



Marandoo Mine Phase 2

Hamersley Iron Pty Ltd

**Report and recommendations
of the Environmental Protection Authority**

**Environmental Protection Authority
Perth, Western Australia**

**Report 1355
April 2010**

Environmental Impact Assessment Process Timelines

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Summary and recommendations

This report provides the Environmental Protection Authority's (EPA's) advice and recommendations to the Minister for Environment on the proposal to extend mining at the existing Marandoo mine below the water table by Hamersley Iron Pty Ltd, a member of the Rio Tinto group.

Section 44 of the *Environmental Protection Act 1986* (EP Act) requires the EPA to report to the Minister for Environment on the outcome of its assessment of a proposal.

The report must set out:

- The key environmental factors identified in the course of the assessment; and
- The EPA's recommendations as to whether or not the proposal may be implemented, and, if the EPA recommends that implementation be allowed, the conditions and procedures to which implementation should be subject.

The EPA may include in the report any other advice and recommendations as it sees fit.

The EPA is also required to have regard for the principles set out in section 4A of the EP Act.

Key environmental factors and principles

The EPA decided that the following key environmental factors relevant to the proposal required detailed evaluation in the report:

- (a) Flora and Vegetation;
- (b) Groundwater; and
- (c) Rehabilitation and Decommissioning.

There were a number of other factors which were very relevant to the proposal, but the EPA is of the view that the information set out in Appendix 3 provides sufficient evaluation.

The following principles were considered by the EPA in relation to the proposal:

- (a) the precautionary principle;
- (b) the principle of biological diversity and ecological integrity; and
- (c) the principle of waste minimisation.

Conclusion

The EPA has considered the proposal by Hamersley Iron to extend mining at the existing Marandoo Mine below the water table. The EPA considers that the location of the proposal surrounded by the Karijini National Park demands that the impacts associated with the proposal can be managed to meet the EPA's environmental objectives for the area with a high level of confidence.

The key environmental assets to be protected during the implementation of this proposal include:

- the Priority Ecological Community (PEC) Coolibah Woodlands within the Karijini National Park; and
- springs, pools and gorges within the Karijini National Park.

The EPA notes that extensive hydrological investigations and modelling have been carried out at Marandoo. Following advice from the Department of Water and review of the model by independent experts, the EPA accepts the proponent's conclusion that leakage from the unconfined aquifer to the confined aquifer is highly unlikely due to the nature of the clay layer separating the aquifers below the Coolibah Woodland. The EPA notes that, given this conclusion, groundwater drawdown in the vicinity of the Coolibah Woodland is predicted to be in the order of 2.5-4m.

The EPA also notes that the Coolibah Woodland is unlikely to be entirely dependant on groundwater and that, given the slow rate of the predicted fall in groundwater over 21 years resulting from mine dewatering, it is likely that the Coolibahs would be able to adapt to the changes in groundwater. The EPA has recommended a condition requiring that there be no impact to the Coolibah Woodland as a result of this proposal.

In the unlikely event that a decline in tree health in the Coolibah Woodlands is detected, the proponent has outlined contingency management strategies including artificial irrigation of the woodlands. The EPA considers that irrigation of the woodland using the currently proposed methods is not appropriate. This is due to the potential to change the assemblage of vegetation in the Woodland and the physical disturbance to the Woodland and the Karijini National Park from the proposed irrigation infrastructure. The EPA has recommended a condition to ensure that alternative management strategies are developed by the proponent using appropriate experts prior to the commencement of dewatering, and to ensure that these contingencies, if required, are delivered in an appropriate and timely manner.

The modelling and water chemistry studies conducted by the proponent demonstrate that, with the exception of Minthicundunna Spring, water sources including springs, gorges and pools in the Karijini National Park are unlikely to be impacted by drawdown associated with the proposal. Monitoring and mitigation strategies to manage impacts to Minthicundunna Spring have been proposed.

The EPA considers that, given the existing evidence, springs and pools within the Karijini National Park are unlikely to be impacted by the proposal. However, given the high ecological, cultural and tourism values of these water sources, the EPA has recommended a condition to ensure that these values are maintained in the event that modelling is proved to be inaccurate.

The EPA notes that intermittent discharge of excess dewater to the environment would be required. The Hamersley Station Themeda Grassland Threatened Ecological Community (TEC) is located approximately 26km downstream of the proposed dewater discharge points. The proponent has predicted that impacts discharge would not extend further than 20kms from the discharge points.

The EPA accepts the proponent's conclusion that areas impacted by the discharge are likely to return to a similar composition to pre-mining within decades after the cessation of discharge. The EPA has recommended a condition to ensure that dewater discharge does not travel outside the area predicted by the proponent, and that the spread of weeds does not significantly impact vegetation along the proposed dewater discharge channels.

The EPA has also recommended conditions to ensure that, in the event of sinkhole formation occurring within the Karijini National Park as a result of dewatering activities, sinkholes would be detected in a timely manner and managed appropriately.

The EPA has concluded that it is unlikely that the EPA's objectives would be compromised, provided there is satisfactory implementation by the proponent of the recommended conditions set out in Appendix 4, and summarised in Section 4.

Recommendations

The EPA submits the following recommendations to the Minister for Environment:

1. that the Minister notes that the proposal being assessed is to extend operations at the existing Marandoo mine site below the water table;
2. that the Minister considers the report on the key environmental factors and principles as set out in Section 3;
3. that the Minister notes that the EPA has concluded that it is unlikely that the EPA's objectives would be compromised, provided there is satisfactory implementation by the proponent of the recommended conditions set out in Appendix 4, and summarised in Section 4; and
4. that the Minister imposes the conditions and procedures recommended in Appendix 4 of this report.

Conditions

Having considered the proponent's commitments and information provided in this report, the EPA has developed a set of conditions that the EPA recommends be imposed if the proposal by Hamersley Iron to extend operations at the existing Marandoo Mine below the water table is approved for implementation. These conditions are presented in Appendix 4. Matters addressed in the conditions include the following:

- (a) that the proponent shall ensure that groundwater abstraction, dewatering activities and mitigation strategies required to implement the proposal do not adversely impact the Coolibah Woodlands within the Karijini National Park;
- (b) that the proponent shall develop appropriate mitigation strategies to remediate any decline in health of the Coolibah Woodlands to the satisfaction of the CEO of the Office of the EPA, on advice from DEC prior to the commencement of any dewatering activities;
- (c) that the proponent shall ensure that groundwater abstraction, dewatering and interception of surface flows required to implement the proposal do not adversely affect any of the springs, pools or creeks in the Karijini National park;

- (d) that there is a TEC located approximately 26kms downstream of the dewater discharge point. The proponent shall ensure that dewater discharge does not extend more than 20kms along the designated discharge channels and that there is no increase in the variety or distribution of weed species as a result of dewater discharge;
- (e) that the proponent shall ensure that sinkhole formations attributable to the proposal are detected in a timely manner and managed appropriately; and
- (f) that closure and rehabilitation activities shall be planned and implemented appropriately.

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1. Introduction and background

This report provides the advice and recommendations of the Environmental Protection Authority (EPA) to the Minister for the Environment on the key environmental factors and principles for the proposal by Hamersley Iron Pty Ltd to extend mining at the existing Marandoo mine below the water table.

The existing Marandoo mine was approved by the Minister for the Environment in 1992. Mining commenced in 1994 and current production is 15 million tonnes per annum. The mine is located within the Marandoo mining lease, which was excised from the Karijini National Park in 1991, and is bounded by the park on three sides. (Figures 1 and 2)

To date, all mining at the existing mine has taken place above the water table. The current proposal involves widening and deepening the existing mine pit to mine ore below the water table.

The proposal was referred to the EPA on 2 July 2007. A level of assessment was set at Public Environmental Review (PER) with a review period of eight weeks on 30 July 2007. This level of assessment was based on the scale of mining, and impacts to vegetation, flora, and cultural values, with particular regard to priority ecological communities and the values of the adjacent Karijini National Park. The PER document was released for public review between 29 September and 25 November 2008.

Further details of the proposal are presented in Section 2 of this report. Section 3 discusses the key environmental factors and principles for the proposal. The Conditions to which the proposal should be subject, if the Minister determines that it may be implemented, are set out in Section 4. Section 5 provides Other Advice by the EPA, and Section 7 presents the EPA's Recommendations.

Appendix 6 contains a summary of submissions and the proponent's response to submissions and is included as a matter of information only and does not form part of the EPA's report and recommendations. Issues arising from this process, and which have been taken into account by the EPA, appear in the report itself.

2. The proposal

Hamersley Iron Pty Ltd (a member of the Rio Tinto group) proposes to expand existing mining operations at Marandoo by mining below the water table. This would entail expansion of the existing mine pit and development of new waste dumps. The proposal would utilise existing infrastructure and services associated with current Marandoo operations, however, additional infrastructure would be required.

The proposal is located in the central Pilbara region, approximately 37 kilometres (kms) east of Tom Price and 77 km north-east of Paraburdoo (Figure 1). The mining component of the proposal is confined to the existing Marandoo mine lease, which was excised from Karijini National Park in 1991 (Figure 2). Dewatering water would be piped from Marandoo to the Southern Fortescue borefield, Tom Price and

Hamersley Station. The locations of the major components of the proposal are shown in Figure 3.

The key components of the proposal considered in this assessment include:

- expansion and deepening of the existing open cut pit below the water table;
- modification of the existing dry processing plant to accommodate wet processing;
- construction and operation of a Residue Storage Facility (RSF);
- expansion of existing unsealed roads;
- operation of a dewatering borefield and associated infrastructure to allow dewatering of the confined bedrock aquifer;
- operation of a dewatering pipeline from Marandoo to the Southern Fortescue Borefield (Southern Fortescue Borefield) and associated pipelines for re-injection, and development of approximately four new re-injection bores to allow for disposal of excess dewatering water;
- disposal of excess dewatering water;
- construction of additional buildings and infrastructure including sewage treatment facilities, power supply, and construction camp.

The main characteristics of the proposal are summarised in Table 1 below. A detailed description of the proposal is provided in Section 4 of the PER (Rio Tinto, 2008).

Table 1: Summary of key proposal characteristics

| Element | Description |
|---------------------|--|
| General | |
| Project life | 15 – 20 years. |
| Area of disturbance | Up to 1000 hectares direct disturbance, localised impact to riparian vegetation along discharge drainage lines. |
| Ore production rate | Approximately 16 Million tonnes per annum |
| Mining | |
| Pit | Single pit, Marra Mamba ore; mining below the water table. |
| Waste rock disposal | Surface dumps; expansion of existing stockpiles and progressive backfilling of mine pits. |
| Dewatering | Peak dewatering of up to 100 megalitres per day. |
| Dewater disposal | Dewater disposal through water use hierarchy including: <ul style="list-style-type: none"> • use on site; • transfer to Tom Price; • re-injection at southern Fortescue Borefield; and • discharge to the environment. |
| Processing | Wet processing of ore. |
| Residue | Construction and operation of residue |

| Element | Description |
|-----------------------|---|
| | storage facility. |
| Greenhouse gases | Up to 190,000 tonnes CO ₂ – e per year, plus one-off emission of 50,000 tonnes CO ₂ – e resulting from clearing. Up to 15.3 tonnes CO ₂ – e per kilotonne of ore. |
| Infrastructure | |
| Water supply | All water requirements supplied from dewatering activities. |
| Product transport | By existing rail facilities to Dampier and Cape Lambert. |

Since release of the PER, changes to the proposal have been made by the proponent. These include:

- change to the predicted peak dewatering rate from 75ML/day to 100ML/day;
- recalibration of the groundwater model – drawdown of 2.5 to 4m is now predicted to occur in the unconfined aquifer over 21 years as opposed to 8 years as previously predicted.
- change to the amount of dewater able to be transferred to Tom Price from 30ML/day to 18ML/day, removing the requirement for additional infrastructure at Tom Price; and
- Hamersley irrigated hay scheme proposed as additional dewater disposal method.
Note: the impacts of this scheme are to be assessed separately to this proposal.

The potential impacts of the proposal initially predicted by the proponent in the PER document (Rio Tinto 2008) and their proposed management are summarised in Table ES2 and Appendix 2 of the proponent’s document.

3. Key environmental factors and principles

Section 44 of the EP Act requires the EPA to report to the Minister for Environment on the environmental factors relevant to the proposal and the conditions and procedures, if any, to which the proposal should be subject. In addition, the EPA may make recommendations as it sees fit.

The identification process for the key factors selected for detailed evaluation in this report is summarised in Appendix 3. The reader is referred to Appendix 3 for the evaluation of factors not discussed below. A number of these factors are relevant to the proposal, but the EPA is of the view that the information set out in Appendix 3 provides sufficient evaluation.

It is the EPA’s opinion that the following key environmental factors for the proposal require detailed evaluation in this report:

- (a) Flora and Vegetation;
- (b) Groundwater; and
- (c) Closure and Decommissioning.

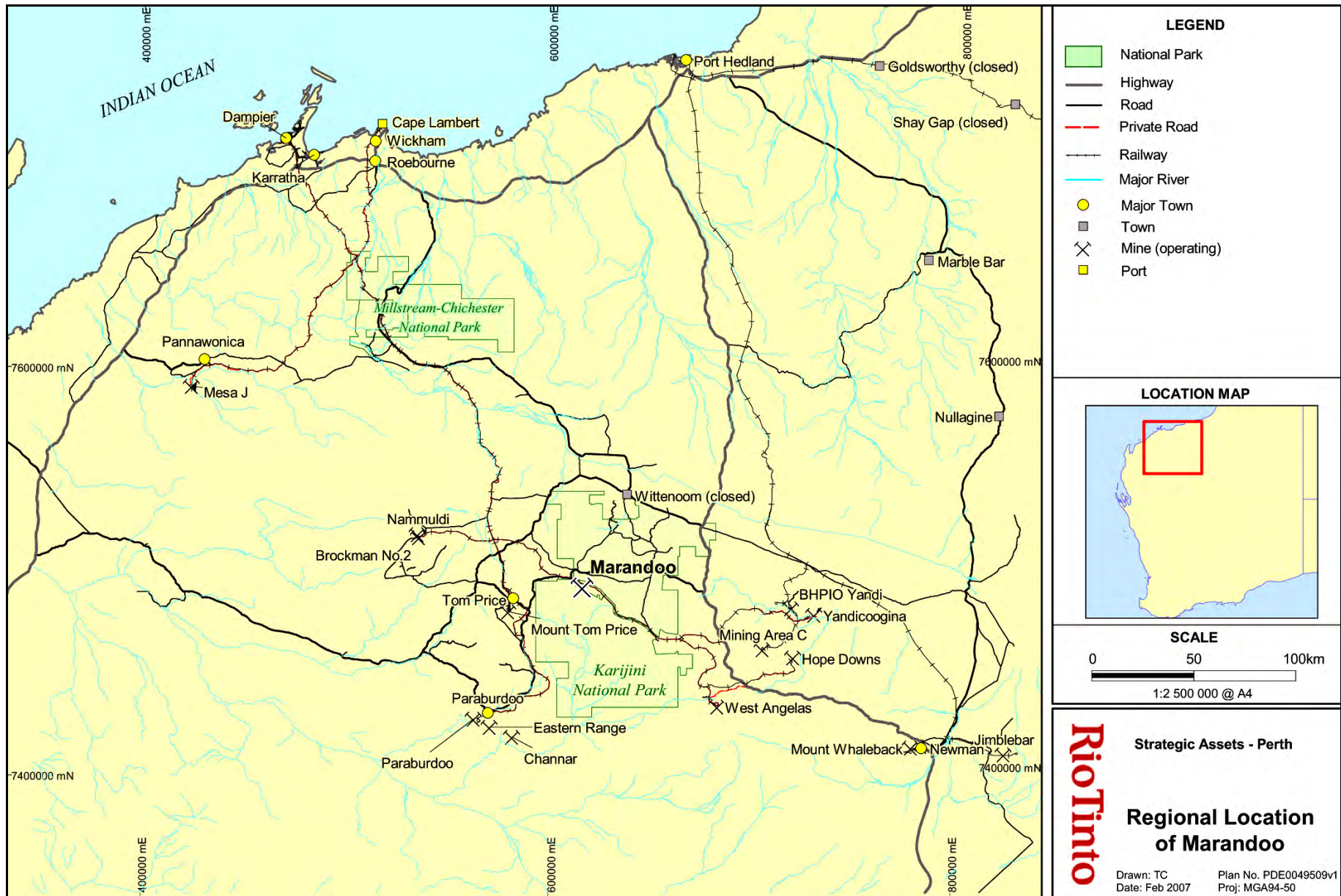


Figure 1: Mine location within Karijini National Park

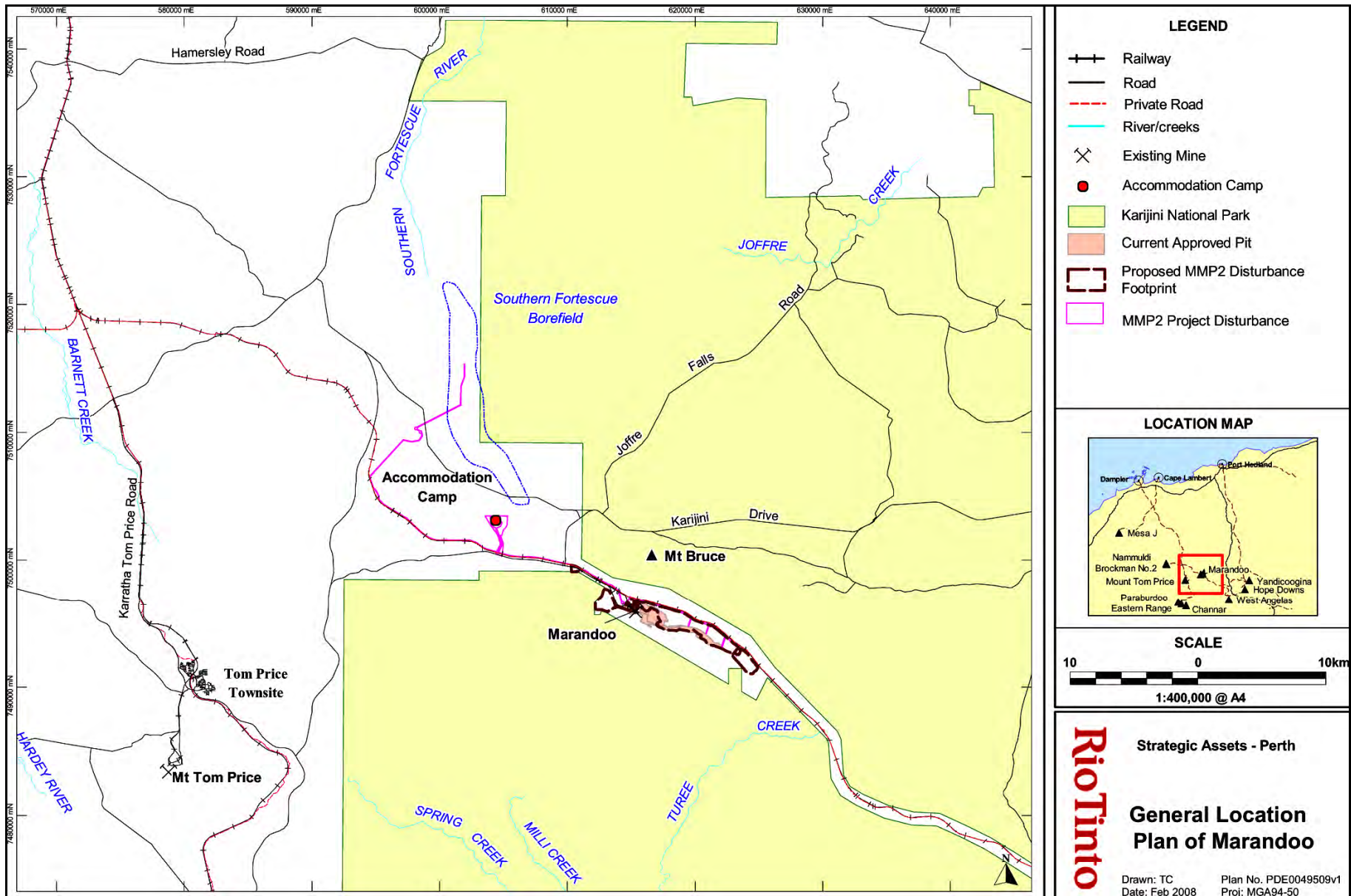


Figure 2: General location of Marandoo

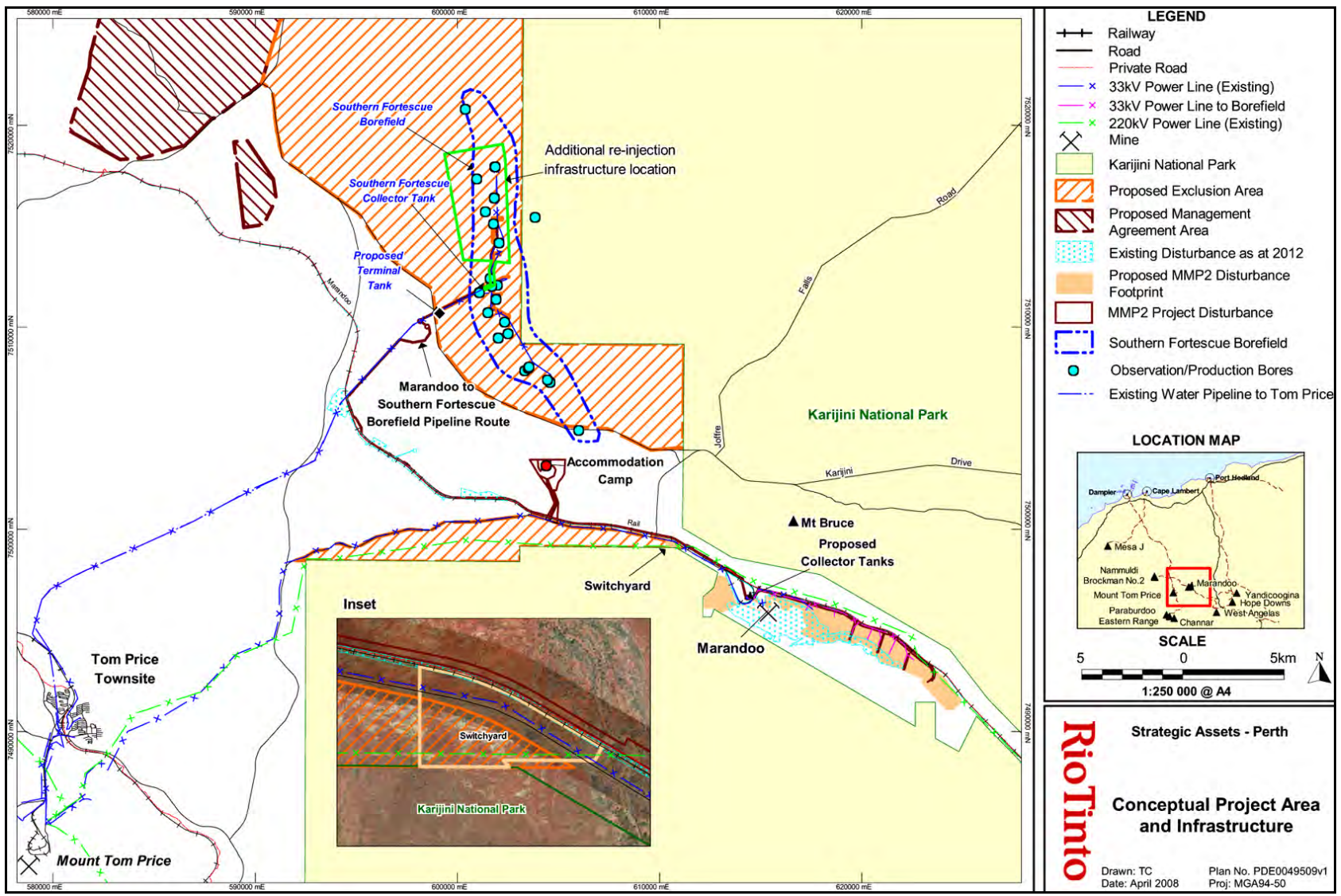


Figure 3a: Location of key components of the proposal

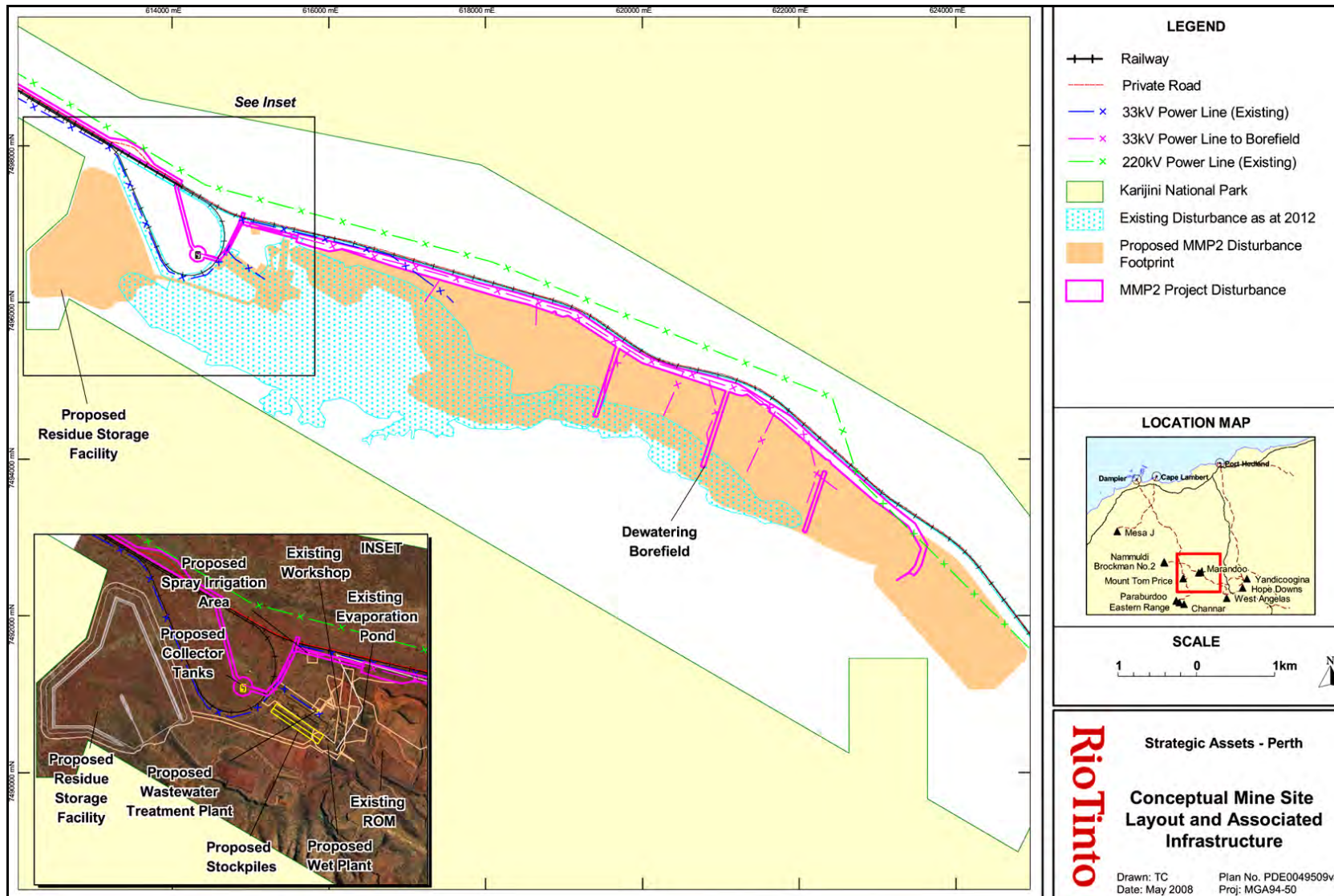


Figure 3b: Location of key components of the proposal

The above key factors were identified from the EPA's consideration and review of all environmental factors generated from the PER document and the submissions received, in conjunction with the proposal characteristics.

Details on the key environmental factors and their assessment are contained in Sections 3.1 – 3.3. The description of each factor shows why it is relevant to the proposal and how it will be affected by the proposal. The assessment of each factor is where the EPA decides whether or not a proposal meets the environmental objective set for that factor.

The following principles were considered by the EPA in relation to the proposal:

- (a) the precautionary principle;
- (b) the principle of biological diversity and ecological integrity; and
- (c) the principle of waste minimisation.

3.1 Flora and Vegetation

Description

The proposal is located in and adjacent to the existing Marandoo mining area, within State Agreement lease AML 70/272. This area was excised from the Karijini National Park in 1991, and is adjacent to the park on three sides. There is potential for mining operations to impact flora and vegetation within the National Park.

Activities associated with the proposal that have the potential to impact flora and vegetation include:

- clearing;
- groundwater drawdown;
- dewater discharge;
- changes to surface water flows and quality; and
- re-injection of dewater at the Sothern Fortescue borefield.

Clearing

A maximum of 1000 ha of native vegetation would be removed over the life of the proposal.

Extensive flora and vegetation sampling and survey work has been undertaken in the Marandoo mining lease and the surrounding areas since the 1970's. Mattiske (1992) mapped the vegetation of the mining lease and rail corridor on a scale of 1:10 000. More recent flora and vegetation work undertaken by Biota Environmental Sciences involved updating the description of the existing Mattiske mapping units (Biota, 2008).

No Declared Rare Flora have been recorded in the vicinity of the project, however seven priority species were recorded. Of those species which were located within the disturbance area, only scattered individuals were located at one or two locations.

The proponent has detailed management strategies in the PER to minimise the impacts of clearing on species diversity and abundance in the project area, including:

- progressive rehabilitation of disturbed areas;
- identification and mapping of target weed species and eradication of weeds on an ongoing basis; and
- prevention of unnecessary clearing through location of infrastructure within or adjacent to previously cleared areas.

Groundwater Drawdown

The groundwater resource at Marandoo consists of two aquifer units; an unconfined aquifer and a deeper confined aquifer, separated by clays up to 40m in thickness. Dewatering of the mine pit is proposed in the confined aquifer. This would result in some vertical leakage from the unconfined aquifer into the confined aquifer. The excavation of the mine void would also result in lowering of the unconfined aquifer through seepage into the pit. Drawdown in the unconfined aquifer has the potential to impact groundwater dependant flora and vegetation in areas within, and adjacent to, the proposal area.

Vegetation in areas likely to be impacted by drawdown does not comprise strongly phreatophytic species and is therefore unlikely to be affected, with the exception of the Coolibah Woodlands, located within the Karijini National Park approximately 2 km outside the proposed disturbance footprint. This woodland is listed by the DEC as a Priority Ecological Community (PEC). The Coolibah Woodlands are seasonally inundated and are considered to be a wetland of national significance.

The proponent has carried out extensive hydrogeological investigations and modelling at Marandoo. The unconfined aquifer receives the majority of its recharge in the area of the Coolibah Woodlands on Mount Bruce flats (MWH, 2006). Groundwater flows radially outward from the resulting groundwater mound. The proponent's modelling predicts that seepage into the mine pit would result in drawdown beneath the Coolibah Woodlands of 2.5m to 4m over the life of the mine (Figure 4).

The proponent considers that significant leakage from the unconfined aquifer to the confined aquifer as a result of dewatering is highly unlikely due to the nature of the clay layer separating the aquifers below the Coolibah Woodlands. This has been supported by an independent expert review (Commander, 2009). There is some interconnection between the confined and unconfined aquifers where both layers abut the Marandoo orebody near the edge of the proposed mine pit. This has been considered in the modelling of the predicted drawdown.

Following the release of the PER concern was expressed regarding the potential impacts of the proposal to the Coolibah Woodlands. The proponent was requested to provide further information on the potential impacts to the Coolibah Woodlands, with particular regard to the reliability of the groundwater model, the water requirements of the Coolibah Woodland, and potential mitigation and remediation measures. With the endorsement of the EPA, the proponent commissioned independent experts to review all available information in relation to these factors.

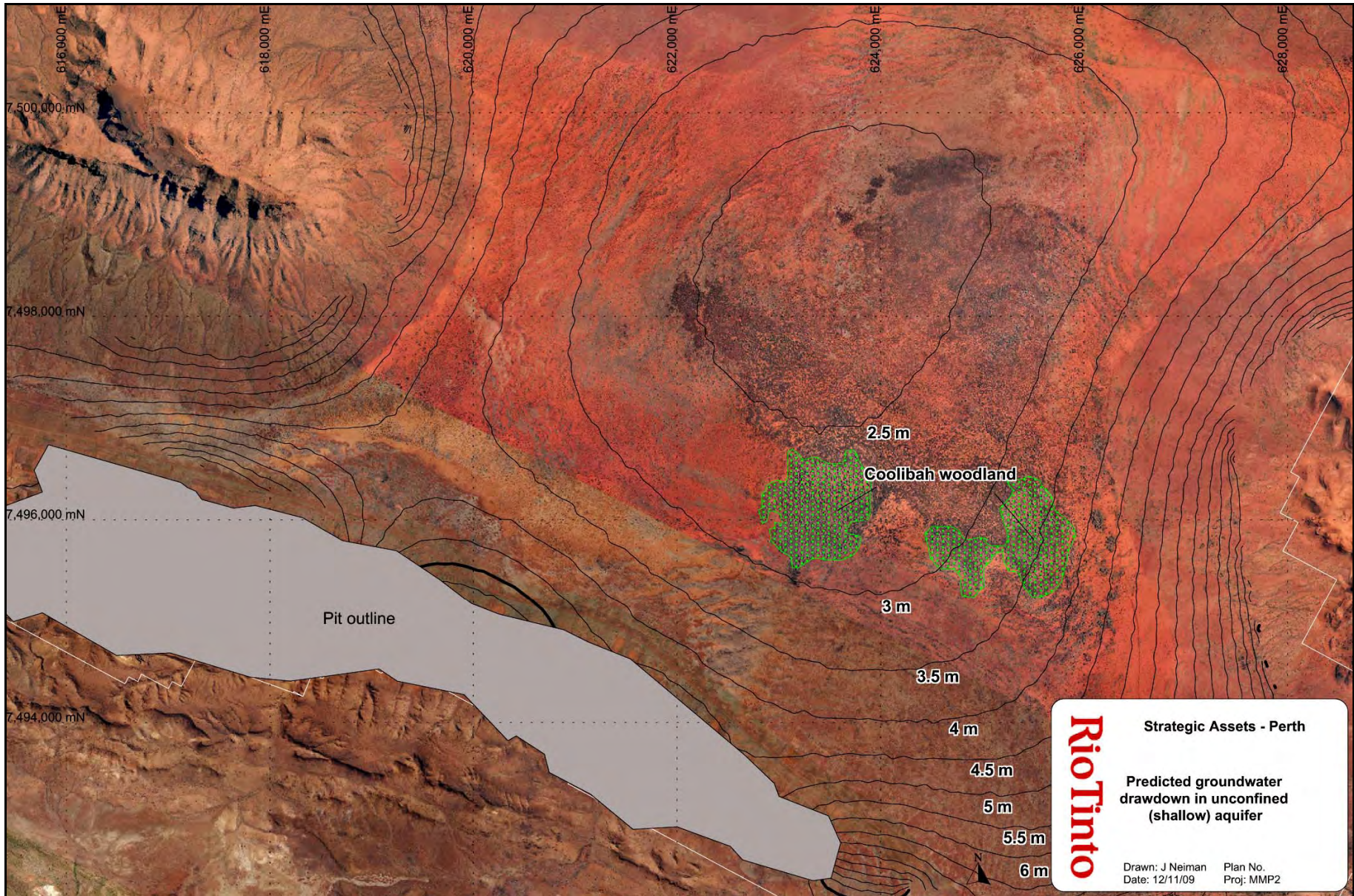


Figure 4: Drawdown in the Unconfined Aquifer

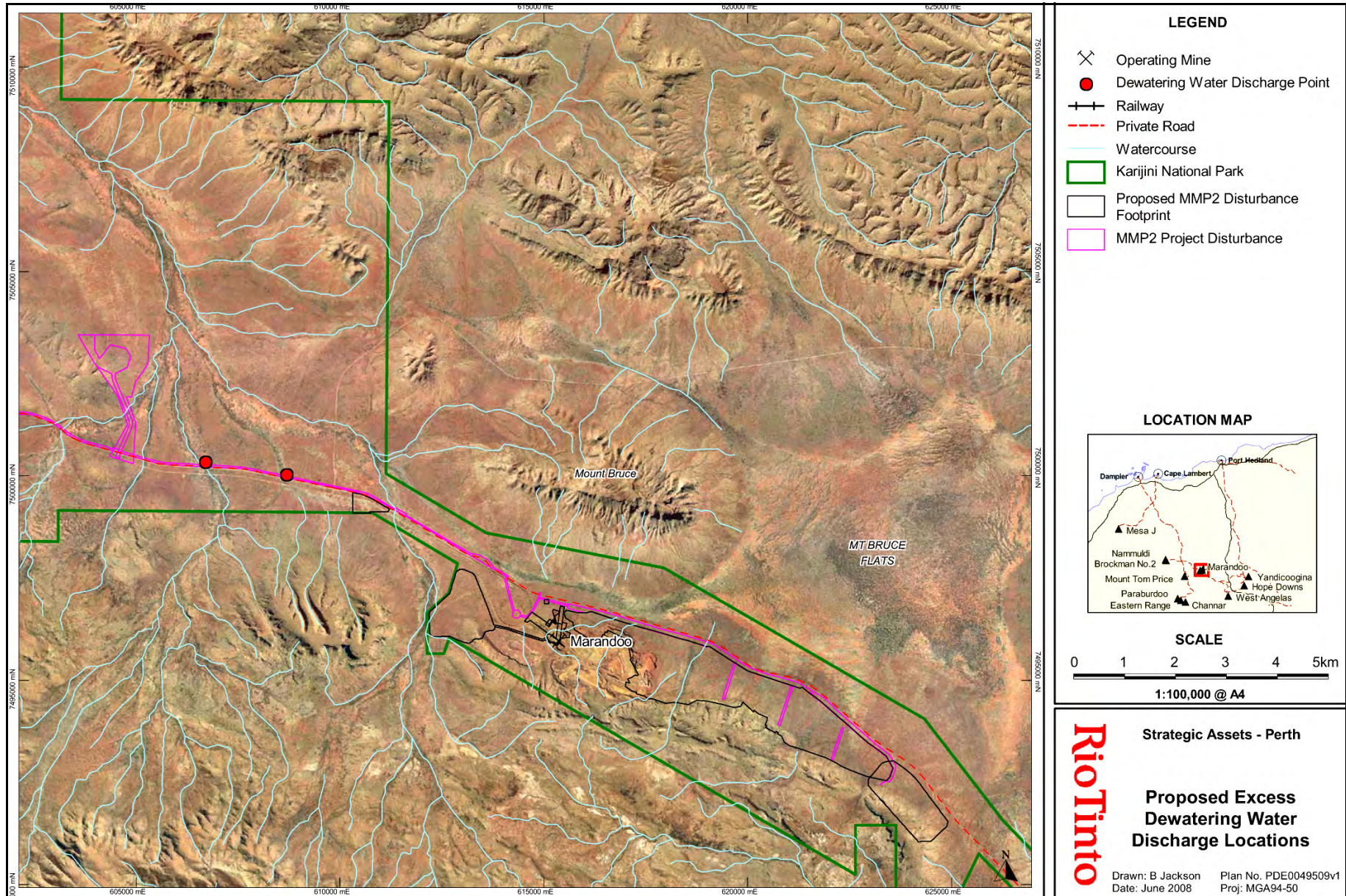


Figure 5: Location of discharge point

The proponent considers that the gradual nature of the drawdown, at a rate of less than 0.3m/year, should allow the trees to adapt, given that the changes to groundwater are within the range of natural events. The independent expert review supported this finding, noting that the predicted fall in groundwater levels is small in magnitude compared to natural events, and that the predicted rate of fall would require root growth of only 0.5mm per day to maintain contact, which appears possible (Batini, 2009).

The proponent has proposed monitoring and management strategies to minimise impacts to the Coolibah woodland as a result of drawdown in the confined aquifer, including:

- monitoring of the Coolibah woodland for tree health;
- monitoring of water levels in bores between the minesite and the woodland;
- if impacts are observed, artificial supplementation of water to the Coolibah Woodland in the wet season via spreading pipelines with low velocity outflow; and
- amendments to dewatering or mine planning including reduction in the rate of abstraction or changes to mine extent or depth sufficient to reverse drawdown trends below the Coolibah Woodland.

Dewater Discharge

Dewatering for the proposal is proposed at a peak rate of 100ML/day for the first three years and 80ML/day thereafter for the life of the project. The proponent has described a hierarchy for disposal of dewater via use at site, aquifer re-injection, and transfer to other sites such as Tom Price and Hamersley Station for municipal and irrigation use. Following the implementation of these disposal options there is likely to be an excess amount of water requiring discharge to the environment. The discharge would be along an ephemeral tributary of the Southern Fortescue River.

The proponent predicts that discharge to the environment would be intermittent, occurring during shutdown events or high rainfall events when irrigation must be scaled back. These events are likely to require discharge of 80 to 100ML/day and be several weeks in duration.

The proponent considers that there should be no need for continuous discharge to the environment, however this is dependant on the success and/or approval of alternative disposal methods, including re-injection at the Southern Fortescue Borefield and irrigation at Hamersley Station.

Substantial and prolonged discharge of dewater may lead to an increase in some plant species and a loss of plant species that cannot tolerate waterlogging. Further loss of species can occur when discharge is ceased, where plants have altered their root distribution in response to the discharge. There is likely to be an increase in the distribution and abundance of weed species in the discharge area as a result of seed dispersal by discharge water and increased water availability.

The proponent has nominated two discharge points within the mine lease (Figure 5). An assessment of the condition of flora and vegetation downstream of the proposed dewatering discharge locations was undertaken in July 2008 by Matiske, consisting of collection of specimens along 18 transects, and visual evaluation of stress in

vegetation along the transects. No DRF or Priority Flora have been recorded within 20 kms downstream of the dewater discharge points (Mattiske, 2008).

The discharge points are located approximately 5 kms upstream of areas within the 2015 Exclusion Zone. This is an area of Hamersley Station which is designated to become part of the Karijini National Park in 2015, and is considered to have high conservation significance. The proponent estimates that dewater could travel approximately 20 km along the drainage lines and is therefore likely to encroach into the 2015 Exclusion Zone.

The Hamersley Themeda Grasslands are a Threatened Ecological Community which occurs 26 kms downstream of the discharge points. The proponent considers that it is highly unlikely that dewater would travel more than 20 kms along the discharge channels.

The proponent has proposed management strategies to minimise the impact of dewater discharge to flora and vegetation, including:

- design of discharge points to mimic natural flow characteristics, minimising erosion and sedimentation of drainage lines;
- alternate use of two discharge points to manage saturation of watercourses;
- monitoring of riparian vegetation health along discharge channels;
- progressive stabilisation and rehabilitation of disturbed areas as part of the proponent's closure plan;
- ensuring that water discharged to the environment meets ANZECC water quality guidelines;
- identification and mapping of weed species;
- bi-annual monitoring of weed species and abundance along discharge drainage lines; and
- eradication of weed species on an ongoing basis.

Changes to surface water flows and quality.

There would be some alteration of surface water runoff reaching vegetation downstream of the proposed mine pit as a result of the physical presence of the mine pit and infrastructure.

Changes to surface water flows have the potential to impact stands of Mulga in the area, which are dependant on incidental rainfall and surface runoff. The stands of Mulga on the Mount Bruce flats are considered to be important to the ongoing representation and conservation of Mulga in the region.

The natural hydrological regime at Marandoo has been modified for over 10 years as a result of the construction of the railway from Rosella Siding to Homestead Junction. The railway runs roughly east-west and is located to the north of Marandoo. Sheetflow is intercepted by the railway embankment and subsequently directed towards the Mount Bruce flats via culverts through the embankment. Spreader structures disperse the concentrated flows.

Excess water collected in the pits and diverted by infrastructure associated with the proposal would be diverted to in-pit sumps and then discharged to culverts through

the railway embankment. Water quality would be monitored prior to each discharge event to ensure that any contaminated water is treated prior to discharge.

The proponent has been monitoring the health of Mulga adjacent to the Marandoo railway since 2000, with the most recent measurements occurring in 2007. No substantial negative effect associated with the railway has been recorded to date.

Re-injection

Re-injection of excess dewatering water at the Southern Fortescue Borefield may affect vegetation health as a result of saturation of the soil profile.

Recent flora and vegetation surveys included additional flora mapping within the Southern Fortescue Borefield. Most species occurring in the area have shallow root zones, including Mulga, and should not be affected by the proposed re-injection, provided that the groundwater does not approach within 5m of the ground surface.

The proponent has proposed management measures to minimise any impact to vegetation as a result of re-injection to the Southern Fortescue Borefield, including;

- optimisation of the location of re-injection bores to spread the rise in groundwater level across the borefield; and
- monitoring of observation bores to ensure groundwater does not rise more than 5m above pre-abstraction levels;

Submissions

Submissions regarding flora and vegetation were concerned with the spread of weeds in the project area, with particular concern for dewater discharge sites, and with the management of vegetation in the Southern Fortescue borefield.

Submissions concerning the Coolibah Woodland indicated a general view that impacts to this ecosystem would not be acceptable. The design of monitoring and management strategies was considered to be important with particular concern relating to the additional impacts of installing any infrastructure required to supply water to the woodland.

Submitters were also concerned by the potential for vertical leakage to increase drawdown in the superficial aquifer below the Coolibah Woodland beyond the level predicted.

Assessment

The relevant area of consideration for this assessment is areas within and adjacent to the Karijini National Park, the Marandoo Mine lease, areas of the Southern Fortescue Borefield which may be impacted by re-injection activities, and areas downstream of the proposed dewater discharge points.

The EPA's environmental objective for this factor is to maintain the abundance, diversity, geographic distribution and productivity of flora species and ecosystem levels, through the avoidance or management of adverse impacts and improvement in knowledge.

Clearing

Based on recent and historical surveys, no vegetation unit of high conservation significance would be cleared in association with this proposal. Approximately 85 ha of vegetation of moderate conservation significance would be disturbed. This would represent less than 35% of the mapped extent of any vegetation unit within the proposal area. Given that all affected units extend more widely through the locality and sub region, it is unlikely that clearing would have a significant impact on the abundance or distribution of these vegetation types.

The EPA notes there are no DRF within the proposal area, and that of the seven Priority flora species recorded within the proposal area, only four would be directly impacted by the proposal. Further, the priority species likely to be directly disturbed have been recorded throughout the Pilbara and are not restricted to the Marandoo locality.

The EPA considers that, given the proponent's proposed management strategies, impacts to flora and vegetation as a result of clearing associated with this proposal can be managed to meet the EPA's objectives for this factor.

Groundwater Drawdown/Coolibah Woodlands

There is a potential for impacts to the Mount Bruce Flats Coolibah Woodland PEC to occur as a result of dewatering activities associated with this proposal. The EPA considers that the woodland is a critical asset and has recommended a condition requiring that the proponent ensure that no adverse impacts to the woodland occur as a result of the proposal.

The EPA notes that the Rio Tinto Iron Ore (RTIO) groundwater model being used for this assessment has been developed over several years, and that an independent review of the model confirms the conceptual model of the clay as an aquitard, effectively separating the two aquifers (Commander, 2009). The EPA also notes the Department of Water (DoW) advice that the groundwater model is reasonable under the scenarios presented.

The EPA accepts the proponent's assertion that drawdown in the unconfined aquifer as a result of connectivity between aquifers is unlikely, and that total drawdown in the unconfined aquifer as a result of seepage into the mine pit is likely to be in the order of 2.5 to 4m in the vicinity of the Coolibah Woodland.

The Coolibah Woodland which grows on the Mount Bruce flats is a PEC. It is also listed as a wetland of national significance. The EPA notes that *Eucalyptus victrix* (Coolibah) is a resilient tree and is able to survive some flooding and rapid rises and falls in the groundwater table, as well as extended periods of drought (Batini, 2009). It is likely that *E. victrix* relies primarily on stored soil-water, but may draw some of its water needs from the capillary zone above the shallow groundwater table.

The EPA notes that, should the Coolibahs be entirely dependant on groundwater, given the slow rate of the predicted fall of 2.5 to 4m over a period of 21 years, the required rate of root growth to keep up with the change in ground water would be 0.5mm per day, and that this appears to be within the capabilities of *E. Victrix* (Batini, 2009).

The independent review commissioned by RTIO indicates that the fall in groundwater levels predicted by modelling should not affect the health of the Coolibah Woodlands (Batini, 2009). Peer reviews of this work state that “Drawdown of the magnitude and rate predicted by the modelling results will not necessarily impact adversely on the Coolibah” (Froend, 2009), and “Mining activities are unlikely to have unacceptably large negative impacts on woodland health if the monitoring program is expanded and supplementary irrigation available” (Eamus, 2009). Reductions in the groundwater table of up to 19m over a period of 2.5 years do not appear to have resulted in a substantial decline of foliage cover in *E. Victrix* at Hope Downs. (Batini, 2009).

The proponent has indicated that, should a decline in tree health attributable to dewatering be detected, management actions would include artificial supply of water to the woodland. The EPA notes that the proposed delivery of this water to the woodlands would require disturbance of vegetation within the Karijini National Park. Inundation would also be likely to disturb and potentially change the assemblage of grasses and other low vegetation which form a part of the Coolibah Woodland PEC. Therefore, the EPA does not consider that supplementation of water to the Coolibah Woodlands using the currently proposed methods is an appropriate strategy for protection of the PEC. Further, the EPA does not support any additional disturbance within the Karijini National Park for the purposes of establishing mitigation measures.

In view of the above the EPA has recommended a condition requiring that the proponent ensure that no adverse impacts to the woodland occur as a result of the proposal.

The EPA considers that, if the proposal is granted approval, the proponent should be required to demonstrate to a high level of confidence that alternative mitigation strategies are available. Mitigation strategies must be carried out by the proponent in an effective and timely manner in the event that any decline in the health of the Coolibah Woodland is observed.

The EPA has recommended a condition requiring the proponent to develop an appropriate mitigation strategy to the satisfaction of the Chief Executive Officer of the Office of the EPA on advice from DEC prior to the commencement of dewatering activities.

Dewater Discharge

Discharge of excess water into the tributary of the Southern Fortescue River is likely to have negative impacts as these features typically support episodic drainage and the associated plant communities are unlikely to withstand inundation for more than a few weeks.

The EPA accepts the proponent’s conclusion that areas impacted by the discharge are likely to return to a similar composition to pre-mining within decades after the ceasing of discharge, and considers that these impacts can be managed provided that an appropriate monitoring and management regime is implemented.

The EPA notes that increased water availability and transport of seeds from the discharge points are likely to result in the introduction and spread of weeds within the 2015 exclusion areas.

The Hamersley Station Themeda Grassland is located approximately 26 kms downstream of the proposed dewater discharge points. Inundation of the soil in proximity to the grasslands has the potential to result in changes to the composition of the grassland. The proponent has predicted that impacts from dewater discharge are unlikely to extend more than 20 kms from the discharge point. Impacts to the Themeda Grassland are therefore unlikely.

The EPA has recommended a condition to ensure that dewater discharge does not travel outside the area predicted by the proponent, and that the spread of weeds does not significantly impact vegetation along the proposed dewater discharge channels.

Changes to Surface water flows

The EPA notes that changes to surface water flows as a result of the proposal would be in addition to existing alterations to the hydrology of the project area, and that these additional changes would be managed in accordance with existing practices at the site.

Given that monitoring has not detected any impact to Mulga as a result of existing hydrological alterations, the EPA considers that impacts to vegetation as a result of changes to surface water flows resulting from this proposal can be managed to meet the EPA's objectives for this factor.

Re-injection of water at the Southern Fortescue Borefield

The proponent has set a trigger level of 5m above the pre-abstraction groundwater table for the management of re-injection at the Southern Fortescue Borefield. As pre-abstraction levels were 20-30m below ground level, this equates to a trigger level between 25-25m below ground level. This is considered adequate to ensure a significant buffer remains between the water table and the shallow-rooted non-phreatophytic vegetation that predominates in the area.

Taking into consideration the proponent's proposed monitoring and management strategies, The EPA considers that impacts to vegetation arising from re-injection of dewater to the Southern Fortescue Borefield can be managed to meet the EPA's objective for this factor.

Summary

Having particular regard to the:

- (a) significant conservation values of the Coolibah Woodlands
- (b) low likelihood of impacts to the Coolibah Woodlands
- (c) conservation values of the 2015 exclusion zones; and
- (d) low likelihood of impacts to the 2015 exclusion zone,

it is the EPA's opinion that the proposal can be managed to meet the EPA's objectives for this factor provided that the recommended conditions 6 (Coolibah Woodlands) and

8 (Dewater Discharge) are implemented to ensure that:

- there is no adverse impact to the Coolibah Woodland as a result of the proposal;
- any decline in the health of the Coolibah woodland is mitigated in an effective and timely manner; and
- impacts to flora and vegetation as a result of dewater discharge do not extend beyond the predicted 20 km area, and are monitored and managed appropriately.

3.2 Groundwater

Description

The proposal requires interaction with groundwater resources both at Marandoo and at the Southern Fortescue Borefield. There are two aquifer units at Marandoo, a shallow, unconfined aquifer and a deeper confined aquifer. The two aquifers are separated by a clay layer up to 40m in thickness which acts as an effective aquitard between them.

A maximum of 100ML per day would be extracted from the confined aquifer for the first three years, declining to 80ML per day for the remainder of the life of the project. The proponent expects that dewatering in the confined aquifer would result in minimal vertical leakage from the unconfined aquifer, however, seepage into the pit would result in some drawdown in the unconfined aquifer. Excess dewater would be re-injected into the Southern Fortescue Borefield.

There is a potential for interaction with groundwater to cause impacts to groundwater values including:

- impacts to groundwater quality;
- loss of supply of groundwater to springs and pools in the Karijini National Park; and
- loss of supply of groundwater to voids leading to the formation of sinkholes.

Groundwater Quality

The proposal has the potential to impact groundwater quality through a number of activities, including re-injection of excess dewater at the Southern Fortescue Borefield, storage and use of hydrocarbons, and operation of the proposed residue storage facility.

Re-injection of excess dewater has the potential to impact groundwater quality at the Southern Fortescue Borefield, however, as the water chemistry at Marandoo is very similar to that at the re-injection site, the proposal is unlikely to significantly affect the quality of water at the Southern Fortescue Borefield.

Hydrocarbon storage and use would be managed at Marandoo through existing design infrastructure and in accordance with existing practices and procedures. Hydrocarbon spillage and other potentially polluting activities at Marandoo would be subject to licence conditions issued under Part V of the *Environmental Protection Act* (1986).

There is a potential for seepage from the residue storage facility (RSF) to impact groundwater quality. The proponent has stated that seepage into the groundwater system from the RSF is likely to be limited to approximately 2-5% of the water pumped into the RSF due to design features such as under-drainage blankets and toe drains.

A geochemical assessment of the material to be mined at Marandoo indicated a negligible risk of Acid Rock Drainage generation from processed tailings. Any seepage from the RSF is therefore expected to be of relatively high quality given the benign nature of the residue to be stored.

The proponent has detailed management actions to ensure that groundwater quality at Marandoo is not impacted by the proposed operations. These actions include:

- monitoring of observation bores at the Southern Fortescue Borefield;
- applying existing controls to hydrocarbon transport, handling and disposal;
- applying existing hydrocarbon clean-up procedures;
- appropriate design and installation of drains around the RSF; and
- monitoring of water quality at the RSF.

Springs and Pools and of Karijini National Park

Many of the springs and pools in the Karijini National Park have high tourism values and cultural significance. These water sources support habitat for many species of flora and fauna in the area. Groundwater drawdown in the unconfined aquifer as a result of seepage into the pit or vertical leakage into the confined aquifer has the potential to impact springs or pools which are fed by groundwater.

The majority of springs and pools investigated by the proponent occur in the northern area of Karijini National Park, with the exception of Banjima Pool and Minthicundunna Spring, which occur to the south and south-east of the proposal. Groundwater drawdown further south of these sites is unlikely due to the impermeable barrier formed by the Lower Marra Mamba formations to the south of the proposal area (Dr Wade Dodson, personal communication – January 2009).

Studies indicate that springs, gorges and pools in the northern area are fed by groundwater discharging from the Brockman Iron Formation, and are unrelated to the groundwater occurring near Marandoo. This is confirmed by further studies undertaken following the public review period, which indicate that the water chemistry of springs and pools in the northern area is unrelated to the groundwater resource at Marandoo (Strategen, 2009).

Banjima Pool, which occurs 25m above the regional groundwater table, is also unconnected to the groundwater supply. Minthicundunna Spring, however, is believed to be supported by groundwater. There is a potential that towards the end of the mine life groundwater flow that would normally discharge at Minthicundunna Spring would instead be directed back to the open mine pit.

The proponent has described monitoring and management measures to ensure that the environmental and cultural values of springs, gorges and pools in the Karijini National Park are protected. These include:

- further development of conceptual models for springs and pools in Karijini National Park, with the aim of determining flow and transport systems;
- monitoring of water levels at Minthicundunna Spring, and groundwater levels between Marandoo and the Spring; and
- continuing consultation with the Eastern Garuma and other relevant stakeholders;
- re-injection and or surface irrigation of Minthicundunna Spring as required to the satisfaction of the DEC and the Traditional Owners.

Formation of Sinkholes

Sinkholes may form within the Karijini National Park as a result of groundwater drawdown. Sinkholes have been reported to occur around the world as a result of dewatering, whereby lowering water levels drains voids and removes the buoyant support of water.

Six sinkholes have been identified to date in the Southern Fortescue Borefield as a result of dewatering activities. These depressions are generally 20-30 metres in diameter and have the potential to impact flora and fauna values within the National Park. The rate of sinkhole formation caused by drawdown is generally related to the rate of drawdown (MWH 2007).

Sinkhole formation across the Mount Bruce flats as a result of the proposed dewatering is possible, but unlikely, as the clay layer between the unconfined and confined aquifers is of considerable thickness across the flats and should remain saturated during dewatering. This is in comparison to the Southern Fortescue Borefield which contains a sequence of inter-layered tertiary clays, gravels and calcrete which are more likely to result in the formation of sinkholes.

The proponent considers that, given that the sinkhole formations observed to date in the Southern Fortescue Borefield are limited to 20-30m in diameter, the potential impact to flora and fauna values as a result of sinkholes is limited.

The PER includes management strategies to minimise the potential impact of sinkhole formation should these occur. Management strategies include:

- investigation into the mechanism of sinkhole formation at the Southern Fortescue Borefield and an assessment of high risk areas at the Southern Fortescue Borefield, Marandoo and Surrounding areas;
- studies to monitor sinkholes in the vicinity of Marandoo and Southern Fortescue Borefield including the number and size of existing sinkholes to provide a baseline for future monitoring, which may include visual monitoring or differential photogrammetry with respect to a baseline image;
- managing sinkhole risk through early detection of the onset of surface deformation and/or reactivation of existing features; and
- fencing sinkholes and implementing other measures to reduce any potential risk to public safety.

Submissions

Several submissions expressed concern that the proponent's calculations showing negligible risk to springs and gorges in Karijini may not be accurate. Indigenous groups noted that impacts to Minthicundunna Spring are likely and would have significant cultural impacts.

Submitters considered that further hydrological data should be provided to demonstrate that springs and pools would not be adversely affected, that accurate baseline data should be provided to evaluate potential impacts, and that a methodology should be developed to isolate impacts of drawdown to Springs and Pools from climate variability.

Several submitters considered that the formation of sinkholes within the Karijini National Park is unacceptable, while formation of sinkholes outside the park or within the area excised from the park would be undesirable. It was proposed by submitters that resourcing of rehabilitation and ongoing management of sinkholes should be the responsibility of the proponent.

Assessment

The relevant area of consideration for this assessment is all areas within the Karijini National Park, the Marandoo Mine lease, and areas of the Southern Fortescue Borefield which may be impacted by re-injection activities.

The EPA's environmental objectives for this factor are to:

- maintain the quality of groundwater so that existing and potential uses, including ecosystem maintenance, are protected; and
- to maintain the integrity, ecological function and environmental values of watercourses, and to ensure that alterations to surface expressions of groundwater do not adversely impact native vegetation or flow regimes.

The EPA notes the Department of Water (DoW) advice that the groundwater modelling undertaken by the proponent is reasonable under the scenarios presented. This advice has been confirmed by independent experts.

Groundwater Quality

The EPA considers that, given the high quality of water being extracted from Marandoo for re-injection at Southern Fortescue Borefield, there is a low risk of groundwater contamination at the Southern Fortescue Borefield.

The EPA notes that hydrocarbon storage has been adequately managed by the proponent at the site to date under existing approvals. The EPA further notes that potentially polluting activities associated with the proposal including hydrocarbon storage and operation of the Residue Storage Facility would be subject to licence conditions issued under Part V of the EP Act.

The EPA considers that impacts to groundwater quality can be managed to meet the EPA's environmental objectives for this factor.

Springs and Pools of Karijini National Park

The EPA notes that the modelling and water chemistry studies conducted by the proponent demonstrate that, with the exception of Minthicundunna Spring, water sources including springs, gorges and pools in the Karijini National Park are unlikely to be impacted by drawdown associated with the proposal.

While Minthicundunna Spring has limited ecological value, it has considerable indigenous heritage values. The EPA considers that the monitoring and mitigation strategies proposed by the proponent are appropriate to maintain the values of Minthicundunna Spring.

The EPA considers that, given the existing evidence, springs and pools within the Karijini National Park are unlikely to be impacted by the proposal. However, given the high ecological, cultural and tourism values of these water sources, the EPA has recommended a condition to ensure that these values are maintained in the event that modelling is proved to be inaccurate.

Sinkholes

The EPA notes that formation of sinkholes presents a potential risk to the flora, fauna and tourism values of the Karijini National Park, however, the EPA considers that the risk is acceptably low as a result of the geological properties of the area, and that any risks to fauna and public safety arising from sinkhole formation can be adequately managed.

The proponent has presented management strategies to minimise the impacts of sinkhole formation as a result of the proposal. The EPA considers that the ongoing rehabilitation and management of any sinkhole formations which may occur as a result of the proposal should be the responsibility of the proponent and has therefore recommended a condition to ensure that sinkhole formations are detected in a timely manner and managed appropriately.

Summary

Having particular regard to the:

- (a) proponent's proposed management of potentially polluting activities;
- (b) proponent's modelling and studies indicating a negligible risk of impact to springs and pools in the Karijini national Park as a result of the proposal; and
- (c) proponent's proposed management of sinkhole formations,

it is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objectives for this factor provided that the recommended conditions 7 (Springs, pools and creeks of Karijini National Park) and 9 (Sinkholes) are implemented requiring the proponent to:

- ensure that no impact to any spring, gorge or pool in the Karijini National Park occurs as a result of the proposal; and
- ensure that any sinkhole formations which occur as a result of the proposal are detected and managed appropriately.

3.3 Closure and Decommissioning

Description

Due to the sensitive location of Marandoo adjacent to the Karijini National Park, closure management is particularly important to ensure that infrastructure and pit areas do not pose a threat to social and environmental values in the national park.

The post mining land use for the project area is undetermined, however, the proponent has indicated that the general objective of mine closure would be to create self-sustaining natural ecosystems, or an alternative land use based on an agreed set of land use objectives.

The proposal has an estimated life of 15 – 20 years. Following this, the proposal area would be decommissioned in accordance with a Closure Plan. A conceptual closure plan has been developed to identify key aspects of closure that would require further investigation throughout the life of the proposal. These include:

- visual impact;
- re-establishment of surface water flows;
- impacts to groundwater;
- future land use; and
- rehabilitation.

The development of pit lakes after closure and the potential impacts to groundwater quality at Marandoo are the subject of ongoing numerical modelling. The proponent's planned closure scenario is for the pit to be backfilled to a nominal 1m above the pre-mining level of the unconfined aquifer, although this may be subject to revision prior to finalisation of the Closure Plan.

The mine void would be backfilled progressively from the west to the east throughout the life of the proposal. The backfill surface is likely to be designed to incorporate elevated areas greater than 1m above the water table, and low areas which would become artificial wetlands. The proponent considers that this is likely to provide a better water quality outcome than the establishment of a uniform surface 1m above the water table. This strategy would be further developed in consultation with stakeholders.

The residue storage facility would be capped with a 2m layer of inert waste, prior to rehabilitation with stockpiled topsoil and local provenance seed. The outer walls of the RSF would be battered back to an angle of less than 20 degrees prior to rehabilitation.

Some waste rock dumps would not be completely utilised in the backfill of the void and would remain as raised landforms. These would be designed to optimize the configuration and stability of the waste dumps to facilitate rehabilitation.

Submissions

Submitters considered that the proponent should make a clear commitment to backfill at least 1m above the water table, and that backfilling to ground level would be highly desirable.

Submitters also noted that standard rehabilitation processes applied at other mine sites in the Pilbara are not appropriate in this instance given the environmental values of the area, and recommended that rehabilitation and closure objectives be developed in consultation with stakeholders.

Other submitters considered that the proposal should not be approved until such time as the proponent is able to demonstrate through existing rehabilitation projects the ability to rehabilitate vegetation to the standard required for return of the proposal area to the National Park.

Assessment

The area considered for this assessment is the area of the mining lease as excised from the Karijini National Park in 1991.

The EPA's environmental objectives for this factor are to:

- ensure that mining is planned and carried out so to ensure a sustainable mine closure outcome is achieved, consistent with mining industry best practice as set out in the Australia and New Zealand Minerals and Energy Council / Minerals Council of Australia, 2000, *Strategic Framework for Mine Closure*; and
- ensure that self-sustaining native vegetation communities are returned after mining, which in species composition and ecological function are as close to possible to naturally occurring analogue sites;

The EPA acknowledges that the proponent has committed to progressive rehabilitation and post-closure monitoring. The EPA notes that the proponent has developed a set of conceptual closure objectives which would be revised and made more specific, and that measurable targets would be developed in consultation with stakeholders.

The EPA considers that the proponent's objective of backfilling to 1m above the water table is an appropriate goal at this time. Backfilling to ground level is not considered to be practical at this time, however, the possibility of further backfilling should be considered in line with current best practice during the preparation of the final closure and decommissioning plan prior to the completion of mining.

The EPA has recommended condition 10, which requires that rehabilitation achieve specific outcomes to ensure that, at closure, the waste dumps and other disturbed areas above ground are left in a safe, stable and non-polluting condition. This type of condition is a standard requirement for any mine in Western Australia.

In order to ensure the long-term success of mine closure and rehabilitation the EPA recommends that the recommended condition 11 be imposed on the proponent. This condition requires that the proponent be required to submit a full project-specific conceptual closure strategy prior to the start of ground-disturbing activities. This approach of requiring "up-front" mine closure planning is fully consistent with Australian and international mining industry best practice as set out in the Australia and New Zealand Minerals and Energy Council / Mining Council of Australia, 2000, *Strategic Framework for Mine Closure* and the Australian national "Leading Practice"

handbook on mine closure and completion (Department of Industry, Tourism and Resources, 2007).

Condition 12 requires the proponent to prepare a Final Closure and Decommissioning Plan at least 5 years prior to the final completion of mining. This requirement is again consistent with Australian and international mining industry best practice for sustainable mine closure.

Summary

Having particular regard to the:

- (a) proposed management measures; and
- (b) planning for mine closure in the early stages of project development,

it is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objective for this factor subject to implementation of conditions.

3.4 Environmental principles

In preparing this report and recommendations, the EPA has had regard for the object and principles contained in s4A of the EP Act. Appendix 3 contains a summary of the EPA's consideration of the principles.

4. Recommended Conditions

Section 44 of the *EP Act* requires the EPA to report to the Minister for Environment on the environmental factors relevant to the proposal and on the conditions and procedures to which the proposal should be subject, if implemented. In addition, the EPA may make recommendations as it sees fit.

Having considered the information provided in this report, the EPA has developed a set of conditions that the EPA recommends be imposed if the proposal by Hamersley Iron to extend mining at the existing Marandoo Mine below the water table is approved for implementation.

These conditions are presented in Appendix 4. Matters addressed in the conditions include the following:

- (a) that the proponent shall ensure that groundwater abstraction, dewatering activities and mitigation strategies required to implement the proposal do not adversely impact the Coolibah woodlands within the Karijini National Park;
- (b) that the proponent shall develop appropriate mitigation strategies to remediate any decline in health of the Coolibah Woodlands to the satisfaction of the CEO of the Office of the EPA, on advice from the DEC prior to the commencement of any dewatering activities;
- (c) that the proponent shall ensure that groundwater abstraction, dewatering and interception of surface flows required to implement the proposal do not adversely affect any of the springs, pools or creeks in the Karijini National park;

- (d) that there is a TEC located approximately 26kms downstream of the dewater discharge point. The proponent shall ensure that dewater discharge does not extend more than 20kms along the designated discharge channels and that there is no increase in the variety or distribution of weed species as a result of dewater discharge;
- (e) that the proponent shall ensure that sinkhole formations attributable to the proposal are detected in a timely manner and managed appropriately; and
- (f) that closure and rehabilitation activities shall be planned and implemented appropriately.

It should be noted that other regulatory mechanisms relevant to the proposal are:

- *Explosive and Dangerous Goods Act 1961* – dangerous goods licence;
- *Dangerous Goods Safety Act 2004* – licence for the storage, handling and transport of dangerous goods;
- *Rights in Water and Irrigation Act 1914* – licence for abstraction (dewatering);
- Part V of the *Environmental Protection Act 1986* – various Works Approvals and an operating licence would be required for construction and operation of the project;
- *Environmental Protection (Noise) Regulations 1997* – for construction and operational noise;
- *Mining Act 1978* – mining proposal is required to be approved by the Department of Mines and Petroleum; and
- *Iron Ore (Hamersley Range) Agreement Act 1963* – proposal is required to be approved by the Minister for State Development.

5. Other Advice

The proposal would result in greenhouse gas emissions of approximately 190,000 tonnes of CO₂ equivalent per annum, with a carbon intensity of approximately 15.3 tonnes CO₂ equivalent per kilotonne of ore produced. There would also be an additional once off emission of 50,000 tonnes CO₂ equivalent as a result of clearing.

The EPA notes that the proponent has set targets for all its existing proposals for increasing efficiency and reducing energy consumption and emissions of greenhouse gas. The EPA expects that the measures outlined in the PER would provide a mechanism for continuous improvement in emissions resulting from the proposal.

6. Recommendations

The EPA submits the following recommendations to the Minister for the Environment:

1. That the Minister notes that the proposal being assessed is to extend operations at the existing Marandoo Mine site below the water table;
2. That the Minister considers the report on the key environmental factors and principles as set out in Section 3;

3. That the Minister notes that the EPA has concluded that it is unlikely that the EPA's objectives would be compromised, provided there is satisfactory implementation by the proponent of the recommended conditions set out in Appendix 4, and summarised in Section 4; and
4. That the Minister imposes the conditions and procedures recommended in Appendix 4 of this report. Matters addressed in the conditions include the following:
 - potential impacts to the Coolibah woodlands within the Karijini National Park;
 - development of appropriate mitigation strategies to remediate any decline in health of the Coolibah Woodlands
 - potential impacts to springs, pools or creeks in the Karijini National park;
 - impacts related to dewater discharge;
 - detected and management of sinkhole formations; and
 - closure and rehabilitation activities.

Appendix 1

List of submitters

Government Organisations:

Department of Water

Department of Environment and Conservation

Department of Environment, Water, Heritage and the Arts

Department of Indigenous Affairs

Department of Health

Department of Mines and Petroleum (formerly Department of Industry and Resources)

Tourism WA

Non-Government Organisations:

Conservation Council of WA

Martu Idja Banyjima Native Title Claim Group

Wintawari Garuma Aboriginal Corporation

Individuals:

1 Confidential submission

Appendix 2

References

ANZECC & ARMCANZ (2000) *National Water Quality Management Strategy, An Introduction to the Australia and New Zealand Guidelines for Fresh and Marine Water Quality 2000*, Australia and New Zealand Environment and Conservation Council; Agriculture and Resource Management Council of Australia and New Zealand, 2000.

Batini (2009) *Eucalyptus Victrix, Karijini National Park Report to EPA*. Frank Batini, October 2009.

Biota (2008) *Marandoo Mine Phase 2 Project Vegetation and Flora Survey*. Report prepared for Hamersley Iron by Biota, June 2008.

Commander (2009) *Mount Bruce Flats Hydrogeological Conceptual Model Review*, Dr. Phil Commander, November 2009.

DoIR (2007), *Strategic Framework for Mine Closure* Department of Industry, Tourism and Resources, 2007.

Eamus (2009) *A review of the report written by Frank Batini entitled "Eucalyptus Victrix, Karijini National Park."* Prof Derek Eamus, November 2009.

Froend (2009) *Peer review of the Mt Bruce Flats Coolibah Woodland 'State of Knowledge' Report*, Dr Ray Froend, November 2009.

Mattiske (2008) *Review of Flora and vegetation along creek systems near discharge points – Marandoo*. Prepared for Rio Tinto by Mattiske, August 2008.

MWH (2006) *Marandoo BWT Order of Magnitude Study: Water management Options*. Report prepared for Pilbara Iron by MWH, January 2006.

MWH (2007) *Southern Fortescue Sinkholes Position Paper*. Report prepared for Pilbara Iron by MWH, July 2007.

Rio Tinto (2008) *Public Environmental Review, Marandoo Mine Phase 2*, Rio Tinto, September 2008.

Stratagen (2009) *Marandoo Mine Phase 2 – Response to submissions*. Prepared for Rio Tinto by Stratagen, May 2009.

Dr Wade Dodson, Principle Hydrogeologist, Rio Tinto Iron Ore. – personal communication, 13 January 2010.

Appendix 3

Summary of identification of key environmental factors and principles

| Preliminary Environmental Factors | Proposal Characteristics | Government Agency and Public Comments | Identification of Key Environmental Factors |
|-----------------------------------|---|---|--|
| BIOPHYSICAL | | | |
| <p>Flora and vegetation</p> | <p>The proposal has the potential to impact flora and vegetation in the project area, in the adjacent Karijini National Park, and in the re-injection site in the Southern Fortescue borefield.</p> <p>Potential impacts include clearing, groundwater drawdown, alterations to surface water flows including dewater disposal, spread of weeds from vehicle and earth movements, and increased fire frequency.</p> <p>Vegetation in the proposal area is generally open and dominated by spinifex, Acacias and occasional Eucalypts. No DRF has been found in the vicinity, however seven Priority Species have been located in the Marandoo area. Twenty introduced species have been recorded.</p> <p>The Coolibah Woodlands are a PEC located to the north of the minesite within the Karijini National Park. The woodland is seasonally inundated and is considered a wetland of national importance. Groundwater drawdown related to the proposal would reduce the groundwater levels beneath the woodland by approximately two</p> | <p><u>Department of Water</u></p> <ul style="list-style-type: none"> • vertical leakage from the shallow aquifer to the confined aquifer could pose a risk to the nearby Coolibah Woodlands. • A monitoring program and management strategy to maintain water levels for the CW should be established. <p><u>The Garuma and MIB aboriginal groups</u></p> <ul style="list-style-type: none"> • The flora and fauna species lists seemed superficial and based on surveys within the lease as opposed to within the impact area of drawdown. • Species data also has not been put into a context of broader ecological functioning, nor is it clear whether the surface vegetation is connected to the ground water system. • insufficient details have been given regarding the methods of controlling discharge to the environment. <p><u>Department of Environment and Conservation</u></p> <ul style="list-style-type: none"> • Further hydrological modelling is required to determine the risk to the Coolibah Woodlands. If the risk can be demonstrated to be acceptably low, monitoring design and management strategies should be designed in consultation with DEC. • DEC does not support the use of up to 40% loss of foliage cover as a trigger level for plant health. Further, the location of the reference site referred to in the plan is not identified. • vegetation and flora management plans should include the objective of eradicating ruby dock and other environmental weeds in the project area. • the proponent should re-assess the necessity of discharge to non-riparian systems in the Pilbara, and provide information on the impact of such discharge to waterways, springs and pools within the KNP. | <p>Flora and Vegetation is considered to be a key factor. See section 3.1</p> |

| Preliminary Environmental Factors | Proposal Characteristics | Government Agency and Public Comments | Identification of Key Environmental Factors |
|-----------------------------------|--|---|---|
| | <p>to three metres, and is likely to impact the Coolibah woodlands.</p> <p>Mulga stands in the Karijini National Park are particularly important to the ongoing representation and conservation of Mulga in the region. The extension of the mine tail pit would reduce the natural surface flows northwards and may further affect the Mulga stands on the Mount Bruce Flats.</p> <p>Disposal of dewater to the environment has the potential to impact riparian vegetation along the discharge channels through inundation and the spread or introduction of weed species. The proposed discharge points are located 5km upstream of areas within the 2015 exclusion zone, which will become part of the Karijini National Park in 2015.</p> | | |
| Terrestrial Fauna | <p>Fauna surveys in the Marandoo mining lease and adjacent areas have recorded up to 247 fauna species including avifauna, herpetofauna and mammal species. 10 species of conservation significance have been recorded during surveys of the mine lease. Three groups of invertebrate fauna were also recorded.</p> | <p><u>Department of Environment and Conservation</u></p> <ul style="list-style-type: none"> • it was unclear whether all areas of potential impact have been adequately assessed for short range endemic fauna. DEC recommended that additional explanation of the scope, design and selection of sites for the SRE fauna survey be provided. • The fauna management plan should be amended to address the potential for fauna entrapment during trenching activities. • Sinkhole formation in the National Park needs to be prevented to avoid fauna entrapment/mortality and loss of habitat. <p><u>The Garuma and MIB aboriginal groups</u></p> | <p>The construction of dewatering infrastructure is not included in this assessment and would be subject to a separate environmental assessment. Management of trenching activities is therefore not considered necessary.</p> <p>Following the preparation of the proponent's Response to Submissions, DEC has carried out a desktop survey and does not consider the area to be</p> |

| Preliminary Environmental Factors | Proposal Characteristics | Government Agency and Public Comments | Identification of Key Environmental Factors |
|-----------------------------------|--|--|---|
| | <p>Potential impacts to fauna include disturbance or removal of habitat during clearing activities and through groundwater drawdown or alteration of surface water flows, vehicle movements and entrapment of fauna during excavation and trenching activities.</p> <p>Habitat types recorded in the proposal area do not appear to be restricted within the locality.</p> | <ul style="list-style-type: none"> The flora and fauna species lists seemed superficial and based on surveys within the lease as opposed to within the impact area of drawdown. Species data also has not been put into a context of broader ecological functioning. | <p>significant for supporting SRE habitat.</p> <p>Most of the species of conservation significance recorded within the project area consist of bird species, which are highly mobile and likely to be able to avoid impacts associated with mining activities. The remainder have been recorded outside the area of proposed disturbance. The proposal is unlikely to affect the conservation status of any terrestrial fauna.</p> <p>Management actions described in the PER to avoid and mitigate impacts to fauna include:</p> <ul style="list-style-type: none"> Progressive clearing of vegetation within the project area; Restriction of clearing to within designated areas; Feral animal control measures; Progressive rehabilitation of cleared areas; Implementation of appropriate speed limits for vehicles; Reflectors to be placed on barbed wire fencing to deter bats; Workforce education and training. <p>Terrestrial Fauna is not considered to be a key factor in this assessment.</p> |
| Groundwater | A total of approximately 200GL would be extracted from the confined aquifer at Marandoo over the life of the project, approximately 13GL/year. | <p><u>Department of Water</u></p> <ul style="list-style-type: none"> the proponent's assertion that springs and pools would not be affected may be erroneous, and a methodology should be provided to isolate drawdown impacts from climate variability. the potential impacts to aquifers have not been adequately modeled or described. Adequate monitoring of the groundwater | Groundwater is considered to be a key factor. See Section 3.2 |

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| | <p>Intersection of the pit with the unconfined aquifer would cause seepage and subsequent drawdown in the unconfined aquifer.</p> <p>Groundwater drawdown in the unconfined aquifer presents a risk of impact to water levels in several springs and pools in the KNP, in particular Minthicundunna Spring. The spring provides habitat for flora and fauna, and has indigenous and recreational values.</p> <p>There is a potential for impacts to groundwater quality as a result of the operation of residue storage facilities, contaminated dewater discharge, re-injection of dewater at the Southern Fortescue borefield, and fuel and chemical storage.</p> <p>Groundwater drawdown beneath the Mount Bruce Flats has the potential to create sinkholes within the Karijini National park.</p> | <p>resource would require new bores within the Karijini National Park, necessitating monthly vehicle access to the bores. If this is not acceptable then the reduced monitoring program would not be acceptable to manage the resource.</p> <ul style="list-style-type: none"> • sinkhole formation within the National Park would be an unacceptable outcome. Discussion on sinkhole formation is inadequate and does not present prevention or remediation strategies. • The proponent’s predictions of the risk of impacts of dewatering depend on the assertion that minimal connectivity between aquifers exists, but there is insufficient information to verify this. Further surveys and modelling are required to determine the risk of impacts, particularly in regard to the Coolibah Woodlands. • dewatering can result in slumping of surface material (sinkholes) Within the National Park this is considered to be unacceptable. <p><u>The Garuma and MIB aboriginal groups</u></p> <ul style="list-style-type: none"> • assumptions used in the groundwater modelling need to be confirmed or corrected. • dewatering could impact the Minthicundunna spring area. The groups note that there are no details in the report of actions to be taken should monitoring show potential impacts to the spring. • the proponent should carry out solute transport modelling in order to clearly demonstrate flow paths and possible connections between dewatering water and any surrounding springs. <p><u>Department of Environment and Conservation</u></p> <ul style="list-style-type: none"> • the predicted degree of interaction between the unconfined and the confined aquifer should be verified through hydrological testing and modelling, and the area around Mt Bruce flats should be investigated for the presence of preferential paths. • the proponent should demonstrate through hydrological investigation that the springs and pools within KNP would not be adversely affected by changes in the unconfined aquifer, and | |

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| | | <p>that the proponent provide accurate baseline data to evaluate potential impacts.</p> <ul style="list-style-type: none"> • further investigation into the potential risk and management of sinkhole formation in the KNP should be carried out. <p><u>Private submission</u></p> <ul style="list-style-type: none"> • the proponent’s calculations showing negligible risk to springs and gorges from dewatering may not be accurate. The proponent should be made legally responsible for any damages resulting from impacts to the tourism industry. <p><u>Conservation Council</u> –</p> <ul style="list-style-type: none"> • the proponent’s previous failures in ground/surface water modelling and failures in adaptive management response increase the risk to KNP. • The mechanisms causing sinkhole formation should be fully understood and management demonstrated before any abstraction is allowed. | |
| Dewater Disposal | <p>The proponent anticipates a peak abstraction rate of 65ML/day, reducing to 50ML/day after the first three years.</p> <p>Approximately 5ML a day would be used for wet processing, dust suppression and other uses at the mine site. A further 30ML/day would be transferred to the Tom Price mine and township throughout the duration of the proposal.</p> <p>Following use on site and transfer to Tom Price, there would be an excess of 30ML/day during the first three</p> | <p><u>Department of Water</u></p> <ul style="list-style-type: none"> • reinjection to the Southern Fortescue Borefield is acceptable, however contingencies should be available if reinjection is less effective than anticipated. • overall modelling for re-injection is reliable since the Southern Fortescue Borefield has been monitored for many years. • the proponent needs to demonstrate how creek discharge could be managed at a range of discharge rates. 15ML/day for a three year period would fundamentally change the surface water regime in the area and is an undesirable outcome. • the assessment should examine the potential width/depth of flow, channel velocity and bed stability. • the proponent should demonstrate how creek discharge could be managed at a range of discharge rates. The worst case scenario resulting in a continuous base flow of 15ML/day would fundamentally change the surface water regime and is an undesirable outcome. • The report does not demonstrate sufficient understanding of the | <p>Impacts to flora and vegetation arising from dewater discharge to the environment, and from re-injection to the Southern Fortescue Borefield, are considered to be a key factor, and are addressed in section 3.1 – Flora and Vegetation.</p> <p>The Proponent has investigated suitable methods for the disposal of dewater in accordance with the water use hierarchy and EPA objectives.</p> <p>Impacts to aquatic fauna as a result of dewater discharge are expected to be minimal and short term.</p> <p>The proponent has detailed appropriate</p> |

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| | <p>years of the proposal and 15ML/day thereafter.</p> <p>Re-injection into the Southern Fortescue Borefield is proposed for disposal of excess water. Based on the proponent's current modelling, the aquifer can accept 15ML/day.</p> <p>Re-injection of groundwater into the Southern Fortescue Borefield (Southern Fortescue Borefield) has the potential to cause sinkholes to form in the borefield, and to affect groundwater quality through hydrocarbon spills.</p> <p>Any dewater which is not used in accordance with the disposal hierarchy would be released into ephemeral tributaries of the Southern Fortescue River.</p> <p>This discharge would comprise intermittent, high volume discharge during shutdown events at Tom Price, and a continuous flow of up to 15ML/day discharge of any excess which exceeds the capacity of the Southern Fortescue Borefield.</p> | <p>capacity of ephemeral tributaries.</p> <p><u>The Garuma and MIB aboriginal groups</u></p> <ul style="list-style-type: none"> • there should be greater impact assessment of returning water to the Southern Fortescue Borefield, particularly given that the PER states that salinities vary widely. • insufficient details have been given regarding the piping of water to Tom Price and the methods of controlling discharge to the environment. <p><u>Department of Environment and Conservation</u></p> <ul style="list-style-type: none"> • insufficient information has been provided to demonstrate that the Southern Fortescue Borefield would be able to support the volume of water proposed for re-injection., and that baseline data, justified trigger levels and management strategies should be provided for vegetation in the Southern Fortescue Borefield area. | <p>management strategies to prevent erosion and sedimentation impacts to surface water quality as a result of dewater discharge. Discharge points would be designed and located to minimise erosion, consisting of multiple discharge points and energy dissipation structures.</p> <p>Given the high quality of the water in the confined aquifer, discharge of this water is not expected to impact surface water quality. The proponent has detailed monitoring strategies to ensure that dewater discharge does not impact surface water quality.</p> <p>Impacts to surface water quality and aquatic fauna arising from dewater disposal are not considered to be a key factor in this assessment.</p> |
| Subterranean Fauna | The proposal has the potential to impact subterranean fauna | No submissions were received in relation to Troglifauna. The following submissions relate to Stygoafauna. | The stygoafauna sampling methods and level of effort presented in the PER |

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| | <p>through loss of habitat related to dewatering activities and clearing of vegetation, contamination of groundwater, vibration from blasting activities and re-injection of water at the Southern Fortescue Borefield.</p> <p>Historical sampling for stygofauna has occurred at the Marandoo site since 1999. Further sampling was conducted for the purpose of this assessment. 64 bores have been sampled in total.</p> <p>For the purposes of this assessment, 43 bores were sampled. 30 of these were within the predicted 2m drawdown contour and 13 outside this area.</p> <p>68 individuals from four orders were collected during the multi-phase sampling program. Stygofauna were collected from eight of the 64 bores sampled.</p> <p>No stygofauna were collected from the Southern Fortescue Borefield.</p> <p>No sampling for troglofauna has been undertaken. A desktop review and risk assessment determined that the likelihood of troglofauna occurring in the proposal area was low. Two</p> | <p><u>Department of Environment and Conservation</u></p> <ul style="list-style-type: none"> the adequacy of stygofauna sampling was difficult to ascertain from the information provided in the PER, and that the proponent should provide further information regarding the location of sampling bores in relation to drawdown impacts. <p><u>Conservation Council</u></p> <ul style="list-style-type: none"> the loss of stygofauna populations protected within the park is unacceptable, regardless of whether these species are represented outside the park. | <p>appear to be consistent with EPA guidelines, with particular regard to Draft EPA Guidance Statement 54a.</p> <p>Given that stygofauna have not been found to exist in the confined aquifer, and that drawdown in the unconfined aquifer is predicted to be minimal as a result of seepage into the pit, it is unlikely that stygofauna populations would be significantly impacted by the proposal. Further, no stygofauna taxa appears to be restricted specifically to the mining area.</p> <p>The EPA considers that the proponent's assessment of risk to troglofauna is environmentally acceptable, and that there is a low risk of impact to troglofauna diversity as a result of the proposal.</p> <p>Subterranean Fauna is not considered to be a key factor in this assessment.</p> |

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| | <p>troglobitic individuals were collected opportunistically during stygofauna sampling.</p> | | |
| <p>Surface water</p> | <p>There is a potential for the proposal to impact surface water flows and quality.</p> <p>The proposed extensions to the Marandoo Mine Pit are located on the north side of Marandoo Ridge and intersect three ephemeral drainage lines that flow northwards toward the Mount Bruce flats.</p> <p>Surface water flows to the Mount Bruce flats are already highly modified by existing operations. Runoff generated on Marandoo ridge would be intercepted by the pit.</p> <p>Diversion of surface water flow has the potential to impact vegetation including the locally significant Mulga communities.</p> <p>Potential impacts to surface water quality would include seepage from the Residue storage facility, drainage from waste rock dumps, and storage of fuels and other chemicals.</p> | <p><u>Department of Mines and Petroleum</u></p> <ul style="list-style-type: none"> the proponent should provide further characterization of the material to be excavated in order to demonstrate the benign nature of the material to go to the residue storage facility. <p><u>Department of Mines and Petroleum</u></p> <ul style="list-style-type: none"> information on the volumes of material to be encountered which may have the potential to generate Acid Rock Drainage should be provided | <p>The location of the proposed RSF is not expected to intercept significant volumes of surface water. Diversion bunds and channels would be constructed if required, to direct surface flows around the RSF into the downstream catchment</p> <p>The proponent considers that this slurry would be benign, as the mineralised Marra Mamba Formation does not contain asbestiform material.</p> <p>The EPA notes that the RSF would be subject to the requirements of the Department of Mines and Petroleum.</p> <p>Seepage into the groundwater system from the RSF is likely to be limited to approximately 2-5% of the water pumped into the RSF. Seepage would be relatively high quality and is not expected to affect vegetation in the area.</p> <p>Drilling and geotechnical investigations at the site have indicated negligible amounts of shale within the proposed mine pit shell. ARD is therefore not considered a significant risk at Marandoo.</p> <p>Sulphur assays would continue to be monitored throughout the proposal and any ARD risk material would be managed in accordance with the proponent's Mineral Waste Management Plan.</p> |

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| | | | <p>Impacts to surface water flows and quality are not considered to be a key factor in this assessment.</p> <p>Impacts to Mulga stands in the vicinity of the proposal as a result of changes to surface water flows are considered to be a key factor, and are addressed in Section 3.1: Flora and Vegetation.</p> |
| Fire management | <p>Increased vehicular traffic and personnel movement throughout the life of the proposal would increase the risk of accidental outbreaks of fire in adjacent areas.</p> <p>There is a potential for increased fire frequency to favour the establishment of weeds and destroy or prevent the regeneration of native vegetation, particularly fire sensitive species such as Mulga.</p> | <p><u>Department of Environment and Conservation</u></p> <ul style="list-style-type: none"> the fire management plan for the project should be developed in consultation with and to the satisfaction of DEC | <p>Management of fire risks would be undertaken by the proponent throughout the life of the proposal, including basic fire awareness and fire fighting training for all personnel, maintenance of adequate fire breaks across the mine site and working areas, and use of a fire spotter when clearing vegetation near sensitive areas.</p> <p>The EPA supports the proponents commitment to develop fire management plans in consultation with DEC according to the Statement of Mutual understanding between DEC and Rio Tinto.</p> <p>Fire management is not considered to be a key factor in this assessment.</p> |
| POLLUTION | | | |
| Greenhouse gasses | Greenhouse Gas emissions from the proposal would be approximately 190 000 tCO ₂ -e per year from Mobile mine site (diesel) (98 000) Conveyor/plant infrastructure (88 000) and explosives (4 000) A once off | <p><u>The Conservation Council</u></p> <ul style="list-style-type: none"> greenhouse gas emissions of 190,000tpa are significant in a state context. | <p>Greenhouse Gas is not considered to be a key factor in this assessment. However further information is provided in section 5– Other Advice.</p> |

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| | emission of 50 000 t CO ₂ –e from clearing activities is not included in the above estimate. | | |
| Dust | Dust would be emitted by the project as a result of activities including clearing of vegetation, blasting, excavation, ore handling and processing, stockpiling, and vehicle movement, and by wind episodes over dry open areas, stockpiles and unsealed roads. | No Submissions were received in relation to this factor | <p>Most airborne particulates originating from the proposal would be large particulates (ie, would not fall within the criteria for PM10) and are therefore unlikely to be associated with health problems.</p> <p>Due to the remoteness of the mine from residential areas there is unlikely to be any significant impact to health or amenity arising from dust associated with this proposal.</p> <p>Dust emissions from the proposal would be subject to controls imposed through a licence issued under Part V of the EP Act.</p> <p>Dust is not considered to be a key factor in this assessment.</p> |
| Waste disposal | <p>A new sewage treatment plant would be developed at Marandoo and the existing facility at the camp would be upgraded to accommodate the additional operations workforce.</p> <p>Treated wastewater and sewage from the mine site would be discharged to a sprayfield that would be developed as part of the proposal.</p> <p>Putrescible and inert wastes</p> | <p><u>The Department of Health</u></p> <ul style="list-style-type: none"> wastewater treatment plants would require individual approval under the Health (<i>Treatment of Sewage and Disposal of Effluent and Liquid Waste</i>) Regulations 1974. | <p>Sewage treatment facilities would be registered or licensed as required under the EP Act in accordance with health and safety requirements.</p> <p>Waste disposal is not considered to be a key factor in this assessment.</p> |

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| | from the mine site and operations camp would be deposited in the existing Marandoo Landfill. | | |
| SOCIAL SURROUNDINGS | | | |
| Visual amenity | <p>The extensions to the mine pit, the operations camp and dewatering infrastructure have the potential to impact on visual amenity at several sites, including popular tourist viewpoints at Mount Bruce and other areas within the Karijini National Park.</p> <p>The proponent conducted a landscape and visual assessment of the proposal including proposed pits and waste dumps, the operations camp and dewatering infrastructure. Sensitive receptors considered during the assessment included three viewpoints from Mount Bruce, and three vantage points on Karijini Drive.</p> <p>Taking into account the level of use at each receptor, the potential change to views and the potential sensitivity of the receptor, the landscape and visual assessment concluded that the significance of the visual impact at the eight receptors ranged from ‘moderate’ to ‘severe adverse’, with three of</p> | <p><u>Department of Environment and Conservation</u></p> <ul style="list-style-type: none"> concerned that the visual impacts on KNP have been taken into account in the design and management of the project. The DEC notes that the proximity of the rail/construction/operations camp to the KNP would have impacts on visual amenity. the proposed location of the construction/operations camp should be reconsidered. <p><u>Tourism WA</u></p> <ul style="list-style-type: none"> the proposed site 6 appears to have met requirements for visual impact to KNP. <p><u>Conservation Council</u></p> <ul style="list-style-type: none"> the construction camp should not be placed in a location where it is visible from tourist locations such as Mount Bruce. | <p>The proponent has proposed measures to manage the impact to visual amenity arising from the proposal. These are outlined in the PER and include:</p> <ul style="list-style-type: none"> further visual assessments during the life of the mine and at closure to inform the preparation of the final closure plan; progressive rehabilitation of the proposal area to come as close as possible to local landscape values and surrounding environment; prevention of unnecessary clearing; location of infrastructure within or near previously disturbed areas where possible; selection of colour schemes for buildings and infrastructure to blend with the surrounding landscape; provision of informational signage about the proposal at the Mount Bruce car park lookout. <p>These management measures are considered to be appropriate to meet the EPA’s environmental objective for this factor, which is “to ensure that aesthetic values are considered and measures are adopted to reduce visual impact to the landscape as low as reasonably practicable.”</p> |

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| | the eight sites potentially experiencing a severe adverse impact. | | Visual Amenity is not considered to be a key factor in this assessment. |
| Accommodation | Up to 800 people would be accommodated in the camp during peak periods when construction and operations personnel would coincide. Clearing, Visual impact of the camp, workforce behavior, and waste disposal are covered in other sections above. | <u>Tourism WA</u> <ul style="list-style-type: none"> • Tourism WA agrees that a remote village operations camp is required to best house the workers associated with the proposal, and that using existing accommodation in Tom Price is unacceptable. | Accommodation is not considered to be a key factor in this assessment. |
| Workforce behavior in KNP | The proposal requires approximately 500 personnel during operations, plus an additional 200 personnel during shutdown maintenance periods. The size of the workforce and the proximity to Karijini National Park may impact the social, recreational and tourist values of the area, however the fly in fly out roster combined with the length of working hours (12 hour shifts) would limit the time available to personnel to undertake recreational pursuits. | <u>Department of Environment and Conservation</u> <ul style="list-style-type: none"> • The DEC recommended that the proponent should develop a more detailed workforce management strategy , and provide resources to support the appointment of additional ranger staff in KNP | Recreational and tourism values in the vicinity of the Karijini National Park would be maintained through the implementation of a comprehensive induction program. Key measures include education of mine staff on appropriate low impact behavior within the park, weed control, alcohol restrictions and regulations in relation to camping, remaining on tracks and campfires. Workforce behavior is not considered to be a key factor in this assessment. |
| Indigenous Heritage | Aboriginal heritage sites within the mine lease area include rock shelters, stone artifact scatters, scarred trees, grinding patches, mythological and ceremonial sites and a quarry. | <u>The Garuma and MIB aboriginal groups</u> provided detailed comments via an expert hired to assess the PER document. Technical comments are included in the relevant sections above. Other comments are included below. <ul style="list-style-type: none"> • The report states that community consultation took place however no evidence was provided to suggest that meeting were anything more than information sessions where whoever | The proponent has proposed management measures to address potential impacts to Indigenous heritage arising from the proposal. These include: <ul style="list-style-type: none"> • Avoidance of known heritage sites; • Education of personnel; • Implementation of proponent’s |

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| | <p>Minthicundunna Spring and Banjima Pool, both of which have cultural significance, are located in proximity to the minesite.</p> <p>Potential impacts to areas of indigenous heritage value include clearing and site works, and lowering of water levels in springs and pools related to dewatering activities.</p> <p>The cultural heritage values of Minthicundunna Spring are protected under the <i>Aboriginal Heritage Act 1972</i>.</p> | <p>turned up was provided with a synopsis of the proposal.</p> <ul style="list-style-type: none"> • no concrete evidence has been presented to demonstrate that any actual work was done to assess the impact of the proposal on Aboriginal heritage, with particular regard to impacts of dewatering, injection, impacts to tourism and benefits to the community. • The MIB aboriginal group is opposed to approval of the proposal for various reasons, in particular due to the high level of risk to “Minthayi” Springs. They contend that aboriginal groups have already suffered cultural loss and damage through dewatering at existing mines such as Hope Downs. • The MIB assert that the <i>Aboriginal Heritage(Marandoo) Act 1992 (WA)</i> is racially discriminatory and they are disappointed that this history of Marandoo, including the destruction of sites in the process of developing the mine is not referred to or acknowledged in the PER. | <p>permit system for areas to be disturbed;</p> <ul style="list-style-type: none"> • Additional survey work and ethnographic studies; • Stopping of work and consultation with DIA where human remains or archeological material is uncovered; • Undertaking further hydrogeological investigations between Marandoo and Minthicundunna springs; • Monitoring water levels at Minthicundunna spring; and • Continuing consultation with the Eastern Garuma people and other relevant stakeholders <p>These management measures are considered to be appropriate to meet the EPA’s environmental objective for this factor, which is “ <i>to ensure that changes to the biological and physical environment resulting from the project do not adversely affect cultural associations with the area.</i>”</p> <p>Indigenous Heritage is not considered to be a key factor in this assessment, however, the potential for impacts to Minthicundunna Spring have been addressed in Section 3.2 – Groundwater.</p> |
| Noise/Vibration | <p>Sources of noise associated with the proposal include vehicles and equipment, wet processing plant, and blasting.</p> <p>Sensitive receptors in the</p> | <p><u>Department of Environment and Conservation</u></p> <ul style="list-style-type: none"> • DEC (noise branch) noted that the proposal was remote from any noise-sensitive premises, and that there would be no noise impacts on these sensitive premises. • DEC (noise branch) did not agree with the proponent’s statement that Noise regulations do not apply to Mount Bruce | <p>Blast sizes are not anticipated to be any greater than existing blasts at Marandoo. The majority of blasting would be carried out away from areas commonly accessed by tourists.</p> |

| Preliminary Environmental Factors | Proposal Characteristics | Government Agency and Public Comments | Identification of Key Environmental Factors |
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| | <p>vicinity of the proposal include tourist viewpoints at Mount Bruce and other areas accessed by tourists in the Karijini National Park.</p> <p>Noise from the Wet processing Plant is not expected to be higher than that from the existing dry processing plant, which has not been identified as a source of noise impacts to date. The wet and dry processing plants would not be operated at the same time.</p> | <p>because there are no noise sensitive premises there. The DEC considered that recreational areas should have a more stringent target for noise than the regulatory requirement. The DEC acknowledged that noise emissions from the project were likely able to meet the aspirational goal of 45dB(A) for Mount Bruce.</p> | <p>Vibration impacts associated with blasting are also expected to be reduced compared to the existing blasting regime. It is not anticipated that the proposal would result in impacts from noise or vibration greater than existing operations.</p> <p>Noise and Vibration are not considered to be a key factor in this assessment.</p> |
| <p>Tourism and recreation values in Karijini National Park</p> | <p>Impacts to Tourism and recreation values in the Karijini National Park include</p> <ul style="list-style-type: none"> • Visual amenity • Noise and vibration • Workforce behavior <p>These impacts are addressed separately above.</p> | <p><u>The Garuma and MIB groups</u></p> <ul style="list-style-type: none"> • no concrete evidence was provided of any systematic surveys or analysis of tourist activity in the area. At a meeting on 10 November 2008 it was clear that data in this section was drawn exclusively from entries in one visitation sign in book at one lookout. | <p>Impacts to tourism resulting from this proposal are not expected to be significantly greater than those arising from existing operations.</p> <p>Recreation is not considered to be a key factor in this assessment</p> |
| <p>Mosquito management</p> | <p>There is a potential risk of increased exposure of workforce to mosquitoes and mosquito-borne illnesses as a result of the proposal.</p> <p>Water sources associated with the proposal may also increase mosquito populations in the project area.</p> | <p><u>The Department of Health</u></p> <ul style="list-style-type: none"> • a program to manage mosquitoes would be an important OSH component for the site. | <p>Mosquito management is not considered to be a key factor for this assessment</p> |

| Preliminary Environmental Factors | Proposal Characteristics | Government Agency and Public Comments | Identification of Key Environmental Factors |
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| OTHER | | | |
| Decommissioning | <p>The proponent has developed a set of conceptual closure objectives.</p> <p>Pit voids would be nominally backfilled to 1m above the pre-mining water table.</p> | <p><u>Department of Water</u></p> <ul style="list-style-type: none"> following the cessation of mining the mine voids should be backfilled to at least one meter above the water table. An open void would not be acceptable for this project. The proponent should make a clear commitment to backfilling. <p><u>Department of Environment and Conservation</u></p> <ul style="list-style-type: none"> the proponent should commit to backfilling as close as possible to the surrounding ground level and ensure final landforms are consistent with the surrounding national park. the proponent should provide information on how the proposed rehabilitation and closure strategies will ensure that the design and management of post-mining landforms are consistent with surrounding landforms and uses. | <p>Decommissioning and Rehabilitation are considered to be a key factor for this assessment. See section 3.3.</p> |
| | | | |

| PRINCIPLES | | |
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| Principle | Relevant Yes/No | If yes, Consideration |
| 1. The precautionary principle | | |
| <p><i>Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.</i></p> <p><i>In application of this precautionary principle, decisions should be guided by –</i></p> <p>(a) <i>careful evaluation to avoid, where practicable, serious or irreversible damage to the environment; and</i></p> <p>(b) <i>an assessment of the risk-weighted consequences of various options.</i></p> | Yes | <p>In considering this principle, the EPA notes the following:</p> <ul style="list-style-type: none"> • Investigations of the biological and physical environments provided background information to assess risks and identify measures to avoid or minimise impacts. • The assessment of the adequacy of these impacts and management is provided in Section 3 of this report. • Conditions have been recommended where considered necessary. |
| 2. The principle of intergenerational equity | | |
| <p><i>The present generation should ensure that the health, diversity and productivity of the environment is maintained and enhanced for the benefit of future generations.</i></p> | No | |
| 3. The principle of the conservation of biological diversity and ecological integrity | | |
| <p><i>Conservation of biological diversity and ecological integrity should be a fundamental consideration.</i></p> | Yes | <p>In considering this principle, the EPA notes the following:</p> <ul style="list-style-type: none"> • Scientific studies have contributed to the understanding and management of impacts of mining operations on biodiversity and ecological integrity of the area. • The above impacts have been assessed and provided in Section 3 of this report. |
| 4. Principles relating to improved valuation, pricing and incentive mechanisms | | |
| <p>(1) <i>Environmental factors should be included in the valuation of assets and services.</i></p> <p>(2) <i>The polluter pays principles – those who generate pollution and waste should bear the cost of containment, avoidance and abatement.</i></p> <p>(3) <i>The users of goods and services should pay prices based</i></p> | No | |

| PRINCIPLES | | |
|--|------------------------|--|
| Principle | Relevant Yes/No | If yes, Consideration |
| <p><i>on the full life-cycle costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste.</i></p> <p><i>(4) Environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structure, including market mechanisms, which enable those best placed to maximize benefits and/or minimize costs to develop their own solution and responses to environmental problems.</i></p> | | |
| 5. The principle of waste minimisation | | |
| <p><i>All reasonable and practicable measures should be taken to minimize the generation of waste and its discharge into the environment.</i></p> | Yes | <p>In considering this principle, the EPA notes the following:</p> <ul style="list-style-type: none"> ● The proposal would generate residue and waste rock. ● Geotechnical investigations indicate that there is a negligible potential for Acid Rock Drainage to occur. ● Seepage from the Residue storage facility would be of relatively high quality and is unlikely to affect vegetation in the area. ● Other waste products will be created as a result of implementation of the proposal, and would be disposed of according to relevant regulations and legislation. |

Appendix 4

Recommended Environmental Conditions and Identified Decision-making Authorities

RECOMMENDED ENVIRONMENTAL CONDITIONS

**STATEMENT THAT A PROPOSAL MAY BE IMPLEMENTED
(PURSUANT TO THE PROVISIONS OF THE
ENVIRONMENTAL PROTECTION ACT 1986)**

MARANDOO MINE PHASE 2, SHIRE OF ASHBURTON

Proposal: The expansion of existing mining operations at Marandoo by mining below the water table, including expansion of the existing mine pit and development of new waste dumps.

The proposal is further documented in Schedule 1 of this statement.

Proponent: Hamersley Iron Pty Ltd, Rio Tinto Group

Proponent Address: 152-158 St Georges Tce, Perth, 6000

Assessment Number: 1686

Report of the Environmental Protection Authority: Report 1355

The proposal referred to in the above report of the Environmental Protection Authority may be implemented. The implementation of that proposal is subject to the following conditions and procedures:

1 Proposal Implementation

1-1 The proponent shall implement the proposal as assessed by the Environmental Protection Authority and described in Schedule 1 of this statement subject to the condition and procedures of this statement.

2 Proponent Nomination and Contact Details

2-1 The proponent for the time being nominated by the Minister for Environment under sections 38(6) or 38(7) of the *Environmental Protection Act 1986* is responsible for the implementation of the proposal.

2-2 The proponent shall notify the Chief Executive Officer of the Office of the Environmental Protection Authority of any change of the name and address of the proponent for the serving of notices or other correspondence within 30 days of such change.

3 Time Limit of Authorisation

3-1 The authorisation to implement the proposal provided for in this statement shall lapse and be void within five years after the date of this statement if the proposal to which this statement relates is not substantially commenced.

3-2 The proponent shall provide Chief Executive Officer of the Office of the Environmental Protection Authority with written evidence which demonstrates that the proposal has substantially commenced on or before the expiration of five years from the date of this statement.

4 Compliance Reporting

4-1 The proponent shall prepare and maintain a compliance assessment plan to the satisfaction of Chief Executive Officer of the Office of the Environmental Protection Authority.

4-2 The proponent shall submit to the Chief Executive Officer of the Office of the Environmental Protection Authority, the compliance assessment plan required by condition 4-1 at least six calendar months prior to the first Compliance Assessment Report required under condition 4-6 or prior to implementation, whichever is sooner. The compliance assessment plan shall indicate:

- 1 the frequency of compliance reporting;
- 2 the approach and timing of compliance assessments;
- 3 the retention of compliance assessments;
- 4 reporting of potential non-compliances and corrective actions taken;
- 5 the table of contents of compliance reports; and
- 6 public availability of compliance reports.

4-3 The proponent shall assess compliance with conditions in accordance with the compliance assessment plan required by condition 4-1.

4-4 The proponent shall retain reports of all compliance assessments described in the compliance assessment plan required by condition 4-1 and shall make those reports available when requested by the Chief Executive Officer of the Office of the Environmental Protection Authority.

4-5 The proponent shall advise the Chief Executive Officer of the Office of the Environmental Protection Authority of any potential non-compliance within two business days of that non-compliance being known.

4-6 The proponent shall submit a compliance assessment report annually from the date of issue of this Implementation Statement addressing the previous twelve month period or other period as agreed by the Chief Executive Officer of the Office of the Environmental Protection Authority. The compliance assessment report shall:

- 1 be endorsed by the proponent's Managing Director or a person, approved in writing by the Department of Environment and Conservation, delegated to sign on the Managing Director's behalf;

- 2 include a statement as to whether the proponent has complied with the conditions;
- 3 identify all potential non-compliances and describe corrective and preventative actions taken;
- 4 be made publicly available in accordance with the approved compliance assessment plan; and
- 5 indicate any proposed changes to the compliance assessment plan required by condition 4-1.

5 Performance Review and Reporting

- 5-1 The proponent shall submit to the Chief Executive Officer of the Office of the Environmental Protection Authority Performance Review Reports at the conclusion of the second and fifth years after the commencement of productive mining and then, at such intervals as the Chief Executive Officer of the Office of the Environmental Protection Authority may regard as reasonable, which addresses:
- 1 the major environmental risks and impacts; the performance objectives, standards and criteria related to these; the success of risk reduction/impact mitigation measures and results of monitoring related to management of the major risks and impacts;
 - 2 the level of progress in the achievement of sound environmental performance, including industry benchmarking, and the use of best available technology where practicable; and
 - 3 improvements gained in environmental management which could be applied to this and other similar projects.

6 Coolibah Woodlands

- 6-1 The proponent shall ensure that groundwater abstraction, dewatering required to implement the proposal, and any mitigation measures implemented do not adversely impact the Coolibah Woodlands located within Karijini National Park.
- 6-2 To verify that the requirement of condition 6-1 is met the proponent shall:
1. monitor groundwater levels and quality within the woodlands;
 2. monitor soil moisture levels within the woodlands;
 3. monitor soil physical and chemical parameters within the woodlands; and
 4. monitor the health and cover of vegetation within the woodlands, particularly Coolibah trees.

Monitoring is to be carried out according to a monitoring schedule and using methods developed to the satisfaction of the Chief Executive Officer of the Office of

the Environmental Protection Authority on advice from the Department of Environment and Conservation prior to the commencement of dewatering.

Monitoring is to continue until such time as groundwater levels below the Coolibah Woodlands have returned to pre-mining levels, or until such time as the Chief Executive Officer of the Office of the Environmental Protection Authority determines that monitoring and management actions may cease.

- 6-3 The proponent shall, prior to the commencement of dewatering, provide a report to the Chief Executive Officer of the Office of the Environmental Protection Authority which has been prepared using independent experts chosen in consultation with the Office of the Environmental Protection Authority and Department of Environment and Conservation. The report shall detail the following:
1. appropriate trigger values developed to the satisfaction of the Chief Executive Officer of the Office of the Environmental Protection Authority on advice from the Department of Environment and Conservation to be applied to the monitoring program required in condition 6-2, and discussion of the selection of the trigger levels in relation to the EPA's objectives;
 2. a detailed strategy developed to the satisfaction of the Chief Executive Officer of the Office of the Environmental Protection Authority on advice from the Department of Environment and Conservation to avoid and mitigate any impacts to the Coolibah Woodland detected by the monitoring program required by condition 6-2.
- 6-4 Within eight months of commencement of dewatering, the proponent shall provide a report to the Chief Executive Officer of the Office of the Environmental Protection Authority detailing data obtained from the first six months of dewatering. This report shall contain:
1. verification of the groundwater model presented in the Public Environmental Review against actual data; and
 2. recalibration of the model and implications of any deviations from the model on the Coolibah Woodlands.
- 6-5 In the event that monitoring required by condition 6-2 indicates an exceedance of the trigger levels determined in condition 6-3 (1):
1. the proponent shall immediately implement mitigation measures indicated by the mitigation strategy required to be developed by condition 6-3;
 2. report to the Chief Executive Officer of the Office of the Environmental Protection Authority within 7 days of the exceedance being identified;
 3. provide evidence which allows determination of the cause of the exceedance;
 4. if determined by the Chief Executive Officer of the Office of the Environmental Protection Authority to be a result of activities undertaken in implementing the proposal, the proponent shall submit actions to be taken including those required to be developed by condition 6-3; and
 5. implement actions including those required to be developed by condition 6-3 upon approval of the Chief Executive Officer of the Office of the Environmental Protection Authority on advice from the Department of

Environment and Conservation and shall continue until such time the Chief Executive Officer of the Office of the Environmental Protection Authority determines that the remedial actions may cease.

6-6 The proponent shall submit annually the results of monitoring required by condition 6-2 to the Chief Executive Officer of the Office of the Environmental Protection Authority.

6-7 The proponent shall make publicly available the monitoring reports required by condition 6-2 in a manner approved by the Chief Executive Officer of the Office of the Environmental Protection Authority.

7 Springs, Pools and Creeklines of Karijini National park

7-1 The proponent shall ensure that groundwater abstraction, dewatering and interception of surface water flows required to implement the proposal do not adversely affect any of the springs, pools or creeks in the Karijini National park, or their surrounding vegetation.

7-2 To verify that the requirements of condition 7-1 are met:

1. the proponent shall identify all sites and parameters to be monitored to the satisfaction of the Chief Executive Officer of the Office of the Environmental Protection Authority on advice from DEC;
2. undertake baseline monitoring of water levels and native vegetation health and abundance at all sites identified within the predicted cone of drawdown prior to dewatering;
3. monitor groundwater and/or surface water levels at each of the agreed sites; and
4. monitor the health and cover of riparian vegetation at each of the agreed sites.

This monitoring is to be carried out to the satisfaction of the Chief Executive Officer of the Office of the Environmental Protection Authority, and is to be carried out in such a way that, should a significant decline water levels be detected, it will be possible to determine whether the decline is attributable to the implementation of the proposal or to other causes.

Monitoring is to continue until such time as groundwater levels in the project area have returned to pre-mining levels, or until such time the Chief Executive Officer of the Office of the Environmental Protection Authority determines that monitoring and management actions may cease.

7-3 The proponent shall submit annually the results of monitoring required by condition 7-2 to the Chief Executive Officer of the Office of the Environmental Protection Authority.

7-4 In the event that monitoring required by condition 7-2 and 7-3 indicates a decline in water levels at any spring, pool or creek, or in the health and condition of the riparian vegetation:

1. the proponent shall report such findings to the Chief Executive Officer of the Office of the Environmental Protection Authority within 7 days of the decline being identified;
2. provide evidence which allows determination of the cause of the decline;
3. if determined by the Chief Executive Officer of the Office of the Environmental Protection Authority to be a result of activities undertaken in implementing the proposal, the proponent shall determine actions to be taken to remediate the decline in consultation with the Department of Environment and Conservation;
4. submit proposed actions to the Chief Executive Officer of the Office of the Environmental Protection Authority within 21 days of the determination being made; and
5. implement actions to remediate the decline of riparian and groundwater dependent vegetation upon approval of the Chief Executive Officer of the Office of the Environmental Protection Authority and shall continue until such time the Chief Executive Officer of the Office of the Environmental Protection Authority determines that the remedial actions may cease.

7-5 The proponent shall make the monitoring reports required by conditions 7-2 and 7-3 and publicly available in a manner approved by the Chief Executive Officer of the Office of the Environmental Protection Authority.

8 Dewater Discharge

8-1 The proponent shall ensure that any dewater discharged to the environment does not exceed ANZECC/ARMCANZ* default criteria for the protection of marine and freshwater ecosystems.

* Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand 2000, *Australian Water Quality Guidelines for Fresh and Marine Waters* and its updates.

8-2 The proponent shall ensure that dewater discharge does not extend further than 20 kms along the designated discharge channels from the discharge points.

8-3 To verify that the requirements of condition 8-2 are met the proponent shall visually monitor and record the extent of dewater discharge flow on a bi-weekly basis during all discharge events.

8-4 The proponent shall make the records of dewater discharge flow monitoring available on request of the Chief Executive Officer of the Office of the Environmental Protection Authority

8-5 Prior to the commencement of dewater discharge, the proponent shall conduct a baseline survey of the extent and condition of the Hamersley Themeda Grassland to the satisfaction of the Chief Executive Officer of the Office of the Environmental Protection Authority on advice from the Department of Environment and Conservation

- 8-6 Should the flow of dewater exceed the parameters defined in condition 8-2;
1. the proponent shall cease discharge of dewater to the environment immediately;
 2. report such findings to the Chief Executive Officer of the Office of the Environmental Protection Authority within 7 days of the exceedance being identified;
 3. determine actions in consultation with the Department of Environment and Conservation to be taken to prevent future exceedances and to remediate any impact resulting from the exceedance, with particular regard to the Hamersley Themeda Grasslands;
 4. submit actions to be taken to the Chief Executive Officer of the Office of the Environmental Protection Authority within 21 days of reporting the exceedance; and
 5. implement actions identified above upon approval of the Chief Executive Officer of the Office of the Environmental Protection Authority and prior to recommencement of dewater discharge.

8-7 The proponent shall ensure that there is no increase in the variety or distribution of weed species in the vicinity of the dewater discharge channels as a result of dewater discharge to the environment.

8-8 To verify that the requirements of condition 8-6 are met;

1. the proponent shall undertake baseline monitoring of vegetation composition, weed species and abundance; and
2. undertake regular monitoring of weed species and abundance during the operations phase of the proposal.

This monitoring is to be carried out to the satisfaction of the Chief Executive Officer of the Office of the Environmental Protection Authority.

- 8-9 In the event that monitoring required by condition 8-6 indicates an increase in weed species or distribution:
1. the proponent shall report such findings to the Chief Executive Officer of the Office of the Environmental Protection Authority within 21 days of the increase being identified;
 2. provide evidence which allows determination of the cause of the increase;
 3. if determined by the Chief Executive Officer of the Office of the Environmental Protection Authority to be a result of activities undertaken in implementing the proposal, the proponent shall submit actions to be taken to remediate the increase within 21 days of the determination being made to the Chief Executive Officer of the Office of the Environmental Protection Authority; and
 4. the proponent shall implement actions to remediate the increase in weeds species and distribution upon approval of the Chief Executive Officer of the Office of the Environmental Protection Authority and shall continue until such time the Chief Executive Officer of the Office of the Environmental Protection Authority determines that the remedial actions may cease.

8-10 The proponent shall submit annually the results of monitoring required by condition 8-3 and 8-6 to the Chief Executive Officer of the Office of the Environmental Protection Authority.

8-11 The proponent shall make the monitoring reports required by condition 8-8 publicly available in a manner approved by the Chief Executive Officer of the Office of the Environmental Protection Authority.

9 Sinkhole Formation

9-1 The proponent shall conduct all works to ensure that sinkhole formation does not occur as a result of the proposal.

9-2 The proponent shall ensure that any sinkhole formations attributable to the implementation of the proposal are detected in a timely manner using a monitoring strategy and schedule approved by Chief Executive Officer of the Office of the Environmental Protection Authority on advice from the Department of Environment and Conservation prior to the commencement of dewatering activities.

9-3 Should the monitoring required by condition 9-2 detect potential or actual sinkhole formation within the area of drawdown;

1. the proponent shall report such findings to Chief Executive Officer of the Office of the Environmental Protection Authority within 7 days of the formation being identified;
2. provide evidence which allows determination of the cause of the sinkhole formation;
3. if determined by Chief Executive Officer of the Office of the Environmental Protection Authority to be a result of activities undertaken in implementing the proposal, the proponent shall determine actions to be taken to rehabilitate or otherwise manage the sinkhole formation on an ongoing basis in consultation with the Department of Environment and Conservation.
4. submit actions to be taken within 21 days of the determination being made to the Chief Executive Officer of the Office of the Environmental Protection Authority; and
5. implement actions to rehabilitate or manage the sinkhole formation upon approval of Chief Executive Officer of the Office of the Environmental Protection Authority and shall continue until such time as Chief Executive Officer of the Office of the Environmental Protection Authority determines on advice from Department of Environment and Conservation that the remedial actions may cease.

9-4 The proponent shall submit annually a review of sinkhole prevention, monitoring and management strategies employed in relation to current best practice to Chief Executive Officer of the Office of the Environmental Protection Authority.

9-5 The proponent shall make the monitoring reports required by condition 9-4 publicly available in a manner approved by the Chief Executive Officer of the Office of the Environmental Protection Authority

10 Rehabilitation

10-1 The proponent shall undertake rehabilitation to achieve the following outcomes:

1. The waste dump(s) and tailings storage facilities shall be non-polluting and shall be constructed so that their final shape, stability, surface drainage, resistance to erosion and ability to support local native vegetation are comparable to three suitable reference sites within the Karijini National Park or adjacent areas, with reference sites to be chosen in consultation with the Department of Environment and Conservation.
2. Waste dumps, tailings storage facilities and other areas disturbed through implementation of the proposal (excluding mine pits), shall be progressively rehabilitated with vegetation composed of native plant species of local provenance (defined as seed or plant material collected within 100 kilometres of the proposal).
3. The percentage cover of living vegetation in all rehabilitation areas shall be comparable with that of similar natural landforms in the area.
4. No new species of weeds (including both declared weeds and environmental weeds) shall be introduced into the area as a result of the implementation of the proposal.
5. The coverage of weeds (including both declared weeds and environmental weeds) within the rehabilitation areas shall be no greater than the average of three suitable reference sites within the Karijini National Park or adjacent areas, with reference sites to be chosen in consultation with the Department of Environment and Conservation.
6. The composition of vegetation in the vicinity of the dewater discharge channels is returned to its pre-mining composition.

10-2 Rehabilitation activities shall continue as necessary until such time as the requirements of condition 10-1 are met, and are demonstrated by inspections and reports to be met, for a minimum of five years to the satisfaction of the Chief Executive Officer of the Office of the Environmental Protection Authority, on advice of the Department of Mines and Petroleum and the Department of Environment and Conservation.

11 Conceptual Closure Strategy

11-1 Prior to commencing ground-disturbing activity, the proponent shall submit a detailed and project-specific Conceptual Closure Strategy to the requirements of the Chief Executive Officer of the Office of the Environmental Protection Authority, on advice of the Department of Mines and Petroleum.

11-2 The Conceptual Closure Strategy shall include detailed results of geochemical and geophysical characterisation of materials, in particular the potential for acid drainage, metalliferous drainage, and of the occurrence of dispersive materials and asbestiform

minerals. Testing for materials with potential to cause acid and/or metalliferous drainage shall include static and kinetic testing carried out using techniques and timeframes consistent with national and international standards (Leading Practice Sustainable Development Program for the Mining Industry – Managing Acid and Metalliferous Drainage 2009 – Department of Industry, Tourism and Resources; The Global Acid Rock Drainage Guide 2009 – International Network for Acid Prevention).

- 11-3 The Conceptual Closure Strategy shall provide detailed technical information on proposed management measures to prevent pollution, environmental harm or human health impacts during implementation of the proposal and after mine completion and closure.
- 11-4 The Conceptual Closure Strategy shall include maps, diagrams and Global Positioning System (GPS) coordinates, showing the proposed placement, dimensions, design and proposed methods of construction and closure of waste disposal facilities and mine pits.
- 11-5 The Conceptual Closure Strategy shall demonstrate that waste dumps and tailings storage facilities will be located, designed and constructed to ensure that they are non-polluting and so that their final shape, height, stability, surface drainage, resistance to erosion and ability to support native vegetation are comparable to natural landforms in the area.
- 11-6 The Conceptual Closure Strategy shall provide the results of additional detailed groundwater modelling to verify that a lake will not form in the pit void(s) following completion and closure.
- 11-7 The Conceptual Closure Strategy shall provide detailed technical information demonstrating that sufficient quantities of suitable materials are available on site for the implementation and closure (including unplanned or temporary closure) of the proposal.
- 11-8 The Conceptual Closure Strategy shall include specific practicable procedures to ensure the protection of the environment in the event of unplanned or temporary mine closure.
- 11-9 The proponent shall implement the proposal consistent with the Conceptual Closure Strategy referred to in conditions 11-1 to 11-8.

12 Final Closure and Decommissioning Plan

- 12-1 At least 5 years prior to mine completion, the proponent shall prepare and submit a Final Closure and Decommissioning Plan to the requirement of the Chief Executive Officer of the Office of the Environmental Protection Authority, on advice of the Department of Mining and Petroleum.
- 12-2 The Final Closure and Decommissioning Plan shall be prepared consistent with:
 - ANZMEC/MCA 2000, *Strategic Framework for Mine Closure Planning* and

- Department of Industry Tourism and Resources 2006 *Mine Closure and Completion* (Leading Practice Sustainable Development Program for the Mining Industry), Commonwealth Government, Canberra;

and shall provide detailed technical information on the following:

- Final closure of all areas disturbed through implementation of the proposal so that they are safe, stable and non-polluting;
- Decommissioning of all plant and equipment;
- Disposal of waste materials;
- Final Rehabilitation of waste dumps; tailings storage facilities and other areas (outside the mine pit(s));
- Management and monitoring following mine completion; and
- Inventory of all contaminated sites and proposed management.

12-3 The proponent shall close, decommission and rehabilitate the proposal consistent with the approved Final Closure and Decommissioning Plan.

12-4 The proponent shall make the Final Closure and Decommissioning Plan required by 12-1 and 12-2 publicly available in a manner acceptable to the Chief Executive Officer of the Office of the Environmental Protection Authority.

Procedures

1. Where a condition states “on advice of the Office of the Environmental Protection Authority”, the Office of the Environmental Protection Authority will provide that advice to the proponent.
2. The Minister for Environment will determine any dispute between the proponent and the Office of the Environmental Protection Authority over the fulfilment of the requirements of the conditions.
3. The proponent is required to apply for a Works Approval and Licence for this project under the provisions of Part V of the *Environmental Protection Act 1986*.

Schedule 1

The Proposal (Assessment No. 1686)

General Description

The proposal is to expand existing mining operations at Marandoo by mining below the water table. This would entail expansion of the existing mine pit and development of new waste dumps. The proposal would utilise existing infrastructure and services associated with current Marandoo operations, however, additional infrastructure would be required.

The proposal is described in the following document – *Marandoo Mine Phase 2 Public Environmental Review, September 2008*.

Summary Description

A summary of the key proposal characteristics is presented in Table 1.

Table 1: Summary of key proposal characteristics

| Element | Description |
|---------------------|--|
| General | |
| Project life | 15 – 20 years. |
| Area of disturbance | Up to 1000 hectares direct disturbance, localised impact to riparian vegetation along discharge drainage lines. |
| Ore production rate | Approximately 16 Million tonnes per annum |
| Mining | |
| Pit | Single pit, Marra Mamba ore; mining below the water table. |
| Waste rock disposal | Surface dumps; expansion of existing stockpiles and progressive backfilling of mine pits. |
| Dewatering | Peak dewatering of up to 100 megalitres per day. |
| Dewater disposal | Dewater disposal through water use hierarchy including: <ul style="list-style-type: none"> • use on site; • transfer to Tom Price; • re-injection at southern Fortescue Borefield; and • discharge to the environment. |
| Processing | Wet processing of ore. |
| Residue | Construction and operation of residue storage facility. |
| Greenhouse gases | Up to 190,000 tonnes CO ₂ – e per year, plus one-off emission of 50,000 tonnes CO ₂ – e resulting from clearing. Up to 15.3 tonnes CO ₂ – e per kilotonne |

| Element | Description |
|-----------------------|---|
| | of ore. |
| Infrastructure | |
| Water supply | All water requirements supplied from dewatering activities. |
| Product transport | By existing rail facilities to Dampier and Cape Lambert. |

Figures (see figures 2 and 3 in main body of report):

Figure 1: Regional location of mine site

Figure 2: Project footprint and layout of key components

Identified Decision-making Authorities

Section 44(2) of the *Environmental Protection Act 1986* (EP Act) specifies that the EPA's report must set out (if it recommends that implementation be allowed) the conditions and procedures, if any, to which implementation should be subject. This Appendix contains the EPA's recommended conditions and procedures.

Section 45(1) requires the Minister for Environment to consult with decision-making authorities, and if possible, agree on whether or not the proposal may be implemented, and if so, to what conditions and procedures, if any, that implementation should be subject.

The following decision-making authorities have been identified for this consultation:

| Decision-making Authority | Approval |
|---|--|
| 1. Minister for Water | Water extraction licence under the RiWi Act 1914 |
| 2. Minister for Indigenous Affairs | Aboriginal Heritage Act – s 18 clearances |
| 3. Minister for State Development | Approvals under <i>Iron Ore (Hamersley Range) Agreement Act 1963</i> |
| 4. Department of Environment and Conservation | Works Approval and Licence |
| 5. Shire of Ashburton | Planning approval |
| 6. Department of Mines and Petroleum | Approvals under <i>Mining Act 1978</i> |

Appendix 5

Summary of Submissions and Proponent's Response to Submissions