Mesa A Closure Statement

- Revision B
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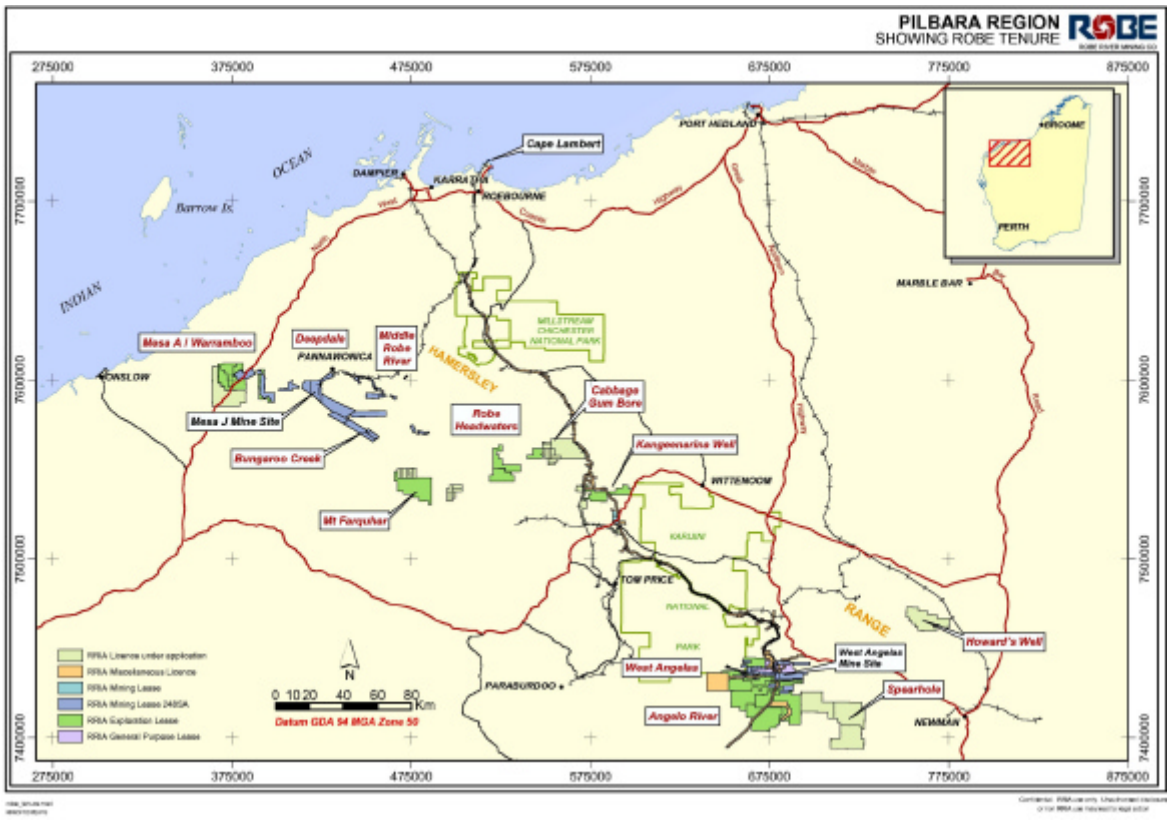
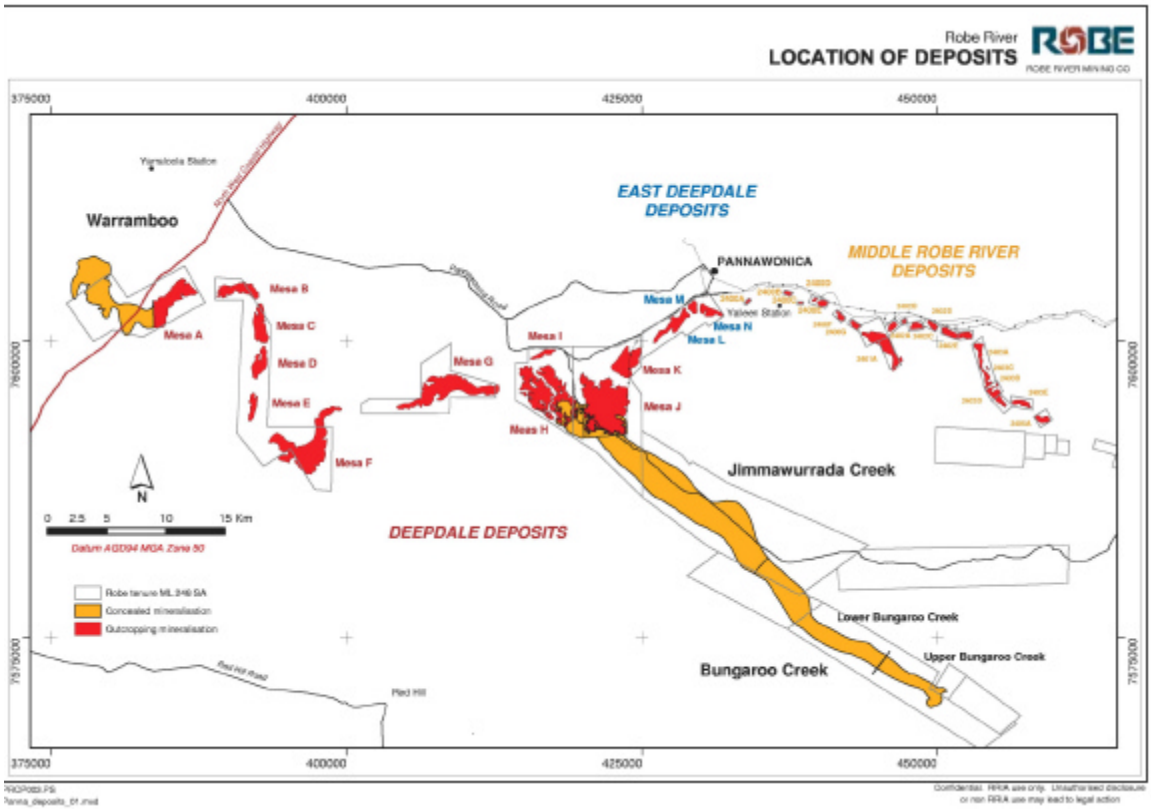
1. Introduction

Pilbara Iron operates and maintains iron ore mining, rail and export facilities in the Pilbara Region of Western Australia on behalf of Hamersley Iron Pty Limited ("Hamersley") and Robe River Iron Associates ("Robe").

Robe currently operates the Greater Pannawonica Operations, comprising the Mesa J and Robe River Valley mines with associated ore preparation and handling facilities and rail infrastructure linking the operations to the port of Cape Lambert. The township of Pannawonica is also wholly owned by Robe, and was established to service the company's workforce. The location of these mining areas and key facilities is shown in **Figure 1**.



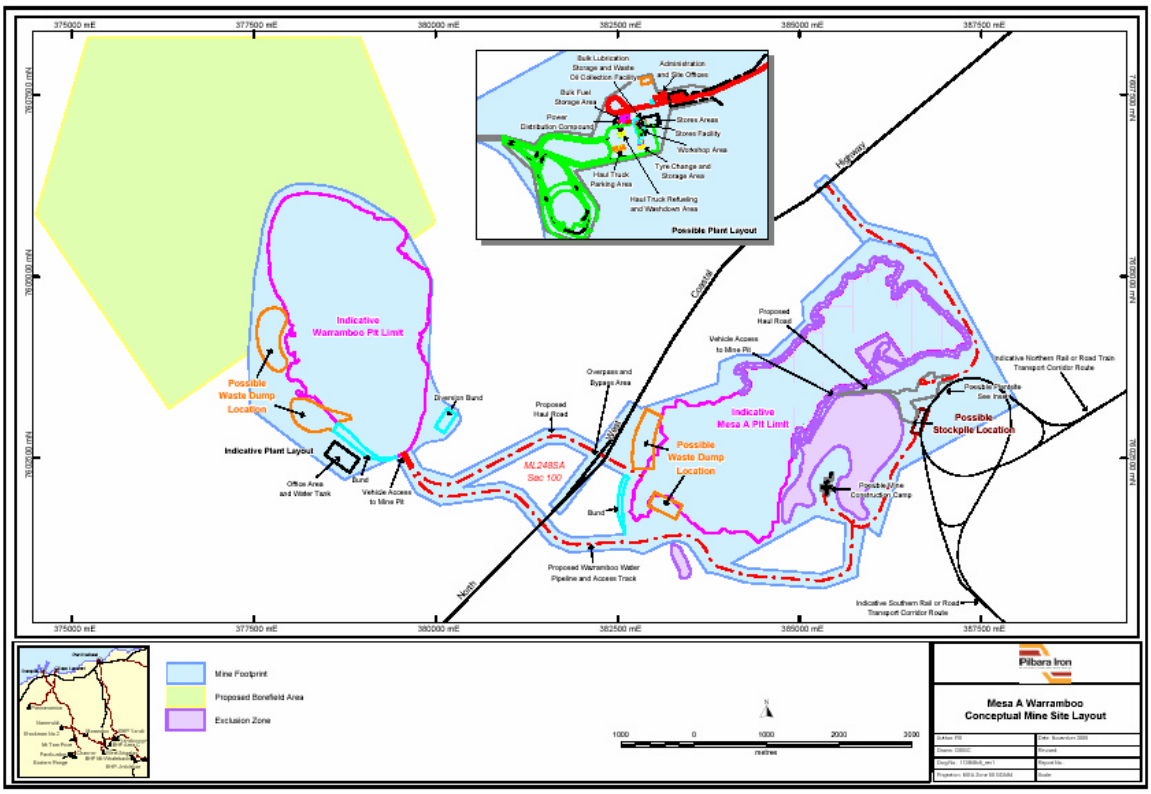
- *Figure 1 Location Map*



- *Figure 2 Location of Ore Deposits*

Current operations are focused on mining at Mesa J. Robe's previously mined pits, including parts of Middle Robe and Mesas K, L, M and N are located east of Mesa J. These are shown on **Figure 2**.

Robe is proposing to develop new mining areas at the Mesa A and Warramboo ore deposits, located 43 km west of the Pannawonica township. The proposed operations will include mining, ore processing, ore transport, and other facilities as shown on **Figure 3**.



- *Figure 3 Preliminary Site Layout and Transport Options*

1.1 Purpose

The objective of this report is to present a statement of closure planning concepts relating to the proposal, and to identify high level risk considerations associated with the eventual closure of the proposed new operations.

This closure statement is intended to identify the key aspects of closure that will require further investigation throughout successive stages of the project. The closure planning process is a dynamic process which will require regular review and further development throughout the life of the operation. This will be necessary to allow for changes to legal obligations, changes to corporate requirements and community expectations, and the development of more detailed knowledge relating to technical issues.

2. Operational Context

2.1 Current Operations

The following sections provide details of existing operations forming the Greater Pannawonica Operations, and provide details of the proposed new mining operations at Mesa A and Warramboo.

2.1.1 Mesa J Mining Operations

Mesa J operations are located approximately 14 km southwest of Pannawonica, as shown in **Figure 1**. The mesa is bounded to the north by the Robe River and to the east by Jimmawurrada Creek. Mining is a conventional drill-and-blast, truck-front end loader/excavator operation. Most site facilities, including administration and amenities, warehouse, service area, laydown areas and tyre, fuelling and lube areas, are all located within the Mesa J operational area. The only exceptions are ammonium nitrate stores, High Energy Fuel (HEF) tanks and explosives magazines which remain at Mesa K. Operational personnel are housed in Pannawonica.

The majority of the ore is hauled directly to the loadout facility (incorporating the sizer) and loaded onto the rail adjacent to Jimmawurrada Creek. However, about a quarter of daily production is made up by subgrade material (a mixture of ore and waste materials), which is first passed through two wet processing plants (scrubber/trommel) to remove clay fractions. The processing plant (PP1) commenced operation in 1999 and has enabled the recovery of specification grade ore from the subgrade material. Process plant two (PP2) was commissioned in July 2001 following the success of PP1. All tailings material is deposited in-pit in Pit 1 and decant water is recovered and recycled within PP1. Mining below the water tables necessitates de-watering. A large proportion of this extracted water is used for dust suppression, potable supply and in the operation of the processing plants. The remainder of the water infiltrates back into the ground via in-pit sumps or is discharged to Jimmawurrada Creek.

2.1.2 Robe Valley

Robe is the manager for ML248SA and first commenced operations in 1972, with the mining of relatively small iron ore deposits in the Robe River Valley, near Pannawonica. These deposits are known as the Middle Robe deposits. In 1982, operations were relocated west, to the Eastern Deepdale deposits and the mining of mesas L, M and N, followed by Mesa K in 1988 and Mesa J in 1992, as shown in **Figure 2**.

For the purpose of this closure statement Robe Valley pertains to all of Robe's previously mined pits, including all of Middle Robe and Mesa K, L, M and N.

2.1.3 Pannawonica Town

The town of Pannawonica is a closed town of approximately 700 people, built in the late 1970's to house the workforce and families of Robe. The town is located approximately 150kms southwest of Karratha, and 45kms to the east of the Northwest Highway, as shown in **Figure 1**. Facilities at Pannawonica Town include a number of landfills, the town sewage treatment plant, and electricity sub-station, a service station and the town services workshop.

2.2 Proposed New Operations

Production from Mesa J will begin to decline in 2008, with active mining scheduled to cease in 2010. At that time wet processing of low grade ore will continue at Mesa J for a further five years at a rate of 7 Mtpa. In order to maintain its current production rate, Robe proposes to develop its Mesa A/Warramboo resources by 2008, to produce primary sized pisolite ore at a rate of 25 Mtpa.

The new operation may utilise existing infrastructure and services associated with the Mesa J operation, however there will be a requirement to construct new infrastructure to service the Mesa A and Warramboo mines. The key components of the Mesa A /Warramboo mines are shown in **Figure 3**, and are summarised below:

- Single open cut pit at Mesa A with associated sub-grade stockpiles and waste dumps, and drainage management structures
- Single shallow open cut pit at Warramboo with associated ore stockpiles and waste dumps, creek diversion, flood protection levees and other drainage management structures
- Unsealed haul road for transport of ore from Warramboo to Mesa A with construction of an overpass to carry the North-West Coastal Highway
- New facility to transport primary sized ore from Mesa A to Cape Lambert, including new crossings of either the Robe River or Mungarathoona Creek,. Transport options are:
  - new sealed road located mainly to the north of the Robe River from Mesa A to Mesa J followed by rail to Cape Lambert on the existing rail line,
  - new rail line located mainly to the north of the Robe River from Mesa A to north east of Mesa J linking to the existing rail line to Cape Lambert, or
  - new road located to the south of the Robe River from Mesa A to Mesa J followed by rail to Cape Lambert on the existing rail line,
  - new rail line located to the south of the Robe River from Mesa A to south east of Mesa J linking to the existing rail line to Cape Lambert
- ROM bin with primary sizer (crushing only) to be constructed at Mesa A. Secondary and tertiary crushing and screening will be conducted at Cape Lambert using existing facilities
- New borefield and associated pipelines to Mesa A/Warramboo to supply 1.5 GL/a water to the operation. Options for location of the borefield are:

  - Warramboo aquifer (preferred option)
  - Robe River alluvium (either upstream or downstream of the Yarraloola Homestead)
- Support infrastructure including; administration buildings, workshop, lube and hydrocarbon storage facility, waste water treatment, landfill, accommodation near Mesa A

This closure statement has been developed to consider the key aspects likely to affect the closure of the proposed new operations at Mesa A and Warramboo.

3. Legal and Corporate Obligations

This section provides details of the key sources of legal and corporate obligations governing the management of closure for the proposed operations. Further developments in closure management planning throughout the life of the operation will require regular reviews to incorporate changes to legal obligations, as well as changes to corporate requirements, developments in industry best practice and changing community expectations.

3.1 Legal Obligations

Obligations regarding environmental aspects of mine closure can be imposed under the following key Statutes and legislation:

- Ministerial approval under *Part IV* of the *Environmental Protection Act* 1986 (EP Act);
- Environmental licensing and pollution control provision under *Part V* of the EP Act;
- Obligations arising under the *Conservation and Land Management Act 1984;*
- Requirements imposed by the *Mining Act 1978* and the *Mining Regulations 1981*;
- Obligations imposed by the *Mines Safety and Inspection Act 1994* (MSIA) and *Mines Safety and Inspection Regulations 1995* (MSIR);
- Procedures and requirements imposed under State Agreement Acts;

Whilst the development of this closure statement precedes the approval processes leading to the application of obligations under many of these pieces of legislation, this statement provides the basis for further development of the closure planning process to address issues likely to be subject to the requirements of the above legislation.

3.2 Corporate Obligations

As an international mining company, Rio Tinto has established corporate-wide closure planning and closure implementation requirements. Similarly, and as a separate business entity, Pilbara Iron has established business requirements for its operations. These requirements include policies, standards, guidelines, and operational documentation (e.g. procedures and work instructions).

Key corporate documents that demonstrate a commitment to managing closure issues are shown in **Table 1**. This closure statement has been developed to be consistent with the principles of these corporate documents.

- *Table 1 Corporate Policies and Standards*

Policy	Version and Date
The Way We Work	April 2003
Rio Tinto Iron Ore Health, Safety and Environment (HSE) Policy	March 2005

Pilbara Iron & Robe River Joint Venture Environmental Policy	August 2004
Standard	**Version and Date**
Acid Rock Drainage Prediction and Control	V1.0 Sept 03
Air Quality Control	V1.0 Sept 03
Rio Tinto Closure Standard	V2.0 June 04
Environmental Management System Standard	V1.0 Sept 03
Hazardous Materials and Contamination Control Standard	V1.0 Sept 03
Land-Use Stewardship Standard	V1.0 Sept 03
Mineral Waste Management Standard	V1.0 Sept 03
Water Use and Quality Control Standard	V1.0 Sept 03
Rio Tinto Community Standard	V1.0 Dec 04

3.3 Industry Best Practise for Closure Management

Regulatory agencies and industry bodies have established guidelines (industry best practice) to assist mining companies to achieve acceptable standards of mine closure and rehabilitation.

While there are no legislative requirements to adherence to these guidelines, both Rio Tinto and Pilbara Iron subscribe to the intent and advice of such guidelines.

Industry 'best practice' guidelines include the following key documents:

- Strategic Framework for Mine Closure (ANZMEC/MCA, 2000);
- Mine Closure Guidelines for Mineral Operations in Western Australia (CME, 2000);
- Enduring Values – The Australian Minerals Industry Framework for Sustainable Development (MCA, 2004);
- Relevant sections of the Best Practice Environmental Management in Mining Series (EA, 1995, 1998; 2002).

This closure statement has been developed to be consistent with the principles of these industry best practice guidelines.

4. Closure Planning Process

Closure planning is a dynamic and iterative process. This closure statement is intended to determine the key issues likely to require detailed consideration in the development of a closure plan for the proposed operations, and outlines the process to achieve these outcomes.

A detailed Closure Study will be developed over the life of the proposed operation. This will comprise conducting studies or acquiring information from different sources to develop a comprehensive Knowledge Base, consulting with stakeholders to develop a Closure Strategy, and preparing a documented Closure Management Plan.

The closure planning process will include the review and assessment of available documentation and appropriate consultation to determine the following:

- Existing environment;
- Legal/regulatory requirements relevant to closure;
- Review of existing and future environmental impacts relevant to closure; and
- Stakeholder expectations for closure.

4.1 Overview of Rio Tinto Closure Planning Process

The following section describes the key stages of the closure planning process based on the Rio Tinto 2004 Closure Standard (RT, 2004) (the Standard):

- **Stage 1 – Knowledge Base** – Collection and review of existing data and information relevant to closure including:
  - Characterisation of the socio-economic, cultural, biotic and abiotic environments;
  - National, regional and local legal and regulatory requirements for closure; and
  - Relevant externally generated information such as industry best practise papers;
- **Stage 2 – Closure Option Evaluation** – Identification and evaluation of closure options and determination of preferred options for closure. This requires consultation with internal and external stakeholders and involves:
  - Identification of potential post closure impacts;
  - Identification of options to address these impacts;
  - Evaluation of options against sustainability criteria. Pilbara Iron has developed a Sustainability Assessment and Decision Making Tool to assess closure options against the principles of sustainability and incorporating stakeholder issues and expectations; and
  - Selection of preferred options.

- **Stage 3 – Closure Strategy and Cost Estimate** – Development of strategy and cost estimate for preferred closure options, including:
  - Verification and rationalisation of inventories;
  - Assessment of risks associated with each option;
  - Determination of objectives and targets;
  - Development of closure measures to meet the objectives and targets;
  - Identification of assumptions associated with the closure measures; and
  - Preparation of a cost estimate for implementation of the closure measures.
- **Stage 4** – **Closure Management Plan** – Development of plans for:
  - Undertaking of research and technical improvement activities to reduce the uncertainty and risk associated with the Closure Strategy;
  - Communication and consultation with stakeholders including statutory agencies, community bodies, Pilbara Iron employees and contractors on closure planning and implementation activities; and
  - Pre-closure and post closure implementation of Closure Strategy, including decommissioning and rehabilitation.

As required by the Standard, the Closure Strategy must be developed and implemented by a multi-disciplinary team, comprising people with appropriate seniority, skill levels and experience.

Pilbara Iron is committed to developing a detailed Closure Study covering all aspects of the Rio Tinto Closure Standard for the proposed Mesa A and Warramboo operations.

5. Closure Scenarios

Closure may be initiated as a result of several scenarios, including Planned Closure, Unplanned Closure and Temporary Closure (Care and Maintenance). The consideration of these scenarios within closure planning activities is a specific requirement of the Strategic Framework for Mine Closure (ANZMEC/MCA, 2000).

- ***Planned Closure***

  Planned closure involves the timely evolution of closure planning activities over the life of the operation allowing for the appropriate development and implementation of the closure strategy. Consideration of a planned closure scenario allows for the inclusion of planned operational developments within the closure inventory.

- ***Unplanned Closure***

  In the event of sudden or unplanned closure, an accelerated closure strategy will need to be implemented, taking into account the site's non-operational status. Due to its immediate nature, consideration of an unplanned closure scenario does not require inclusion of planned operational developments within the closure inventory.

- ***Temporary Closure (Care & Maintenance)***

  As a result of economic or operational circumstances, it is possible that an operation may shut down on a temporary basis. A temporary shutdown of this nature is normally planned and assumes that the operation will recommence. The process involves the implementation of a closure strategy that takes into account the potential for future operations at the site.

This closure statement for the proposed Mesa A and Waramboo operations has focussed on planned closure of the proposed operations only. It is intended that future closure planning activities will include consideration of Unplanned Closure and Temporary Closure scenarios.

6. Existing Environmental and Social Context

Pilbara Iron has extensive experience in the operation of open-cut iron ore mines in the Pilbara region. Several Pilbara Iron managed operations are located in the Robe River Valley and at Mesa J in relatively close proximity to the proposed new operations. An extensive knowledge base of technical, environmental and social issues has been developed since the commencement of mining in these locations in the early 1970's.

The existing mining operations occur in a similar environmental context to the proposed Mesa A and Warramboo mines, such as climate, landform, soils, habitat, vegetation and fauna. The mineral resource occurs in similar geological conditions.

In addition, the social context of the existing and proposed operations is similar in that the location is extremely isolated, there are no private communities in close proximity, and the mine will be serviced from the company owned town of Pannawonica. The former land use in both cases has been pastoral activity, and the proposal falls within the same local government area as the existing operations. The Aboriginal cultural contexts are also similar to those at Mesa J, however further survey work is required to provide more detail on Aboriginal Heritage in the areas proposed for the Mesa A/Warramboo project.

Environmental and have been carried out to provide details of the existing environmental and social aspects of the proposed mining areas. Some Aboriginal Heritage surveys have also been conducted in the area. The outcomes of these detailed background investigations are provided in **Section 2**.

7. Closure Issues and Mitigation Actions

In Stage 3 (Closure Strategy), and Stage 4 (Closure Management Plan), of the ongoing Closure Study Process (**Section 4.1**), Pilbara Iron will develop detailed strategies designed to reduce the risks associated with the chosen closure option, and to minimise the impacts of closure. The Standard also requires the identification of opportunities to make positive contributions to the community post closure.

This section outlines the impact mitigation strategies that have been incorporated into the current conceptual mine plans, and identifies environmental, social and procedural issues which should be incorporated into ongoing closure planning studies for the Mesa A and Warramboo sites.

7.1 Current Project Impact Mitigation Strategies

One of the keys to achieving acceptable closure outcomes, and also reducing the cost of closure, is the successful integration of closure concepts into ongoing short and long-term mine planning activities. In this regard Pilbara Iron has already considered several key aspects of potential closure impacts in the preliminary planning of the proposed operations. The following considerations have been included in the current planning for the project to mitigate potential impacts of closure:

- Part backfilling of the mine voids to achieve more acceptable post mining landform. Progressive backfilling will be undertaken at Mesa A and Warramboo. Backfilling will be partial due to limited quantities of backfill material available;
- Strategic placement of some spoil heaps to restrict public access to mining areas and to minimise visual impacts of the operation from public roads;
- Retaining the outer escarpment of Mesa A along the north western, north eastern and south eastern sides (except for the area where the escarpment will be breached to allow access from the pit to the plant area) with mining to be conducted behind the remaining escarpments to offer protection for known Aboriginal heritage sites located around the escarpment. This mine configuration also assists to minimise visual impacts of both operations and post mining landforms from public roads;
- Identification of the sensitive nature of the sand-sheet land unit located adjacent to Mesa A and the preliminary design of infrastructure and spoil heaps to avoid direct impacts to this area;
- Preservation of an area for a previously undescribed skink species known to exist in a gully on the south eastern side of Mesa A;
- Commencement of research into suitable habitat for troglofauna found to inhabit parts of Mesa A, in order to ensure suitable troglofauna habitat is retained.
- Early establishment and rapid rehabilitation of outer edges of out-of-pit spoil dumps;
- The progressive nature of rehabilitation has been conceptually planned.

- Establishment of a permanent storm water diversion channel around the Warramboo mining area to achieve the following:
  - minimise erosional impacts on mining operations
  - potentially provide protection of post mining landforms from upstream storm flows, and
  - maximise the return of surface water to downstream catchments.

7.2 Environmental Issues

7.2.1 Mine Planning – Future Mining Potential

The description of resource (Section 3.2 of the PER) notes the presence of sub-grade ore underlying the high grade ores which are targeted for mining in Mesa A. Warramboo is described as not having sub-grade ores underlying the mining horizon. Potential exists in the future for mining the Mesa A sub-grade ore located in the floor of the currently planned open cut. This is dependent on whether wet processing of the sub-grade ore is considered viable. The mining of this sub-grade resource in the future has some obvious implications for mine closure.

As noted in **Section 5**, there are three key scenarios for closure being Planned Closure, Unplanned Closure and Temporary Closure (Care and Maintenance). It may be appropriate to undertake closure planning for the proposed Mesa A operations on the basis that the potential to mine the sub-grade deposits requires the objectives for closure to reflect the temporary nature of closure, until a decision on the future of mining of sub-grade ore is made.

Under the Temporary Closure scenario, as a result of economic or operational circumstances, it is possible that an operation may shut down on a temporary basis. A temporary shutdown of this nature is normally planned and assumes that the operation will recommence. The process involves the implementation of a closure strategy that takes into account the potential for future operations at the site.

For the purposes of this report, it has been assumed that a Planned Closure scenario is appropriate, with no confirmed plan for mining the sub-grade ore at Mesa A.

Impact Mitigation Actions

The following recommendations are made on the basis that a Planned Closure scenario is adopted.

Detailed planning of the Mesa A backfill operations will be required. This will include consideration of the location and configuration of Mesa A infill dumping to minimise sterilisation of the future sub-grade resource, and to minimise the disturbance of completed rehabilitation should future mining of the sub-grade ore be undertaken.

7.2.2 Final Landform and Surface Water Drainage;

The mining of Mesa A will result in pit development to a maximum depth of 50m. The outer escarpment of the mesa will be protected from mining and will substantially remain intact. A barrier of around 50 metres (at the top surface of the mesa) will be excluded from mining, except for the area where the escarpment will be breached to allow access from the pit to the plant area. The Warramboo mining area consists of one large, relatively shallow open cut with a series of deeper mining areas in the floor of the pit. The area of disturbance traverses the residual upland landscape from the incised upland in the south east down to the edge of a broad floodplain at its north western extent. The indicative pit limits are shown in **Figure 3**. Approximately 800 hectares of upstream catchment report to the southern mining area mostly through one large incised gully.

Impact Mitigation Actions

Mine planning, including backfilling will be refined to minimise closure impacts to surface water in both the Mesa A and Warramboo pits. Detailed mine planning will optimise the use of backfill material to maximise the extent of each pit that is self draining upon closure and to buttress the internal walls of the Mesa A pit to reduce the internal wall final angle. This will potentially allow rehabilitation and revegetation of sections of the internal walls.

The western half of the Mesa A pit may potentially drain to natural surface to the west, and the eastern half of the pit could use the haul road alignment through the centre of the south eastern escarpment as its the primary drainage route. The final drainage structures exiting the mesa to the south east will be designed to protect the adjacent sand sheet landform from drainage flows out of the mesa. This will be required to reduce the risk of storm flows damaging the adjacent sand sheet land unit.

Any diversion channels around the Warramboo pit will be left in place upon closure to direct runoff from the surrounding areas away from the pit. Detailed design parameters will be selected to ensure the proposed drainage diversion systems are substantial enough to meet long term final design requirements.

Detailed consideration will be given to the construction of all permanent drainage structures to improve long term stability and reduce erosional scouring of the structures. These considerations include maintaining acceptably low flow velocities, minimising constructed batter angles, lining of drop structures with competent rock and maximising vegetation of flow paths.

7.2.3 Groundwater;

An assessment of pre-mining groundwater conditions is provided in **Section 2.1.5 of the PER**. It has been established that mining activities at both Mesa A and Warramboo mining areas will remain above the pre-mining groundwater table. Subsequently there is not predicted to be any

exposure of groundwater in the post mining voids beyond closure. As both mining areas will be designed to free-drain any collected stormwater, there will be minimal potential for stored surface water to interact with groundwater below the mine floor. No specific groundwater impact mitigation measures are anticipated.

7.2.4 Acid Mine Drainage

A description of the geological conditions of each proposed mining area is included in **Section 2.1.3**. This report shows geological conditions are similar to those encountered in the existing Mesa J mining area. Mining will occur to shallow depths only, predominantly extracting ore with low waste to ore ratios of around 0.4:1. The geology is described as simple and flat lying. Experience with mining these horizons at Mesa J shows very low potential for acid generation through oxidation of waste or sub grade material. No specific AMD management measures are anticipated.

7.2.5 Geotechnical Stability of Voids

Failure of unstable void walls may lead to increased risk to the safety of public, graziers, livestock or wildlife in the future.

Experience with mining in these geological conditions has given Pilbara Iron confidence that the integrity of the final mine faces will be maintained in the long term. These mine faces form the internal surfaces of the mesa escarpment after mining has finished and will be approximately 50 metres wide at the top.

Impact Mitigation Actions

The vertical angle of the final Mesa A internal surface will be engineered to ensure long term stability.

Potential exists to utilise backfill material to cover and stabilise the internal mining surfaces should stability issues be encountered. This could also reduce the visual impact by providing opportunities to revegetate the internal surfaces of the mesa escarpment. A geotechnical assessment will be prepared to guide final wall design.

7.2.6 Soil Erosion

Potential exists for erosion impacts to occur post closure, examples of impacts include :

- Failure of rehabilitated drainage structures to carry stormwater runoff.
- Loss of soil through sheet erosion.
- Damage to vegetation on rehabilitation areas.
- Sedimentation of runoff water reporting to downstream water courses; and

- Runoff impacts on adjacent non-mined areas.

Impact Mitigation Actions

The following impact minimisation measures will be implemented:

- Develop post mining drainage design to minimise impacts.
- Incorporate drainage controls into ongoing mine planning.
- Determine appropriate vegetation species and coverage criteria and agree with regulators.
- Develop a staged rehabilitation establishment schedule to minimise impacts.

7.2.7 Impacts on Sensitive Adjacent Landforms or Habitats

Existing terrestrial vegetation and flora are described in **Section 2.2.1 of the PER**. There have not been any sensitive habitats identified adjacent to the Warramboo mining area. Closure planning and rehabilitation activities conducted to Rio Tinto and Pilbara Iron standards will provide adequate protection for adjoining areas, with particular regard to the specific issues noted in this section.

Included in **Section 2** is a description of the sand sheet land unit located adjacent to the south eastern edge of the Mesa A mining area. This land unit is considered likely to be restricted in distribution in both the local area and region and is considered to be of very high conservation significance.

Potential exists for impacts to occur to this area from the post mining landscape including the following:

- Sediment laden runoff reporting to the adjacent sand sheet land unit from rehabilitated mining areas.
- Concentrated runoff flows causing erosional scouring of the adjacent sand sheet areas.

Preliminary mine planning has already delineated the majority of the sand sheet land unit as an "Exclusion Zone", shown on **Figure 4**, where direct disturbance is not to occur.

Impact Mitigation Actions

The following impact controls should be undertaken:

Drainage controls near the sand sheet area will be incorporated into ongoing mine planning to direct potentially sediment contaminated runoff from exposed mining areas away from the sand sheet. In particular, drainage design for closure will direct run-off from the mine pit area away from the sand sheet.

7.2.8 Air Quality

Potential exists for impacts from wind blown dust from exposed areas, including rehabilitation areas with insufficient vegetation, leading to diminished ambient air quality and /or vegetation impacts on the surrounding landscape.

Impact Mitigation Actions

The following mitigation measures should be incorporated in the Closure Management Plan:

- Develop closure criteria for acceptable vegetation cover with regard to dust emission factors.
- Develop a staged rehabilitation establishment schedule to minimise air quality impacts.

7.2.9 Soil Contamination

Contaminated soil remaining on site after closure can lead to impacts on vegetation re-establishment and groundwater. To minimise soil contamination, hydrocarbon storage and handling facilities to meet AS1940 will be installed prior to commencing operations.

Impact Mitigation Actions

The following controls will be implemented to reduce the risk of impacts on closure from contaminated soil:

- Establish and maintain a register of contaminated soil sites during operations.
- Investigate for soil contamination during removal of hydrocarbon and chemical storage facilities.
- Maximise remediation of contaminated sites on an ongoing basis to limit the extent of impacts at closure.

7.2.10 Waste Disposal

Impacts may occur to groundwater and soils through leachates from waste disposal areas remaining after closure. Closure activities may require the disposal of substantial quantities of waste such as building waste at the time of closure.

Impact Mitigation Actions

The following controls will be implemented to reduce the risk of impacts on closure from waste disposal:

- Establish and maintain a register of waste disposal sites during operations.
- Construct waste disposal sites to appropriate standards both during operations and at closure.

- Consider final mine design and closure issues in selecting waste disposal locations during operations.

7.2.11 Sustainable Revegetation

Failure to establish sustainable vegetation communities fit for post mining landuse, eg grazing or habitat re-establishment, may result in the following impacts:

- Future maintenance costs post closure.
- Failure to meet stakeholder expectations.
- Failure to meet legal obligations.
- Erosion of final landform resulting in impacts to surface water, loss of further vegetation and slope instability.
- Damage to corporate reputation.

Impact Mitigation Actions

The following controls will be implemented to reduce the risk of impacts on closure from failed vegetation establishment:

- Undertake stakeholder consultation to understand preferred post mining landuse options prior to rehabilitation.
- Develop closure criteria for acceptable vegetation cover with regard to long term sustainability and final landuse.
- Develop progressive rehabilitation schedule to maximise opportunities to measure sustainability of outcomes.
- Incorporate learnings from rehabilitation activities on other sites.

7.3 Social Issues

7.3.1 Stakeholder Expectations

Risks exist where final landform design and final closure options do not meet stakeholder expectations. These risks can include the following:

- Failure to gain closure acceptance and incurring ongoing financial liability.
- Corporate reputation damaged.
- Increased difficulty in gaining approval for access to future resources.

Impact Mitigation Actions

The Closure Planning Process outlined in **Section 4** includes actions to address and incorporate stakeholder expectations, specifically Stage 2 – Closure Option Evaluation. This process involves the identification and evaluation of closure options and determination of preferred options for closure. This requires consultation with internal and external stakeholders to determine the following:

- Identification of potential post closure social and economic impacts;
- Identification of options to address these impacts;
- Evaluation of options against sustainability criteria. Pilbara Iron has developed a Sustainability Assessment and Decision Making Tool to assess closure options against the principles of sustainability and incorporating stakeholder issues and expectations; and
- Selection of preferred options.

7.3.2 Insufficient Stakeholder "ownership" of Post Mining Land Uses

Insufficient stakeholder involvement may result in a lack of acceptance or 'ownership' of the chosen closure option. As a result this may lead to ongoing maintenance and improvement responsibilities not being divested to future stakeholders, subsequently leading to ongoing company liability.

Impact Mitigation Actions

As noted in **Section 4**, The Pilbara Iron Closure Planning Process and the Rio Tinto Standard require that stakeholders be engaged and participate in the process of determining appropriate options for post closure land uses.

7.3.3 Regional Economic Impacts

Failure to meet the requirement of the Rio Tinto Standard to maximise community opportunities through closure may result in the following impacts:

- Damage to relationships with stakeholders.
- Internal and external business reputation damage.
- Increased difficulty in gaining approval for access to future resources.

Impact Mitigation Actions

Consultation with a range of stakeholders is required to identify opportunities that may be provided through the closure process. This process has commenced for other areas of the Robe Valley and many of the issues raised are also relevant to Mesa A.

7.3.4 Visual Impacts;

Inappropriate final landform design that is not compatible with the surrounding landscape could result in impacts such as:

- Long term corporate reputation damage.
- Increased difficulty in gaining approval for access to future resources.

Impact Mitigation Actions

Visual impacts for the life of the project and at closure were assessed as a separate study for the PER. The modelling considered the adequacy of the 50m exclusion zone around the perimeter of Mesa A, the strategic placement of waste dumps and mine bunds to minimise visual impacts of the mine site and pits, and the visual impact of the highway overpass. The following impact mitigation measures have been incorporated into the preliminary mine design, and will be refined in future detailed mine planning activities:

- Retain the 50m exclusion area on the top edge of Mesa A, except for the area where the escarpment will be breached to allow access from the pit to the plant area.
- Backfill mine pits where practicable.
- Design, place, reshape and rehabilitate waste dumps to be in keeping with the local landscape.
- Final landform design will be incorporated into long and medium term mine planning activities to ensure the correct placement of spoil consistent with the final landform design.

7.3.5 Loss of Ongoing Employment / Business Opportunities

Closure may result in impacts to the local community through the loss of ongoing employment and business opportunities. In the case of the proposed Mesa A and Warramboo operations, these mines will be either supported from the company owned township of Pannawonica or combined with some fly-in/fly-out workforce arrangements. Subsequently there will be little opportunity for indirect employment or business opportunities generated by flow-on effects. However to avoid potential for adverse publicity, a communication plan will be developed for employees and external

stakeholders including contractors to allow maximum notice to be given regarding potential closure.

In addition, the closure planning process will incorporate the development of Pilbara Iron Human Resources management actions such as skills audits, redeployment and retraining opportunities, redundancy schemes and a communications plan.

In Stage 3 (Closure Strategy), and Stage 4 (Closure Management Plan), of the ongoing Closure Study Process (**Section 4.1**), Pilbara Iron will develop strategies designed to reduce the risks associated with the chosen closure option, and to minimise the impacts of closure. The Standard also requires the identification of opportunities to make positive contributions to the community post closure.

7.3.6 Public Access and Safety;

Failure of unstable void walls has potential to cause risks to public safety. Access to highwalls and steep final surfaces may also cause risks to public safety through falls or vehicle and livestock accidents.

Impact Mitigation Actions

- Where mine bunds are required for public safety reasons, the mine bunds will be left in place upon closure. Consideration will be given to drainage implications of the design and positioning of these bunds.
- Mine voids will be self-draining upon closure – reduced public risk

7.4 Infrastructure Issues

The proposed development includes several options for the establishment of infrastructure necessary to access and operate the development. These options are described in **Section 3** of the PER and include descriptions of the following proposed facilities:

- Ore sizing facility.
- Access roads and haul roads for crossing the North-West Coastal Highway.
- Ore transport corridors between Mesa A and Mesa J.
- Service supply systems such as water, power and communications.
- Offices, workshops and other site facilities.

The Closure Planning Process described in **Section 4**, includes extensive consultation with stakeholders, including government and community, to determine sustainable post mining landuses. This includes potential ongoing uses of infrastructure. Should such infrastructure provide

opportunities to contribute to sustainable community outcomes, the opportunity exists for items of infrastructure to be utilised by stakeholders beyond the closure of these mining operations. Potential to retain appropriate items of infrastructure will be incorporated into the Closure Management Plan to suit stakeholder requirements.

In the event that no ongoing post closure uses have been identified for infrastructure through the stakeholder consultation process, all infrastructure will be decommissioned and rehabilitated in a manner consistent with the ongoing post closure landuse, and consistent with legal obligations.

7.5 Procedural Issues

7.5.1 Developing and Gaining Acceptance of Closure Completion Criteria

Pilbara Iron has commenced the process of defining closure acceptance criteria for its operations. This process requires ongoing consultation with relevant stakeholders such as the Department of Industry and Resources (DOIR), the Department of Environment (DoE) and the Department of Conservation and Land Management (CALM) to gain acceptance of appropriate closure criteria.

7.5.2 Future Land Tenure

Post mining land tenure may be unsuitable for selected ongoing landuses, and this issue may limit the implementation of particular options. Restrictions to stakeholder acceptance and “ownership” of post mining land could result from inappropriate land tenure. The Closure Planning Process will consider final land tenure and negotiate with stakeholders towards a suitable outcome.

8. Closure Strategy

8.1 Post Closure Land Use Options Identification

No formal assessment of post closure land use alternatives, land capability, or stakeholder expectations has been undertaken to determine specific post closure land use objectives. As stated in **Section 7.5**, a stakeholder consultation and post closure land use options identification program will be developed to guide the ongoing closure planning process.

8.2 Closure Option Identification and Evaluation

The Pilbara Iron Sustainable Development Decision Making Methodology (SDM) will be utilised to identify and evaluate potential post-closure land use options.

Pilbara Iron recognises that the involvement of a wide range of stakeholders with different skills and disciplines is important for thorough and effective closure planning. Pilbara Iron is also cognisant of the impact that the closure of their operations may have on the local and regional communities in which they operate. Therefore, as an essential element of the Closure Study, internal and external stakeholders will be engaged to determine their understanding of the potential impacts of closure, and to develop and evaluate options for closure that may lead to improved contributions to the sustainable future of the community beyond closure.

To meet this requirement and to engage Pilbara Iron's commitment to sustainable development principles the option analysis will be based on the Pilbara Iron Sustainable Development Decision-Making Methodology (SDM). The SDM is designed to facilitate the process of determining which of the project options makes the greatest contribution to sustainable development

Parameters (factors, measures and limits) for use in the options analysis are to be developed based on the following information:

- Pilbara Iron sustainable development principles and Rio Tinto closure objectives;
- Indicators of Regional Development in Western Australia;
- Environmental, economic and social (EES) issues identified during stakeholder consultation;
- EES issues identified during the review of the knowledge base;

8.3 Objectives and Targets for Closure

To achieve the desired post-closure land use objective and to drive continual improvement in closure planning, specific closure targets will be established. These will reflect the chosen closure land use option, determined using the selection and evaluation methodology outlined in **Section 8.2**.

The preliminary closure objectives established below have been derived from recent closure planning activities (SKM 2005). The objectives are consistent with the closure criteria defined by the Strategic Framework for Closure (MCA, 2000), and need to be continuously reviewed and improved during future closure planning for the proposed operations.

Future closure planning activities need to consider more specific objectives and targets consistent with stakeholder expectations and appropriate technical evaluation. For example, a target for rehabilitation has been assumed for establishment of provincial indigenous species.

To facilitate the further development of closure plans, preliminary closure objectives have been developed under the following themes:

- Decommissioning;
- Decontamination;
- Rehabilitation;
- Management and Workforce; and
- Community and Stakeholder.

The preliminary closure objectives for the proposed Mesa A and Warramboo operations are presented below:

Decommissioning Objectives

- Facilitate opportunities for the ongoing utilisation of infrastructure or facilities to contribute to post closure community sustainability objectives.
- Relinquish the site in a condition that minimises risks to human health or safety or to the natural environment.
- Prioritise sustainable economic returns from decommissioning to offset aspects of closure financial costs.

Rehabilitation Objectives

- Construction of post-mining landforms that are safe, stable and aesthetically compatible with the surrounding landscape.
- Establishment of sustainable vegetation communities consistent with the agreed post closure final landuse.
- Construction of post-mining landforms that are free draining and non-polluting

Decontamination Objectives

- No ongoing contaminated site management is required beyond five years post-closure.

Management and Workforce Objectives

- No unacceptable impacts or unpredicted ongoing liabilities for the Rio Tinto business from closure of the Mesa A or Warramboo mines.
- Transfer of appropriate skilled and experienced personnel within Rio Tinto.
- Retain human resources to implement closure plans.

Community and Stakeholder Objectives

- Develop post closure land uses that may lead to improved contributions to the sustainable future of the community beyond closure.
- Ensure Aboriginal community concerns are identified and addressed.
- Maintain indigenous heritage values in the surrounding area.
- Maintain communication with stakeholders (government authorities, local and Aboriginal community, businesses and service providers, and employees) through closure.

8.4 Closure Planning Research and Improvement Actions

Further studies will be undertaken in the following areas to better understand the potential impacts of closure and to enable the development of impact mitigation strategies

- A stakeholder consultation and post closure options identification program will be developed to determine options for closure planning, to refine closure objectives and guide the ongoing detailed closure planning process;
- The potential for impacts on the environmentally sensitive sand sheet land unit adjacent to the Mesa A operation requires further detailed investigation to refine drainage system designs;
- Specific research into the distribution and habitat needs of troglofauna is required to determine suitable post mining rehabilitation objectives.
- Further investigation of pre-mining Aboriginal heritage sites will be required to determine suitable post mining landuse options.
- Further consultation is required with regulatory bodies, to develop closure acceptance criteria, including monitoring programs. This is required to be developed for the approval of the

Department of Industry and Resources, in consultation with the Department of Conservation and Land Management and the Department of Environment.

9. Closure Study Review

Closure planning is a life of mine process that continually evolves as aspects of the operations change and understanding of specific closure requirements and constraints improve. This Closure Statement is based on the environmental and socio-economic information, and mine planning and development details made available at time of preparation. It represents a commitment to the process of developing a definitive mine Closure Study and Closure Management Plans which will evolve through periodic review to reflect changes in mine development and operational planning and social and environmental conditions. The Closure Study will also evolve as specific aspects and impacts of closure are identified, assessed and amended based on a program of investigation and research.

9.1 Closure Study Review Periods

It is a specific requirement of the Rio Tinto Closure Standard that Closure Studies be periodically reviewed. The review must account for completion of specific improvement actions associated with Closure Management Plans as well as account for changes to operational activities. This review will be undertaken at least every 5 years and should also include a complete assessment of the appropriateness of the Closure Study and Closure Management Plans.

10. Glossary of Terms

The following terms are used in this document:

Business:	A subsidiary or associated company that is managed by Rio Tinto (i.e. Robe River Mining Company Pty Limited).
Operation:	A production unit or exploration prospect within a business (i.e. Pannawonica).
Facility:	A functioning area within an operation (i.e. crushing plant).
Closure:	The process of withdrawing from an operation and meeting Group and business policies, and community and government obligations associated with ceasing production.
Closure Planning:	A term used to cover all aspects of planning for an operation's closure including undertaking the closure study, defining the closure strategy, preparing the closure statement and eventually producing a decommissioning plan prior to ceasing production.
Closure Study:	The process of gathering sufficient information to facilitate the formulation of viable closure options.
Closure Strategy:	A conceptual outline of how the operation will be closed, taking into account the options open, the most viable alternatives and estimated costs. The closure strategy is derived and endorsed by the business's senior management based on information provided in the closure study. The strategy may be subject to change should a more viable alternative be identified at a later date that does not conflict with any externally agreed approach.
Closure Statement:	A formal document detailing the closure strategy, cost estimate and summarising the key information from the closure study.
Decommissioning Plan:	A detailed plan commenced at least 2 years prior to ceasing production, detailing actions to achieve the requirements of the closure strategy. The decommissioning plan will include specific actions to achieve closure, accurate cost estimates, schedule of works etc. It forms the basis of a submission to the relevant boards for capital approval in accordance with the 'Capital Expenditure Management' section of the Rio Tinto Controllers Manual. This process may also be applied to certain facilities if they are shut down and decommissioned prior to final closure.
Decommissioning:	The engineering and management actions needed to deliver the objectives as set out in the closure strategy and detailed in the

	decommissioning plan, and commences with the cessation of production.
Post decommissioning management:	The activities required after decommissioning and before closure. It would include, amongst other things, monitoring the success of closure and taking any remedial actions should the closure targets not be met. These remedial actions may require some form of perpetual care.

11. Bibliography

ANZECC (1992), Australian Water Quality Guidelines for Fresh and Marine Waters – National Water Quality Management Strategy. Australian and New Zealand Environment and Conservation Council.

ANZECC/MCA (2000). Strategic Framework for Mine Closure.

Aquaterra (2001). Pannawonica Turee B Production Bore Installation and Testing. Unpubl. report. Aquaterra Consulting Pty Ltd. April 2001.

Department of Mines (Undated). Guidelines for Waste Dump Design and Rehabilitation.

Department of Mines (1991). Guidelines on Safety Bund Walls around Abandoned Open Pits.

Department of Minerals and Energy (1994). Environmental Management of Quarries: Development, Operation and Rehabilitation Guidelines.

Department of Minerals and Energy (1996). Guidelines for Mining in Arid Environments.

Department of Environmental Protection (1998). Environmental Guidelines – Contaminated Sites.

ecologia / Robe (1998). Pannawonica Project Environmental Review and Management Programme. Unpubl. report, ecologia Environmental Consultants and Robe River Mining Co. Pty Ltd. March 1998.

Environment Australia (1995a). Best Practice Environmental Management in Mining - Environmental Monitoring and Performance.

Environment Australia (1995b). Best Practice Environmental Management in Mining – Tailings Containment.

Environment Australia (1995c). Best Practice Environmental Management in Mining – Rehabilitation and Revegetation.

Environment Australia (1997a). Best Practice Environmental Management in Mining – Hazardous Materials Management, Storage and Disposal.

Environment Australia (1997b). Best Practice Environmental Management in Mining – Managing Sulphidic Mine Wastes and Acid Drainage.

Environment Australia (1998). Best Practice Environmental Management in Mining – Landform Design for Rehabilitation.

Environmental Protection Authority (1997). Policies, Guidelines and Criteria for Environmental Impact Assessment: A Site Remediation Hierarchy for Contaminated Sites. No 17 – Interim Policy.

Groves D.I., Barley M.E. & Shepherd J.M. (1994). Geology and Mineralisation of Western Australia. In M.C. Dentith M.C., K.F. Frankcomb, S.E. Ho, J.M. Shepherd, D.I. Groves & A. Trench (eds) "*Geophysical Signatures of Western Australian Mineral Deposits*". Geology & Geophysics Dept. (Key Centre) and UWA Extension, The University of Western Australia, Publication 26, 1994 and Australian Society of Exploration Geophysicists, Special Publication 7: 1-28.

Hall, J. (1998). The Operation and Management of Decommissioned Pits in the Goldfields. Proceedings of the Workshop on Rehabilitation of Arid and Semi-arid Lands. Goldfields Land Rehabilitation Group, Kalgoorlie 1998.

Haylock, W.J. and Harris, M.A. (1996). Key issues in waste rock dump design. Proceedings: Post-mining Landform Stability and Design Workshop. Australia Centre for Minesite Rehabilitation Research, Brisbane.

John S.L. & Wright A.H. (2001). Central Pilbara Groundwater Study. Water and Rivers Commission, Hydrogeological Record Series, Report HG 8, 102p. http://www.wrc.wa.gov.au/public/HG/hg8/extras.pdf.

NHMRC (1996). *Drinking Water Guidelines.* National Health and Medical Research Council.

O'Brien & Assoc.'s (1992). Marandoo Iron Ore Mine and Central Pilbara Railway. Environmental Review and management Programme. Hamersley Iron Pty Ltd. Frank Daniels Pty Ltd ISBN 0 9590646 9 9.

Rawlinsons (1998). Australian Construction Handbook. Rawlhouse Publishing Pty Ltd Perth WA.

Sinclair Knight Merz (2003). Robe Mine Closure Planning – Gap Analysis Report. Rev 0.

Rio Tinto (1999). Closure Planning Guidelines.

Wright, A (2000). What do we do with the great big holes that are left behind once mining ceases. Proceedings of the 25th national and 4th “International Environmental Workshop. Minerals Council of Australia, Perth 2000.