorities.
64.8	Loss of social values, remote values, European and Aboriginal heritage.	Staff inductions.	Encourage low impact behaviour when visiting remote areas. Provide advice regarding appropriate behaviour around wrecks, Aboriginal heritage sites and other sites of heritage value.	Environmental Manager.
64.9	Impact to neighbouring land users, pastoral, commercial fisheries.	Staff inductions.	Inductions to provide staff with guidance on appropriate behaviour around neighbouring land users and the potential impact that their behaviour may have.	Environmental Manager.

25.4 ENVIRONMENTAL TARGETS AND PERFORMANCE INDICATORS

The key environmental targets and performance indicators will be used to assess performance against the environmental objectives listed in the Section 25.3. Table 65 details environmental targets based on management objectives for recreational use and performance criteria to assist in assessing the achievement of these targets.

Table 65: Environmental Targets and Performance Indicators for Recreational Use

Management objective	Target	Performance Indicator
To limit the impact on the surrounding environment of all recreational activities undertaken by mine employees.	No complaints from neighbouring land user.	Avoidance/minimisation of complaints from neighbouring land users. Timely and appropriate response to complaints received.
To ensure that any activities which are deemed to be adversely affecting the surrounding environment are modified and addressed.	No adversely affect the surrounding environment.	Avoidance of detrimental impact on the quality and abundance of marine flora and fauna in the GSINR and CPMMA attributable to Project-related recreational activities.
To minimise impact of mine employees and subcontractors on the “visitor locations” within the vicinity of the Balmoral South Project site.	No impacts from mine employees and subcontractors on ‘visitor location’ within the vicinity of the Balmoral South Project site.	Maintenance of the public facilities at the Fortescue River mouth and other key visitor locations.
To ensure that access to popular “visitor sites” is maintained for the use of the general public	No impacts from mine employees and subcontractors on the access to popular ‘visitor sites’	Maintenance of the access to popular ‘visitor sites’
To ensure that employees and contractors use appropriate fishing practices.	No inappropriate fishing practices	Compliance (by company and contract personnel) with guidelines and conditions set out in the employee induction with regards to fishing catch limits.

25.5 MONITORING AND CORRECTIVE ACTIONS

In order to ensure progress toward the achievement of the management objectives outline in Section 25.3 of this PEMP, regular meeting will be held to reinforce a positive attitude towards recreational use management and to highlight any issues that arise during the life of the Balmoral South Project. A record of all training will be maintained.

25.6 CONTINGENCY ACTIONS

Triggers will be monitored through the monitoring program. The potential trigger might be:

- Visual observation detects excessive impact from recreation activities.

Contingency actions will be initiated if monitoring shows that triggers may have been exceeded and may result in a level of environmental impact that requires mitigation. These contingency actions shall be implemented concurrently with environmental incident procedures.

The contingency actions for the potential trigger might be used:

- Investigate cause
- Assess compliance of construction activities to the recreational use management actions.
- Rectify immediately if the cause is non-compliance with recreational use management actions.
- Revise recreational use management actions to rectify the situation if activities are in compliance with recreational use management actions.
- Complete an Environmental Incident Report.

25.7 REPORTING

All records created for the recreational use monitoring will be collated and reported on a regular basis to the relevant regulatory agencies. Records will be maintained in accordance with the Balmoral South Project EMS. All non-conformances will be reported immediately to the relevant body and will be summarised in the next regular environmental review report.

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APPENDIX A Construction Inspection Checklist

CONSTRUCTION ENVIRONMENTAL INSPECTION CHECKLIST Balmoral South Iron Ore Project	
Name:	Date:
Location/Sections of development inspected: (indicate on attached map)	Weather:

Yes *if statement is checked and true;* ***No*** *if statement is checked and not true;* ***?*** *if unchecked*

ISSUE	YES	NO	?	COMMENTS
General				
No unauthorised personnel on site.				
Training				
All personnel have undergone Environmental Induction, including instruction regarding Aboriginal heritage procedures.				
Access				
Access points clearly marked.				
Signs erect and legible.				
All vehicles within cleared areas and designated access tracks.				
Access tracks maintained.				
Erosion control in place.				
Drainage structures in place.				
Vegetation, Overburden and Topsoil				
Boundaries of clearing clearly marked.				
Access restrictions adhered to.				
Roads of minimum width.				
Temporary storage of materials within clearing area.				
Cleared vegetation stockpiled (not eroding).				
Erosion control berms in place.				
Reshaped landforms are stable and no runoff to undisturbed areas.				
Drainage patterns re-established.				
Correct revegetation procedures used (endemic species).				
No burning.				
Weed Control				
No Mesquite present.				
No Native Thornapple present.				
Machinery cleaned before movement to new area.				
Amenity gardens use endemic plants.				
Spill Management				
Hazardous materials register up to date.				
Fuel register up to date, no indication of loss.				

Chemical/fuel storage bunds adequate to handle 1.2 times volume of tank/drums.				
Storage facilities in good condition; no water in bunded areas.				
All valves, pumps and connections in good condition.				
Spill response equipment present located in close proximity to storage and refuelling facilities.				
No reported spills.				
No obvious signs of spills.				
Machinery in good condition; no leaks.				
Waste				
Sufficient bins/skips provided.				
Bins/skips regularly emptied; not overflowing.				
No general litter.				
Surface Water				
No "damming" of drainage.				
No excessive erosion.				
No deterioration of stream-line vegetation.				
No ponding or run-off from WWTP irrigation.				
No overflow from wastewater holding tanks.				
Water pH greater than 6.				
Dust				
Exposed areas minimised.				
Dust suppression measures in use and adequate.				
No obvious signs of excessive dust emissions.				
Blasting only under favourable wind conditions.				
Noise				
Equipment noise controls (e.g. mufflers) intact and adequate.				
Accommodation sound-proofing adequate.				
Aboriginal heritage				
Known Aboriginal sites flagged and easily identifiable.				
Aboriginal heritage consultant present for clearing activities.				
Performance Targets				
Minimal area of vegetation disturbance.				
No disturbance of vegetation beyond clearing perimeter.				
No significant establishment of weed infestations in weed-free areas.				
No establishment of Mesquite infestations.				
No establishment of Native Thornapple infestations.				
No spills or escape of hazardous materials.				
Continued compliance with relevant standards and regulations relating to storage and handling of hydrocarbons and chemicals.				
Spills are quickly and effectively cleaned up.				

Surface water quality OK.	
Drainage systems still effective.	
Stream-line vegetation is healthy.	
No waste or rubbish from construction activities is detected off site.	
All waste is disposed of in designated disposal facilities.	
No sustained visual dust generation observed.	
No obvious and unacceptable dust deposition observed off site.	
No complaint of excessive noise levels during construction.	
No un-authorised disturbance to known Aboriginal sites.	
Any newly uncovered sites managed in accordance with the *Aboriginal Heritage Act* and agreements established with local Aboriginal representatives.	
ADDITIONAL COMMENTS / Environmental Incidents	

APPENDIX B Environmental Incident Report

ENVIRONMENTAL INCIDENT REPORT Balmoral South Iron Ore Project	
Reported by:	Date of incident:
Time of incident:	Associated activity:
Location of incident: *indicate location on attached map*	Date investigated:
Investigated by:	Reported to:

INCIDENT DETAIL

Vegetation disturbance outside approved boundary		Injury/Killing of fauna		Erosion issue	
Weed control breach		In construction area		Water pollution	
Fire prevention issue		On public roads		Hydrocarbon spill	
Noise complaint/issue		Dust complaint/issue		Chemical spill	
Other					

Description of incident:
Description of environmental damage/impact:
Contributing factors of incident occurring:
Controls, Procedures, Response plan, and/or Monitoring in place to prevent/address occurrence:

Corrective action taken immediately:
Relevant training or instructions given to personnel prior to incident:
Did this incident occur as a result of non-conformance with construction environmental management plan? ___ Yes ____ No **What related procedures were not conformed to?**

INCIDENT COMMUNICATION

People informed (Contractors, Project Engineer, Authorities):
Information provided:

SPILL RESPONSE

If a spill has occurred: **Details of material cleaned up/recovered – specific type, quantity/volume:**
Method of clean-up
Test and Results after clean-up (if applicable)

RECOMMENDATIONS AND CLOSE OUT

Further remedial action required to address this specific incident:			
Action required	Person responsible	Due date	Date completed

Recommendations to prevent reoccurrence

International Minerals Pty. Ltd.

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