

Brockman Syncline 4 Iron Ore Project

Hamersley Iron Pty Limited

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

**Environmental Protection Authority
Perth, Western Australia
Bulletin 1214
January 2006**

Environmental Impact Assessment Process Timelines

Date	Progress stages	Time (weeks)
29/10/04	Proposal Referred to the EPA	
08/11/04	Level of Assessment Set (following any appeals upheld)	1
08/08/05	Proponent Document Released for Public Comment	39
05/09/05	Public Comment Period Closed	4
13/10/05	Final Proponent Response to Issues Raised	5
05/01/06	EPA Report to the Minister for the Environment	12

ISBN. 0 7307 6855 4
ISSN. 1030 - 0120
Assessment No. 1543

Summary and recommendations

Hamersley Iron Pty Limited (HI) proposes to develop a new open cut iron ore mine in the Central Pilbara area. The major components of the proposed operation includes: 3 mine pits; dry processing plant; associated mine infrastructure and extension to the Brockman 2 rail spur.

The project involves the mining of a Brockman Iron Formation of a haematite/goethite ore body along a 14km ridge. The operation is expected to yield approximately 600 Mt of ore over the 30 year life of the mine. In addition, 40% of the expected 700 Mt of the over burden and waste rock is low-grade ore, which may be processed in the future.

This report provides the Environmental Protection Authority's (EPA's) advice and recommendations to the Minister for the Environment on the environmental factors relevant to the proposal.

Section 44 of the *Environmental Protection Act 1986* requires the EPA to report to the Minister for the 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.

The EPA is also required to have regard for the principles set out in section 4A of the *Environmental Protection Act 1986*.

Relevant environmental factors and principles

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

- (a) Flora and vegetation;
- (b) Fauna;
- (c) Groundwater; and
- (d) Mine rehabilitation and closure.

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) Precautionary Principle;
- (b) Principle of intergenerational equity
- (c) Principle of the conservation of biological diversity and ecological integrity

Conclusion

The EPA has considered the proposal by HI to develop a new iron ore mine in the Central Pilbara area.

The EPA notes in regard to flora and vegetation:

None of the vegetation types significantly affected by the proposal is unique to the study area or regionally significant. Those identified as having moderate conservation significance are represented elsewhere in the Pilbara bioregion, and it is not likely that the Brockman Syncline 4 (BS4) project will significantly affect these vegetation types conservation significance. A second round of PATN (multivariate clustering analysis software package) analysis planned for 2006 will provide greater clarity of the floristic groups present and their conservation status.

The single vegetation type identified as having high conservation significance (P11) within the local area and containing the Priority 1 flora *Ptilotus* sp. "Brockman", is located outside of the active mining envelope and additional measures will be taken to prevent other disturbance. The Priority 4 flora *Eremophila magnifica* subsp. *magnifica* that will be subject to severe disturbance is represented elsewhere in the Hamersley subregion and removal of the population within the active mining envelope will not have a significant impact on the conservation status of the taxon.

However, even though the vegetation types and Priority flora species are known to occur outside the mining area, the EPA recommends the proponent determine the level of representation of these vegetation types and flora species inside secure conservation reserves.

It is also noted that Priority and Declared Rare Flora (DRF) surveying of the rail spur and infrastructure corridors will be completed prior to any disturbance on the site. A condition has been included to ensure this work is completed.

The proponent has committed to prepare Construction and Operation Environmental Management Plans (EMPs) to address all factors that can impact flora and vegetation. They will include ongoing surveys for Priority and Declared Rare Flora, vegetation monitoring and a weed hygiene plan.

The EPA notes in regard to fauna:

No habitat is unique to the study area and all are represented elsewhere in the Pilbara bioregion. Additionally, the majority of the sensitive fauna habitats identified in the BS4 project area (creekline vegetation and calcrete outcroppings) are located outside of the active mining envelope. The few areas that will be impacted are minimal and mining activity is unlikely to have significant impact on the conservation values of these habitats.

Of the four Priority fauna species recorded as being within the project area, none are considered Vulnerable or Endangered and all are represented outside of the BS4 project area. It is unlikely the conservation status of any of these Priority fauna will be affected at a local or regional level. The three other Priority/Schedule fauna considered likely to inhabit the BS4 area have also been recorded in the nearby Nammuldi/Silvergrass area and it is considered unlikely the BS4 project will significantly affect the conservation status of these species.

However, even though the fauna habitats and Priority and Scheduled fauna are known to occur outside the mining area, the EPA recommends the proponent determine the level of representation of these species and habitats inside secure conservation reserves.

No stygofauna populations have been identified within the project area and there is little habitat suitable for stygofauna existing in and around it. HI has committed to undertake additional survey work in new areas containing potential stygofauna habitat, and manage any identified populations in consultation with CALM.

Three short-range endemic taxa of interest have been collected and submitted to the Western Australian (WA) Museum for research/analysis. Presently, HI are funding a study in an effort to resolve the morphology and genetics of land snail species. A condition has been included to protect the unique *Rhagada* “Mt Brockman” population and associated habitat.

The proponent has committed to:

- Prepare Construction and Operation EMPs to address and manage all factors that can impact fauna. These will include habitat, fire and weed management; and
- Fund research into the resolution of the morphology and genetics of land snail *Rhagada* sp. “Mt Brockman”.
- Conduct a third phase of stygofauna sampling in new areas containing potential stygofauna habitat.

The EPA notes in regard to groundwater:

The efficient use of mine dewater for dust suppression and in processing will result in no discharge to the environment. A potential backup water source has been identified and is still undergoing investigation to prove the preliminary findings. A condition has been included to ensure all groundwater investigations are completed by the end of the fifth operational year of the BS4 mine. HI has committed to prepare a Borefield Management Plan prior to abstraction/dewatering addressing all relevant factors including a monitoring program.

The groundwater levels throughout the BS4 area are naturally deep and there is no indication of shallow water table aquifers within the project area. Therefore reduced groundwater levels are not considered likely to have any significant impact on the project area. The area is characterised by low rates of groundwater recharge and throughflow, therefore a reduction in outflow from the BS4 Project area to adjacent areas affects relatively small volumes of water and is not considered likely to have significant impact on the greater environment.

The few small populations of groundwater dependant vegetation that may be impacted by the project are represented outside of the project area in the Nammuldi/Silvergrass area. Any impact to these small populations is not likely to have a significant impact on the conservation status of these vegetation types.

No impacts on stygofauna populations are expected, based on present knowledge of hydrogeology and stygofauna distribution in the inland Pilbara, although further testing will be carried out in targeted dolomite areas prior to any abstraction/dewatering at the site.

The EPA notes that a band of pyritic black shale which has been identified along the southern pit boundary is not intended to be mined, and HI will prepare a contingency

Black Shale Management Plan to address the problem in the event this material is unearthed. HI will also backfill mine voids to above the groundwater level so as to maintain groundwater quality in the area.

The proponent has committed to:

- Prepare a Borefield Management Plan prior to groundwater abstraction at the site; and
- Progressively backfill mine pits to above the ground water level.

The EPA notes in regard to mine rehabilitation and closure:

HI have prepared a Preliminary Rehabilitation and Closure Management Plan (PRCMP) which is being treated as a strategic plan consistent with current best practice for the mining industry.

The PRCMP will be reviewed and updated regularly throughout the life of the operation, with a Final Rehabilitation and Closure Management Plan to be submitted at least two years prior to mine closure. The plan will also address post-closure environmental monitoring and reporting requirements. A separate condition has been included to ensure this work is completed in accordance with ANZMEC & Minerals Council of Australia - *Strategic Framework for Mine Closure* (2000).

The proponent has committed to collect seed and material of Priority flora species within the disturbance area to be later used in rehabilitation works in the re-establishment of these species.

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

Recommendations

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

1. That the Minister notes that the proposal being assessed is for development of an open cut iron ore mine and infrastructure corridor;
2. That the Minister considers the report on the relevant 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, including the proponent's commitments; 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 recommended a set of conditions to be imposed if the proposal by HI to develop a new iron ore mine in the Central Pilbara is approved for implementation. These conditions are presented in Appendix 4. Matters addressed in the conditions include the following:

- (a) The proponent shall fulfill the commitments in the Consolidated Commitments statement set out as an attachment to the recommended conditions in Appendix 4;
- (b) DRF and Priority flora sampling of the rail spur and infrastructure corridors shall be carried out prior to ground disturbance and any DRF or Priority flora identified shall be managed;
- (c) Protection of the unique land snail population and associated habitat;
- (d) Management and monitoring of groundwater resources; and
- (e) Mining area shall be rehabilitated progressively.

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

- Works approval/licensing under Part V of the *Environmental Protection Act 1986*; and
- Permits and licenses under the provisions of the *Rights in Water and Irrigation Act 1914*.

Contents

	Page
Summary and recommendations	i
1. Introduction and background	1
2. The proposal	2
3. Relevant environmental factors and principles	7
3.1 Flora and Vegetation.....	7
3.2 Fauna.....	14
3.3 Groundwater	22
3.4 Mine rehabilitation and closure	26
3.5 Relevant environmental principles	27
4. Conditions and Commitments	27
4.1 Proponent’s commitments	28
4.2 Recommended conditions.....	28
5. Conclusions	29
6. Recommendations	31

Tables

Table 1: Summary of key proposal characteristics	2
--	---

Figures

Figure 1: Site location

Figure 2: Site plan

Appendices

1. List of submitters
2. References
3. Summary of identification of relevant environmental factors
4. Recommended Environmental Conditions and Proponent’s Consolidated Commitments
5. Summary of submissions and proponent’s response to submissions

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 environmental factors and principles relevant to the proposal by Hamersley Iron Pty Limited (HI), to develop an iron ore mine in the Central Pilbara area.

During 2004, HI conducted a review of available iron ore deposits, and identified the Brockman Syncline 4 (BS4) deposit as having the best potential to be developed to meet this increase in iron ore demand. Based on exploration drilling completed to date, the BS4 deposit has a reserve of approximately 600 Mt of high-grade iron ore, with a further 290 Mt of low-grade iron ore which may be processed in the future.

The BS4 project is located within the Hamersley subregion of the Pilbara bioregion. One hundred and seven Land Systems as mapped by the Western Australian Department of Agriculture, occur in the Pilbara bioregion, with seven occurring within the BS4 area:

- Boolgeeda
- Newman
- Platform
- River
- Robe
- Rocklea
- Table

Excluding the Table Land System (ranked as number 31 in abundance), all are well represented in the Pilbara bioregion. The BS4 project area is located approximately 90 km from the nearest boundary of the Karijini National Park and 100 km from the nearest boundary of the Millstream-Chichester National Park.

The Brockman Syncline 4 Iron Ore Project was referred to the EPA in October 2004 and the level of assessment set as Public Environmental Review (PER) with a public review period of 4 weeks. This level of assessment was based on the scale of mining, both direct and indirect impacts to flora and fauna and potential impact on local hydrology.

Further details of the proposal are presented in Section 2 of this report. Section 3 discusses the environmental factors and principles relevant to the proposal. The Conditions and Commitments to which the proposal should be subject, if the Minister determines that it may be implemented, are set out in Section 4. Section 5 presents the EPA's conclusions and Section 6, the EPA's Recommendations.

Appendix 5 contains a summary of submissions and the proponent's response to submissions. It 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

HI proposes to develop a new iron ore mine approximately 60 kilometers west-north-west of Tom Price and 25 kilometers south-west of the existing Brockman 2 mine.

The major components of the project include:

- 3 new mine pits- with approximately 20% of the orebody occurring below the water table;
- Dry processing plant- including crushers, overland conveyor and screens; this will be located to the north of the pits running east/west to the rail loop;
- Associated mine infrastructure- this includes camps, infrastructure corridor, waste dumps, stockpiles etc;
- Extension to the Brockman 2 rail spur- a new rail spur will be constructed to transport ore past Brockman 2 to the Rosella Siding and then along the main line through to the port facilities at either Dampier or Cape Lambert; and
- Infrastructure corridor- for power and water supply.

The main characteristics of the proposal are summarised in Table 1 below. A detailed description of the proposal is provided in Section 3 of the PER prepared by HI in August 2005.

Table 1: Summary of key proposal characteristics

Element	Description
General	
Project life	Estimated 30 years
Area of disturbance	Approximately 2,470 ha
Potential ore reserves	600 Mt high-grade (>60% Fe) 280 Mt low-grade (>50% Fe)
Mining rate	Minimum 20 Mt/pa
Waste rock	420 Mt (approx 150 Mt of which will be used to backfill pits)
Green house gas emissions	5.59 kg CO _{2e} (per tonne of production per annum)
Mine and mining	
Pits and ore type	Three pits with high phosphorus Brockman ore. The deposit extends approximately 14 km in length, is 1 km wide and averages 150 m deep.
Ore below water table	Approximately 20 % of total ore (variable between each pit)
Stripping ratio	Ranges from 0.5:1 to 1.5:1 waste to ore depending on processing and stockpile strategies (average 1.2:1)
Waste rock disposal	Surface dumps until mined out pit voids become available, then backfilled to above pre-mine water table
Dewatering	
	Dewatering required to access ore from below the water table.

Element	Description
Infrastructure	
Water Supply	6,200 kL/d (plus additional 300 kL/d for the mine camp). Supplied from the Orebody and Wittenoom Dolomite aquifers. Boolgeeda borefield as an additional source via pipeline along infrastructure corridor.
Power Supply	13.5 MW supplied from the Dampier – Tom Price 220 kV transmission system via a 66 kV sub-transmission system. Power lines will approach the mine within the infrastructure corridor.
Processing Plant	A dry plant with a crushing and screening circuit for 20 Mt/pa of ore.
Product transport	By rail via a 35 km long rail spur from the project area to Brockman 2 mine then along the existing Brockman 2 rail spur and main railway to port.
Airstrip	Approximately 2 000 m airstrip
Workforce	
Construction Operation	Peak of 700 300 (plus approximately 40 during periodic shutdown maintenance periods).
Accommodation	A permanent village and contractor's camp, plus small rail spur camps.

Abbreviations:

e – equivalent
Fe – iron
ha – hectare
km – kilometre
kL/d – kilolitres per day
kV – kilo volts
m – metres
Mt – mega tonnes
Mt/pa – mega tonnes per annum
MW – mega watts

Vegetation will be cleared where necessary to make way for infrastructure such as pits, waste dumps, stockpiles, ROM pads, ore processor, conveyor etc. The cleared vegetative material will be stockpiled in designated areas for later use in rehabilitation works. Topsoil will be removed to a depth of approximately 300 mm and subsoil to a depth of approximately 500-800 mm and then stockpiled in designated areas for later use in rehabilitation.

Borrow material will be required for the initial construction phase to develop the foundations of the various infrastructure i.e. rail spur line. This material will be sourced from pre-strip overburden taken from pit footprints and local borrow pits.

Waste dumps and low-grade stockpiles will be kept separate to avoid cross contamination, waste material will be used during rehabilitation to backfill pits above the water table level. The stockpiled low-grade ore may be processed in future, however if this does not occur, the stockpiles will be shaped and revegetated. All stockpiles will be consistent with necessary design parameters and will be located in areas that are protected from contamination and erosion.

Drilling and blasting will be required in all pits to remove the hard-cap layer immediately above the ore body. Approximately 20% of the ore body lies below the regional water table, however mining below the water table is not expected until approximately year 6.

Since release of the PER, a number of modifications to the proposal have been made by the proponent. The main changes are as follows:

Rail Spur Alignment

The two options considered for the rail loop location were, the loop centrally located to the mining area and the loop located at the eastern end of the mining area. Due to the steep gradient of the central location, it was decided the eastern location was the most suitable.

Processing Plant

A dry processing plant was chosen for the site. If in future the low-grade ore is deemed to be economically viable, a wet processing plant may be required for further treatment.

The potential impacts of the proposal and their proposed management are summarised in Appendix 3.

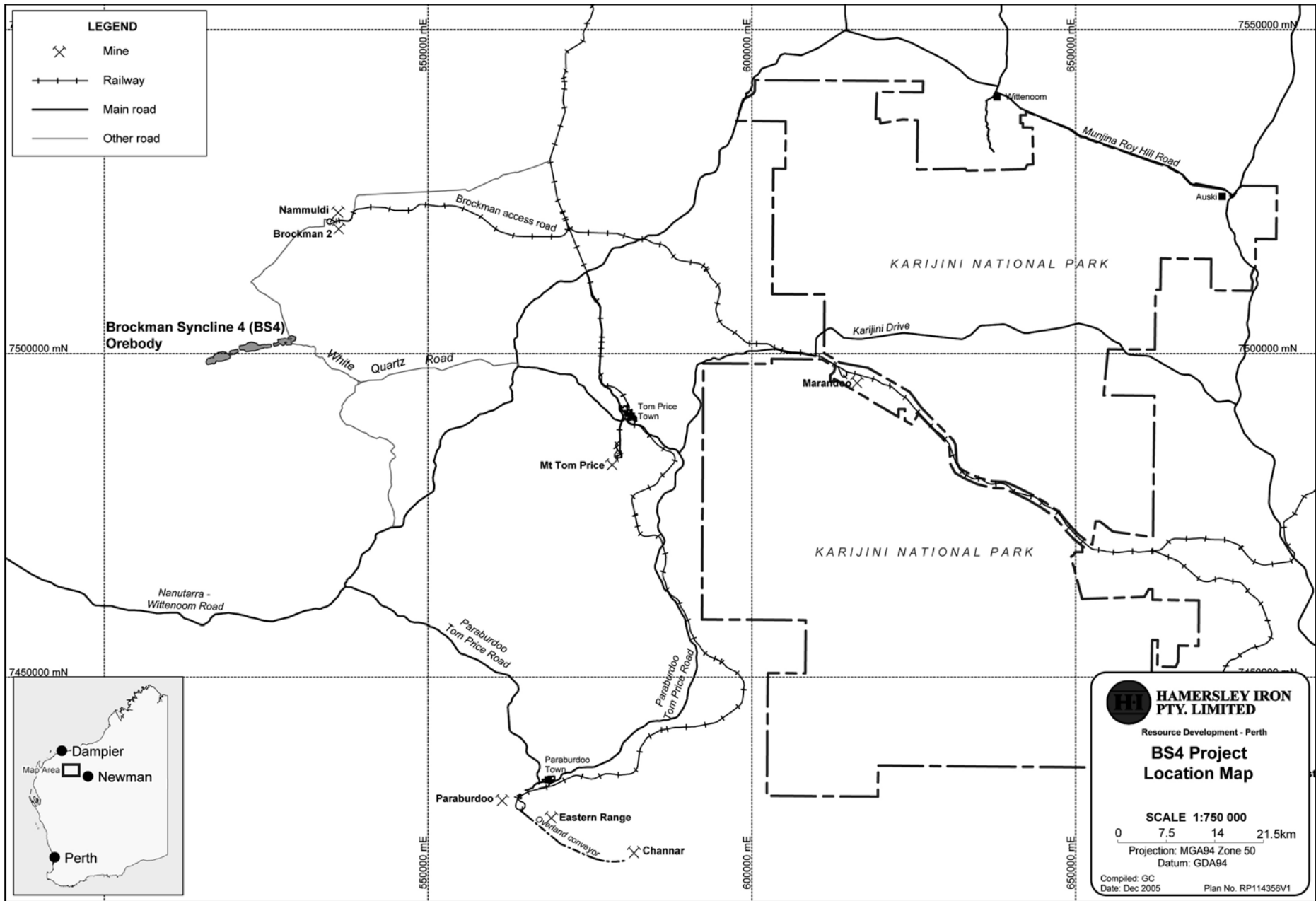


Figure 1: Site Location of BS4 project area

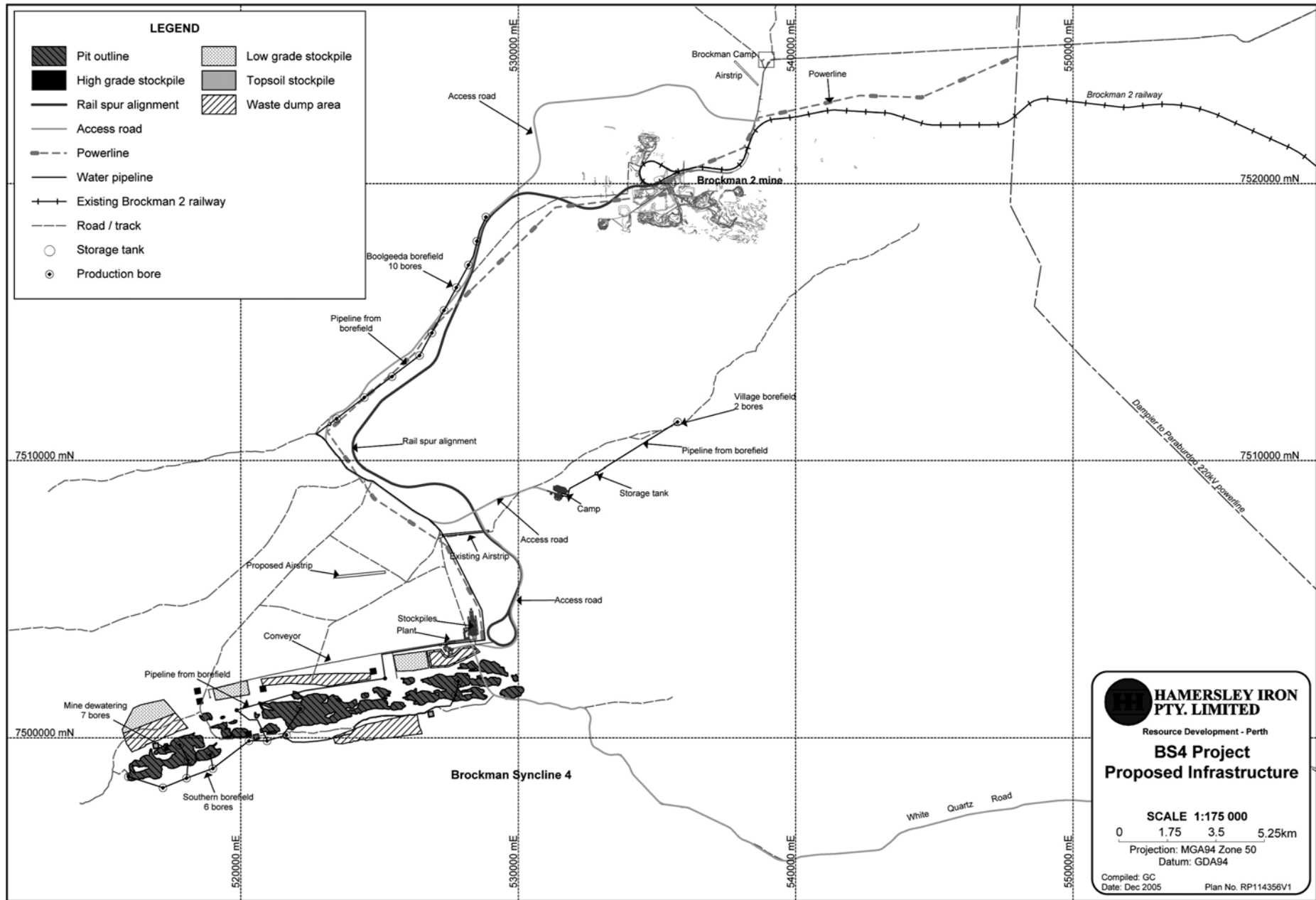


Figure 2: Site Plan of BS4 mine

3. Relevant environmental factors and principles

Section 44 of the *Environmental Protection Act 1986* requires the EPA to report to the Minister for the 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 relevant 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, such as mine footprint, offsets, surface water features and waste materials are very 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 environmental factors relevant to the proposal require detailed evaluation in this report:

- (a) Flora and vegetation;
- (b) Fauna;
- (c) Groundwater; and
- (d) Mine rehabilitation and closure.

The above relevant 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 relevant environmental factors and their assessment are contained in Sections 3.1 - 3.4. 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) Precautionary principle;
- (b) Principle of intergenerational equity; and
- (c) Principle of the conservation of biological diversity and ecological integrity.

3.1 Flora and Vegetation

Description

Native Vegetation

Approximately 2470 ha of native vegetation will be cleared or disturbed by the project. The main components occupying the majority of the active area are:

- Mine pits 949 ha (~38%) ;
- Waste dumps 529 ha (~21%) ;

- Stockpiles 320 ha (~13%); and
- Rail spur 300 ha (~12%).

Biota Environmental Sciences were commissioned to conduct a desk-top study of internal HI reports, Department of Conservation and Land Management (CALM) and Western Australian (WA) Herbarium databases plus published documentation by other botanists for the project area. In addition to this, the project area was field surveyed by Biota and HI staff between February and June 2003 and again in October 2004. A total of 367 taxa of native vascular flora from 149 genera belonging to 52 families were recorded in the BS4 project area.

The project area lies within the Fortescue Botanical District of the Eremaean Botanical Province as defined by Beard. The vegetation of this province is typically open and dominated by spinifex, wattles and eucalypts. In accordance with Beard's mapping, two broad vegetation associations exist within the BS4 project area:

- *Eucalyptus leucophloia* (Snappy Gum); and
- *Acacia aneura* (Mulga).

Fifty three vegetation types were identified within the two vegetation associations inside the BS4 area, these vegetation types were located within three main habitat types:

- Vegetation of stony hills;
- Vegetation of plains; and
- Vegetation of drainage areas.

PATN (multivariate clustering analysis software package) analysis was used to identify potentially restricted vegetation types in the BS4 project area. The analysis identified one vegetation type (P11) as having high conservation significance as it is the main associated vegetation type for the Priority 1 flora *Ptilotus* sp. Brockman. This vegetation type occurred within the Newman Land System.

Eighteen other vegetation types are considered to be of moderate conservation significance. Of these, five were indicative of the stony hills habitat, six were indicative of the plains habitat and seven were indicative of drainage area habitat. Additionally, these eighteen types occurred in five of the seven identified Land Systems.

Priority and Declared Rare Flora

A search of the CALM Threatened and Priority flora database and the WA Herbarium Specimen database was conducted for the BS4 project area and surrounds. This search identified that no Declared Rare Flora (DRF) and four Priority species are recorded as occurring within 10 km of the project area.

During the 2003 field surveys, six Priority flora species were identified within and around the BS4 area:

- *Ptilotus* sp. "Brockman" (Priority 1);
- *Abutilon trudgenii* (Priority 3);
- *Phyllanthus aridus* (Priority 3);
- *Sida* sp Wittenoom (Priority 3);

- *Eremophila magnifica* subsp *magnifica* (Priority 4); and
- *Goodenia stellata* (Priority 4).

The Priority 1 *Ptilotus* sp. “Brockman” is associated with one main vegetation type within the project area (P11). A large population of this species occurs in a valley to the south of the central mine pit.

The majority of the Priority flora species located within the project area are not likely to be significantly impacted by the project. However, the Priority 4 *Eremophila magnifica* subsp. *magnifica* has been identified as occurring in both the west pit and waste dump mining envelopes and will be greatly impacted by the project.

No DRF were identified during field surveys.

Weeds

During the field surveys six species of introduced flora were identified within the project area:

- *Cenchrus ciliaris* (Buffel Grass);
- *Cenchrus setigerus* (Birdwood Grass);
- *Setaria verticillata* (Whorled Pigeon Grass);
- *Malvastrum americanum* (Spiked Malvastrum);
- *Bidens bipinnata* (Beggars Ticks); and
- *Acetosa vesicaria* (Ruby Dock).

None of these is listed as Declared Plants for the Pilbara under the *Agriculture and Related Resources Protection Act 1976*. The majority of these species were found to inhabit ephemeral creek lines.

It is likely that several of these species are present due to the historic agricultural use in the area i.e. sheep and cattle. The extent of grazing and mustering of stock in the BS4 area is now limited, however there is evidence of degradation of native vegetation from previous grazing and trampling.

Submissions

Key comments focused on:

- Adequacy of flora surveying within the project area- quantity and methodology;
- The need for further surveying for Priority taxa in order to fully identify impacts to flora;
- The need for greater analysis of the plant communities in a regional context to properly identify conservation significance of plant communities within the project area;
- The need for an assessment of the potential impact of groundwater drawdown on vegetation;
- The importance of the reconciliation of the conservation significance of *Ptilotus* sp. “Brockman”; and
- The need for weed hygiene protocols.

Assessment

Native Vegetation

The condition of vegetation within the project area varies between the three main habitat types. Vegetation of the stony hills habitat was generally in very good to excellent condition due to stock not being able to access the area. The plains area had been subject to past grazing and impact was apparent, and several creeklines in the western section of the BS4 project area were substantially degraded from weed invasion and trampling by stock.

Other factors such as fire and dust have also had an impact on vegetation condition. However, it should be noted that fire is a naturally occurring event due to lightning strikes and the Pilbara region has naturally high background dust levels. Considering both external and natural factors, on average the vegetation over the whole project area was considered to be in good condition.

None of the fifty three vegetation types identified is listed as Threatened Ecological Communities by CALM. Eighteen vegetation types were identified as having moderate conservation significance. This is due to several of these types being somewhat restricted within the project area and/or within the greater region. Two of these vegetation types (P1, C1) were identified as being phreatophytic (groundwater dependant). These are associated with the Boolgeeda Creek to the north and vegetation within the vicinity of mine production bores south of the western pit. The vegetation associated with the Boolgeeda Creek (C1) is not expected to be impacted by the project, however the vegetation located near the mine production bores (P1) may be impacted. This is further discussed below in section 3.3 Groundwater.

However, of the fifty three vegetation types, thirteen will have greater than 30% impacted within BS4 project area during the life of the mine, which equates to almost a quarter of the vegetation types identified. Of these thirteen, none is considered to be high conservation significance, three (H12, H16, P2) are considered to be of moderate conservation significance, and the rest are considered to be low conservation significance. One type will have 100% impacted in the project area (C15) but is considered to have low conservation significance.

The analysis identified vegetation type P11 as the single type to have high conservation significance in the BS4 area. Even though this vegetation type does not belong to a restricted floristic group, it is the main associated vegetation type for the Priority 1 flora *Ptilotus* sp. "Brockman". It is not proposed to clear or disturb any of this vegetation type within the project area.

The three moderate conservation types that will be subject to greater than 30% impacted will be significantly affected within the localised area, however these areas only account for 0.8% of the total mining envelope. Even though these vegetation types are restricted within the region, the quantity of vegetation that will be affected is not likely to cause any significant impact to the conservation status of these vegetation types in the greater region. It is also note-worthy that two of the moderate conservation significance vegetation types (P8, C18) identified within the project area will not be subject to any clearing.

The other thirty four vegetation types have been identified as low conservation significance. This is due to these types being represented outside of the BS4 project area, and being relatively common across the Hamersley Ranges. Clearing of these vegetation types will not have significant impact on the conservation status of these vegetation types within the BS4 project area or the greater region.

The vegetation survey work carried out by Biota was in accordance with the requirements stipulated in EPA Guidance Statement 51. However, it was noted that there were limitations to the survey work, specifically a lack of comparable sites for PATN analysis. The lack of base data created difficulty with analysis of the vegetation types identified and thus difficulty in assigning conservation status to the vegetation types identified. This has been acknowledged by HI and a second round of PATN analysis will be undertaken in 2006 prior to any site disturbance in an effort to further clarify floristic groups and their conservation status.

It is believed that none of the vegetation types are genuinely restricted in the Pilbara region; nevertheless, the proponent has agreed to only clear in areas where it is necessary, and to minimise the size of the mine footprint wherever practicable. Additionally, when the results of the second PATN analysis become available, the EPA recommends the proponent determine the level of representation of these vegetation types inside secure conservation reserves.

The proponent has also committed to prepare Construction and Operational Environmental Management Plans (EMPs) to address all environmental factors that could have a negative impact on flora and vegetation, such as dust, fire, topsoil management, rehabilitation etc.

Priority and Declared Rare Flora

The Priority 1 *Ptilotus* sp. "Brockman" is a small compact perennial herb which is considered distinctive in both habitat and floral characteristics. It was first identified in 2003 during surveys carried out by HI. A total of thirty one recordings of this plant has been made along the southern edge of the central pit in the BS4 project area.

Additionally, *Ptilotus* sp. "Brockman" has also been recorded in at least three other separate locations:

- 3 records from the calcareous stony plain immediately west of the BS4 project area;
- 2 records immediately south of the BS4 project area, in the area referred to by Hamersley Iron as the 'Beasley River area'; and
- 8 records to the east of the BS4 project area along the White Quartz Road extending over approximately 19 km.

The population along White Quartz Road is quite large, estimated at between 2000 – 3000 individuals. Despite the fact this species is somewhat restricted inside the BS4 area, its distribution does not correlate with any particular Land System as defined by the WA Department of Agriculture. In the greater BS4 area this species is associated with the Robe, Newman and Rocklea Land Systems. It is unclear if these three areas support genetically distinct populations; the WA Herbarium is currently conducting a formal description of the species.

The population located near the central pit has been subject to previous disturbance via an access track traversing the area. The population will be protected from further disturbance by exclusion of its associated vegetation type (P11) from the active mining envelope and restricted access along the existing access track. Additionally, the area will be sign posted and specific information on the significance of the flora will be incorporated into the staff induction information. Upon cessation of mining HI proposes to rehabilitate the access track with local flora species. The three other locations are not expected to be impacted by the BS4 project. It is not likely that the species will be significantly impacted within the project area or the greater regional area.

The Priority 3 *Abutilon trudgenii* is a low shrub that has a tendency to occur in recently burnt areas, this is a likely reason why it has been poorly collected in the past. However, with this knowledge, this species is now found to be quite widespread throughout the Hamersley and Chichester subregions of the Pilbara. This plant was recorded eight times just west of West pit and nine times approximately 4 km north-north-west of the West pit. Therefore, it is unlikely this species will be significantly impacted within the project area or greater regional area.

The Priority 3 *Phyllanthus aridus* is an annual herb that typically occurs along creeklines but also occasionally occurs on rocky outcrops. The inconspicuous nature of this plant is believed to be a reason why it has been poorly collected in the past. Three plants were recorded on the broad gravel bed of the Boolgeeda Creek. It is considered unlikely this plant will be significantly impacted within the project area or greater regional area.

The Priority 3 *Sida* sp. Wittenoom is a medium to low shrub believed to have been poorly collected in the past, as it is now frequently recorded during surveys and is considered to be widespread through both the Hamersley and Chichester Ranges. It is similar in appearance to *Sida echinocarpa* and *Abutilon trudgenii* sp. so it is possible it could have been wrongly identified in past surveys. This plant was recorded eight times in the BS4 area, mostly on the clayey plains to the north of the west pit, and twelve times in the surrounding area. It is considered unlikely this plant will be significantly impacted within the project area or greater regional area.

The Priority 4 *Goodenia stellata* is a small perennial herb known to occur within hummock and tussock grasslands on clayey substrates in drainage areas. Several populations have been identified in the Hamersley subregion. This plant was recorded once along a creekline to the north of the BS4 project area, with no recordings inside the project area. Therefore, it is considered unlikely this plant will be significantly impacted within the project area or greater regional area.

The Priority 4 *Eremophila magnifica* subsp. *magnifica* is a moderate height shrub known to be distributed through the central-eastern Hamersley Ranges. Twenty five recordings of this plant were found within the BS4 project area in the stony hills habitat. No additional recordings were made in the BS4 vicinity. All recordings were located within the boundary of the West pit and western waste dump area.

Even though this species will be severely impacted within the BS4 project area, it is represented elsewhere within the region. The species is a Priority 4, which is the

lowest category assigned by CALM. The removal of this population of *E. magnifica* subsp. *magnifica* is not likely to affect the overall distribution and conservation status of the species. However, even though this species is known to occur outside the mining area, the EPA recommends the proponent determine the level of representation of this species inside secure conservation reserves.

For all Priority flora that will be disturbed, HI intends to collect/harvest seed and plant material and conduct research into the re-establishment of these species upon rehabilitation.

At the time of field surveying the preferred route for the rail spur had not been finalised. As a result, detailed searches for DRF and Priority species were not carried out along the corridor. Field surveying was supposed to have been undertaken in October/November 2005, however due to a lack of availability of field consultants and the narrow seasonal window of opportunity for surveying, the survey has been deferred until spring 2006. All surveys will be completed prior to any disturbance to the site and a condition has been included to ensure this work is carried out.

Weeds

Of the six weed species identified within the project area, three are considered to be serious environmental weeds: Ruby Dock, Buffel Grass and Birdwood Grass. Both grasses were introduced by pastoralists as fodder plants for stock, and have since escaped into the environment. Buffel Grass is commonly found along creeklines. There were twelve recordings of Buffel Grass and one recording of Birdwood Grass within the BS4 project area. Infestations of Buffel Grass are common within the Hamersley Ranges and the weed is reasonably widespread over the Pilbara region.

One recording of Ruby Dock was found on the western edge of the project area. Ruby Dock was originally introduced into the Pilbara for mine site rehabilitation and has since spread, however it occurs in limited areas within the Pilbara. Ruby Dock is an invasive perennial herb that spreads both vegetatively and by seed and is carried by wind, storm water, birds and mammals.

HI intends to prepare a weed hygiene protocol in consultation with CALM to ensure weeds are not spread within the BS4 area or introduced into new areas as a result of mining activity on the site. This protocol will be included in both the Construction and Operational EMPs.

Additionally, HI intends to eradicate Ruby Dock from the BS4 area over the course of the mining operations. As the population is relatively isolated within the local area, eradication of this population will stem the spread of Ruby Dock across the greater region.

Summary

Having particular regard to the following:

- The proponent will prepare EMPs to address all factors that can impact flora and vegetation. It will include ongoing surveys for Priority flora, vegetation monitoring and a weed hygiene plan;
- None of the vegetation types significantly affected by the proposal is unique to the study area or regionally significant;

- The vegetation type identified as having high conservation significance (P11) within the local area is outside of the active mining envelope and measures will be taken to prevent other disturbance;
- The proponent has agreed to minimise clearing and the size of the mine footprint wherever practicable;
- The proponent plans to conduct a PATN analysis of vegetation types to further clarify floristic groups and conservation significance;
- A condition has been included to ensure DRF surveys of the infrastructure corridor will be completed prior to any disturbance on the site;
- The Priority 4 flora *Eremophila magnifica* subsp. *magnifica* is represented outside the BS4 area and removal of the population within the active mining envelope will not have a significant impact on the conservation status of the taxa;
- A proponent commitment to re-establish Priority species in rehabilitated areas; and
- The proponent intends to eradicate Ruby Dock within the BS4 area; the EPA considers the issue of Flora and Vegetation has been adequately addressed and can meet the EPA's objectives.

3.2 Fauna

Description

Terrestrial fauna

Biota Environmental Sciences conducted a desk-top study of CALM and WA Museum databases for fauna records within the BS4 area. In addition to this, the project area was field surveyed by Biota and Western Australian (WA) Museum staff between 18-30 October 2004 and 12-21 April 2005. Results from previous surveys of the Nammuldi/Silvergrass area (located approximately 30 km north of the BS4 project area) were also reviewed and compared to results of the BS4 surveys.

BS4 systematic trapping consisted of fifteen survey sites within the main BS4 area, each located within a defined habitat. Pitfall traps, Elliott traps and funnel traps were used for small animals, avifauna surveying was undertaken via observation at systematic grids and from opportunistic sites, and bat surveys were undertaken using echolocation and harp nets. The surveys carried out by HI's consultant (Biota Environmental Sciences) were in accordance with the requirements stipulated in EPA Guidance Statement 56.

The results of the surveying within the BS4 area revealed:

- 83 birds;
- 8 native ground mammals;
- 5 introduced ground mammals;
- 7 bats;
- 54 reptiles;
- 2 frogs; and
- Over 100 invertebrate taxa including 2 millipedes, 4 land snails and 6 trap-door spiders.

Short Range Endemics

Of the land snails found within the BS4 area, one group has been identified as belonging to the genus *Rhagada*. Currently no mainland species of *Rhagada* are known to have overlapping distributions. On this basis the snails collected would be expected to be the commonly found *R. radleyi*, however the snails collected differ from this species. The specimens collected are presently un-described and results from recent investigations have shown they appear to represent a new taxon (currently termed '*Rhagada* sp. "Mt Brockman"'). This species has been identified as occurring within rail spur corridor, near the West pit and waste dump and near mine production bores and water pipeline to the south of West pit. It is considered likely this species will be impacted.

Fauna habitats

Fauna habitats were also recorded during field surveys. Results revealed five primary habitats within the BS4 project area:

- Creeklines;
- Mulga shrublands;
- *Acacia* over *Triodia*;
- Gorge; and
- *Triodia* hilltop.

This was developed based on the dominant landform and vegetation type present. Survey results show the *Triodia* hilltop habitat will be subject to the greatest disturbance from the project with 75% of this type present in the project area being impacted.

Aquatic fauna

Stygofauna is a general term used to describe the obligate subterranean fauna occurring in groundwater. These animals tend to be highly specialised inhabitants of aquifers and alluvial deposits and often have restricted distributions. Stygofauna can be impacted through disturbances to their habitat such as:

- Dewatering;
- Groundwater abstraction;
- Pollution from spills/leaks and acid rock drainage; and
- Incursion of saline water.

A two-phase field sampling program for stygofauna was undertaken between 8-11 February 2005 and 1-4 April 2005 by Biota Environmental Sciences. Twenty seven bores were surveyed; five in control sites outside the BS4 area and twenty five inside the BS4 area.

During the February sampling a single stygofauna specimen was found in a control site to the north of the mining envelope. This specimen was later identified as a Bathynellid. During the April surveying no stygofauna were recorded in either the control or project area.

A third phase of stygofauna surveying is planned for an alluvial creek system in a valley north of the project area. This phase of surveying will be carried out prior to construction.

Priority and Scheduled fauna

Four Priority fauna species were recorded during the field surveys of the project area:

- *Pseudomys chapmani* (Pebble-mound Mouse) P4;
- *Ardeotis australis* (Australian Bustard) P4;
- *Burhinus grallarius* (Bush Stonecurlew) P4; and
- *Notoscincus butleri* (Lined Soil-crevice Skink) P4.

In addition to this, four Priority and four Scheduled species are historically recorded, or are likely to occur within the project area:

- *Dasyurus hallucatus* (Northern Quoll);
- *Pezoporus occidentalis* (Night Parrot) S1;
- *Liasis olivaceus barroni* (Pilbara Olive Python) S1;
- *Falco peregrinus* (Peregrine Falcon) S4;
- *Lagorchestes conspicillatus leichardti* (Spectacled Hare-wallaby) P3;
- *Sminthopsis longicaudata* (Long-tailed Dunnart) P4;
- *Macroderma gigas* (Ghost Bat) P4; and
- *Leggadina lakedownensis* (Lakeland Downs Mouse) P4.

One species (Northern Quoll) is not listed at the State level, but is listed as 'Endangered' at the Federal level. Additionally, the Night Parrot is listed as 'Endangered' at the Federal Level and the Pilbara Olive Python is listed as 'Vulnerable' at the Federal Level.

Eight specimens of poorly known taxonomy were also recorded, all were reptiles, these may be considered significant species in the future with further investigation.

Submissions

Key comments focused on:

- Adequacy of fauna surveying within the project area- quantity, methodology and timing;
- The need for further taxonomic analysis of short-range endemics;
- The need for further analysis of the impact on habitats present inside the project area;
- The need for further targeted surveys for stygofauna; and
- Management of potential stygofauna populations.

Assessment

Terrestrial fauna

Of the eighty three birds recorded within the BS4 area three species were seen to be breeding, Zebra Finches, a pair of Ground Cuckoo-shrikes and a pair of Cockatiels. None of these species is of particular conservation significance and all recordings occurred at survey sites outside the active mining envelope. Therefore, the project is not expected to affect these species within the BS4 area. There are no records of endemism or restricted taxa within the area, however two birds of conservation significance (Australian Bustard, Bush Stone-curlew) were recorded within the BS4 project area and are discussed below in Priority fauna.

Of the thirteen ground mammals recorded during the surveys, eight are native species:

- 2 kangaroos;
- 2 carnivorous marsupials;
- 4 rodents;

and five are introduced species:

- Feral dog;
- Feral cat;
- Donkey;
- Horse;
- House mouse.

Only one of the native mammals recorded was of conservation significance (Western Pebble-mound Mouse) and is discussed below in Priority fauna. The two species of carnivorous marsupials recorded during the surveys are the only natives considered to be near endemic to the Pilbara bioregion, however both are widespread across the region in a range of substrate types.

Seven species of bats were recorded during the surveying, however no roosts were identified within the project area. No Priority taxa were recorded during the surveys, however the Priority 4 Ghost Bat is known to exist in the eastern portion of the Silvergrass area and is discussed below in Priority fauna.

Fifty four species of reptile were recorded during the surveys, being forty eight lizards and eight snakes. Seven of these species are considered to be endemic to the Pilbara bioregion including the one Priority taxa identified (Lined Soil-crevice Skink). This species is discussed below in Priority fauna.

Two frog species were recorded in locations outside the active mining envelope in creekline and stony plains habitats. Neither has any particular conservation status, and both are have widespread distribution over the Pilbara bioregion, other parts of Western Australia, Northern Territory and Queensland.

Short Range Endemics

Over one hundred invertebrate taxa were recorded, however only those belonging to groups known to include short-range endemics were identified beyond Family level. Three groups of interest were identified:

- Millipedes;
- Trap-door Spiders; and
- Land Snails.

Millipedes are a group that have, in general terms, been poorly studied taxonomically. The Pilbara bioregion is no exception to this with only one species commonly collected. During surveying three taxa were collected, and have been forwarded to the Western Australian Museum for identification. Several spiders were collected in the project area, most notably were those belonging to the Sub-order *Mygalomorpha*. Mygalomorphs are a group of arachnids that include Trap-door Spiders. Five adult Trap-door Spiders were collected and upon analysis all except one were found to be from the same taxon. Biota are presently in co-operation with the Western Australian Museum in establishing a reference collection of Pilbara Mygalomorphs in order to

develop contextual information for determination of conservation significance of this group.

Snails were collected from five fauna sampling sites inside the BS4 project area and from five control sites along the White Quartz Road. Four species of land snail were identified, of which one has been identified as belonging to the genus *Rhagada*. The *Rhagada* specimens collected differ from those indicative of the area and are presently un-described (currently termed '*Rhagada* sp. "Mt Brockman"'). *Rhagada* sp. "Mt Brockman" specimens were collected both inside the mine area and at control sites.

HI has committed to fund a study currently being conducted by the Western Australian Museum in the Pannawonica area, on snails with similar morphology to the "Mt Brockman" snails. From preliminary results of this study, it appears as though the "Mt Brockman" snails differ significantly from those near Pannawonica. In addition to this, results show there is sequence divergence consistent with species level difference in one of the "Mt Brockman" snail populations. Snails located at fauna survey site BROMD differ from those collected at all other sites in the BS4 area. The vegetation at site BROMD also differs from the other sites, in that it is associated with a discrete area of *Triodia* under Mulga, as opposed to the open continuous *Triodia* plains of the other sample sites.

Fauna survey site BROMD is located south of West pit near the mine production bores and pipeline. This area also coincides with the groundwater dependant (and moderate conservation significance) vegetation type P1. Presently, the area will likely be impacted from the bore pipeline, therefore it is recommended that the pipeline be relocated to the northern side of site BROMD in an existing track so as to protect the snail population and associated vegetation type. A separate condition has been included to address this issue and other indirect impacts to the snails and their habitat.

Fauna habitats

Fauna habitat surveying found the five habitat types to be associated with the three main vegetation habitats:

- Creekline habitat associated with the vegetation of drainage areas;
- Mulga shrublands and *Acacia* over *Triodia* habitats associated with vegetation of stony plains; and
- Gorge and *Triodia* hilltop habitats associated with the vegetation of the stony hills.

These vegetation and fauna habitat types are dispersed over the seven land systems identified within the project area. Habitat of the *Triodia* hilltop (associated with vegetation types H2 and H16) will be most affected inside the BS4 mining area. However, this habitat type is generally widespread and abundant throughout the region and is associated with the Newman Land System, which is the second most abundant Land System in the Pilbara bioregion.

Creekline habitat associated with the River Land System has been identified as having importance for the Priority 4 species Lined Soil-crevice Skink and Australian Bustard. However, this habitat is located outside of the active mining envelope and is not expected to be impacted by the project.

Habitat associated with calcrete outcroppings (associated with vegetation type P10) has been identified as important to both land snail and stygofauna populations. This habitat type is associated with the Table Land System, which is scattered across the south of the Pilbara bioregion. Whereas a section of calcrete outcrop will be impacted by the western pit and waste dump areas, other outcrops exist to the north of the mining envelope and along the White Quartz Road. Neither of these other calcrete outcrops will be impacted by the project.

However, even though these fauna habitats are known to occur outside of the mining area, the EPA recommends the proponent determine the level of representation of these habitats inside secure conservation reserves.

The proponent has committed to prepare Construction and Operation EMPs to address all environmental factors that could have negative impacts on native fauna, such as fire, habitat modification, vehicular movement etc.

Aquatic fauna

Biota noted that in comparison to other stygofauna surveys conducted in the Pilbara, it is unusual for a repeat sampling effort of twenty seven bores to record such little evidence of stygofauna. The results of the field testing revealed some problems associated with sampling, which may have hindered the process. High water turbidity in some bores made the borehole environment unsuitable for stygofauna and difficult to sample the aquifer effectively.

Due to the timing of the sampling program (phase one 2-4 months and phase two 4-6 months after bore completion), it is unlikely attributed to insufficient time between borehole completion and sampling. Additionally, the same Biota field team, using the same equipment and methodology sampled other locations within the vicinity with a high success rate, so it is unlikely to be attributed to equipment, personnel or methodology.

As part of the investigation by Biota, a review of the subterranean geological features intersected by the twenty seven sampling bores indicated that:

- 19 bores intersected geological formations that would be unlikely to provide habitat for stygofauna;
- 4 bores contained calcrete, alluvium or dolerite above the water table; and
- 4 bores intersected areas of alluvium below the water table.

The review revealed that only two geological features present in the project area commonly provided habitat for stygofauna when saturated, being calcrete and alluvium along drainage lines.

A small area of calcrete occurs to the north-west of the mining envelope in a location where groundwater levels would be lowered by approximately 55 m. No bores intersect this location, but other bores within the vicinity that intersect calcrete showed this formation to be above the water table, and therefore unsuitable for stygofauna.

The most significant occurrence of alluvium in the project area occurs in the drainage system in the valley to the north of the BS4 mining area (associated with the Wittenoom Formation). In areas where the formation is below the water table, it is likely to provide habitat for stygofauna. This is supported by the only recorded animal from the two-phase sampling, being collected from a bore which intersects this area.

As this area is intended to be developed for the Boolgeeda Borefield (see section 3.3 Groundwater) HI has committed to conduct a third phase of sampling of the existing bores, plus a targeted survey of the alluvium drainage valley prior to any dewatering or abstraction. Any stygofauna populations identified during surveying will be managed in consultation with CALM.

Priority and Scheduled fauna

The Priority 4 Pebble-mound Mouse is a small placental mammal known to build and inhabit pebble-mound burrows. This animal is endemic to the Pilbara, and is fairly well distributed over the region. The species has been removed from the endangered species list by CALM and assigned the lowest conservation category (P4).

No active mounds were recorded during the field surveys, however a single individual was captured in a pit-fall trap in the *Triodia* hilltop habitat during the April survey. Whereas the project could possibly impact this species within the BS4 project area, the activity will not affect the conservation status of the species at either the Pilbara bioregion or Hamersley subregion level.

The Priority 4 Australian Bustard lives on open grassy plains and low shrubby areas in northern Australia. It has an omnivorous diet and nests on the bare stony ground. Five birds were sighted during the October 2004 fauna survey flying through creekline habitat and one bird was recorded from amongst native grasses. There were eleven records from the April 2005 survey phase at several locations along the White Quartz Road.

The project will result in some habitat loss and potential mortalities from vehicular movement through the area. It is proposed to include a fauna mortality register, as part of the EMP's to address this issue. However, this bird is represented outside of the project area in the Pilbara bioregion and also occurs in the Mid-West and Gascoyne regions of Western Australia, Queensland and Southern New Guinea. The project is unlikely to affect the conservation status of this species at either the Pilbara bioregion or Hamersley subregion level.

The Priority 4 Bush Stonecurlew is a ground dwelling bird that inhabits sparsely grassed, lightly timbered forests or woodland. It has an omnivorous diet and nests on the bare ground or in a small scrape. One record of this bird was made in the stony plains habitat in April 2005. This bird is widespread in the tropical north of Australia and New Guinea, however, has suffered a severe decline in numbers in temperate Australia. This is believed to be due to fox predation, although habitat clearing is another possible factor. The project will result in some habitat clearing, and potential mortalities from vehicular movement through the area. It is proposed to include a fauna mortality register, as part of the EMP's to address this issue. The project is considered unlikely to affect the conservation status of the species at either the Pilbara bioregion or Hamersley subregion level.

The Priority 4 *Notoscincus butleri* sometimes referred to as the Lined Soil-crevice Skink is a small, diurnal, egg laying reptile that inhabits spinifex-dominated areas along creek and river margins. This reptile was recorded inside the creekline habitat associated with the Boolgeeda System. This reptile is endemic to the arid north-west of Western Australia. It is not as well known as the other Priority species found in the BS4 project area, however it was also found in the Nammuldi/Silvergrass area during a previous field survey. This skink is not expected to be impacted by the BS4 project as the area it inhabits is located outside of the active mine envelope.

Of the eight other Priority/Scheduled species identified in association with the project area, but not observed during field surveys, three are considered likely to be present (Northern Quoll, Peregrine Falcon, Ghost Bat), three are considered to possibly be present (Pilbara Olive Python, Long-tailed Dunnart, Lakeland Downs Mouse) and two are considered unlikely to be present (Night Parrot, Spectacled Hare-wallaby) in the BS4 area.

Of the species considered likely to be present, none is expected to have its conservation status affected by the BS4 project. Whereas the Northern Quoll is listed as Endangered at the Federal level it does occur in the Pilbara and Kimberley regions of Western Australia as well as in Queensland and the Northern Territory. Despite a decline in numbers and distribution, it is still relatively abundant across parts of the Pilbara. This species was also recorded in the Nammuldi/Silvergrass area on previous surveys.

The Peregrine Falcon inhabits a wide range of habitats including forest, woodlands, wetlands and open country of the Pilbara. The availability of prey is apparently more important than habitat in determining its distribution. It was not recorded during the BS4 survey, but it is possible that this species could reside in the BS4 Project area, given that suitable prey species, such as parrots are common. Biota have recorded this species near Tom Price as well as within the Nammuldi-Silvergrass Project area during previous surveys. Whilst its status is difficult to determine in the Pilbara, it is considered relatively common.

The Ghost Bat is distributed across the north of Western Australia extending into Queensland. Whilst not detected during the surveys, it is possible that this species forages in the BS4 Project area and may use some of the larger caves in the area for roosts. The project might result in the loss of some foraging habitat, however this loss will not have a significant impact on the species, as there are other foraging areas outside of the BS4 project area.

However, even though the Priority and Scheduled fauna are not expected to be significantly impacted and are known to occur outside the mining area, the EPA recommends the proponent determine the level of representation of these species inside secure conservation reserves.

Summary

Having particular regard to the following:

- The proponent will prepare EMPs to address and manage all factors that can impact native fauna;

- The proponent has committed to fund research into the resolution of the morphology and genetics of land snail *Rhagada* sp. “Mt Brockman” as preliminary results indicate it is a new taxon;
- A unique population and associated habitat of *Rhagada* sp. “Mt Brockman” appears to have been identified south of the West pit and a condition has been included to protect it;
- Millipedes and spiders of significance have been logged by the WA Museum for further research into the conservation significance of these groups;
- No fauna habitat is unique to the study area and all are represented elsewhere in the bioregion region;
- The majority of the sensitive fauna habitats identified in the BS4 project area are located outside of the active mining envelope;
- No stygofauna populations have been identified within the project area and the proponent has committed to undertake further targeted surveys for stygofauna prior to dewatering/abstraction; and
- It is unlikely the conservation status of Priority fauna known to inhabit or likely to inhabit the BS4 project area will be affected at a local or regional level; the EPA considers the issue of fauna has been adequately addressed and can meet the EPA’s objectives.

3.3 Groundwater

Description

Groundwater conditions in the BS4 area were investigated between 2003 and 2005. HI contracted Aquaterra Consulting to undertake groundwater investigations which involved:

- Geological studies;
- Drilling;
- Aquifer testing; and
- Groundwater modeling.

No previous investigation of this area has been undertaken, and therefore there is also no long term monitoring data available. The investigations focused on three main objectives:

- Develop an understanding of the regional groundwater system;
- Assess the sustainability and impact of dewatering; and
- Assess the sustainability and impacts of abstraction to meet project needs.

Dewatering will be necessary as approximately 20% of the high grade ore body is below the water table. The West pit will require the most dewatering with approximately 34% of the reserve being below the regional water table. Supply water will be needed during project construction and operation for dust suppression, use in the process plant and workshop, and at the mine camp.

As part of the investigation thirty bores were drilled and assessed, including hydraulic testing and surveying for the presence of stygofauna (see section 3.2 Fauna). Aquifers in the study area are generally confined at considerable depths, with low permeability. The exceptions to the low permeability are the dolomite of the Wittenoom Strike

Formation south of the orebody and the orebody aquifer which is a high permeability unconfined aquifer.

Active recharge is mainly from creek channels and drainage lines. Due to geology it appears the annual recharge is very low, estimated at less than 1% of the rainfall volume over the catchment. Groundwater discharge occurs as subsurface outflow, mostly to the south into the Beasley River catchment.

The groundwater quality over the area varies from fresh to slightly brackish. In the Boolgeeda Valley groundwater system, salinity ranges between 180 mg/L upstream and 1 400 mg/L downstream. In the orebody and dolomite aquifers, salinity ranges between 500 mg/L upstream and 700 mg/L downstream.

The Orebody aquifer and the Wittenoom Dolomite aquifer have been identified as the only aquifers with any groundwater development potential in the immediate vicinity of BS4, however investigations are on going.

Dewatering alone will not be sufficient to provide the required water volume at a sustainable rate. Therefore, it is also necessary to develop the Boolgeeda Dolomite borefield in approximately year 5-6. The proposed Boolgeeda borefield is located in a section of the Wittenoom Formation on the northern side of the mining area. It is estimated to have a groundwater resource of between 4 000-8 000 kL/d.

The nearest other groundwater user in the area is a Rocklea Station bore used to water livestock. This bore is located approximately 10 km west of the Boolgeeda borefield and 15 km north-west of the western pit.

Submissions

Key comments focused on:

- A detailed Borefield Management Plan needs to be approved prior to any abstraction of groundwater;
- Process water will be sourced from the Silvergrass Valley should the Boolgeeda borefield not be sustainable;
- More detail on the dewatering quantities is required for the Groundwater Operating Strategy;
- The impact of groundwater draw-down on the surrounding environment should be monitored/investigated; and
- Backfilling of the mine voids above the water table should be undertaken.

Assessment

Mining below the water table is not expected until approximately year 6, however water will be sourced for dust control and processing from within the mine pits from project start up. All mine water will be used for dust suppression and processing, so there will be no dewater discharged to the environment. The Boolgeeda borefield and pipeline will be located inside the infrastructure corridor. If this source is proven, it will be adequate as a source of make-up water in conjunction with mine dewatering. In the event the Boolgeeda borefield option proves to be unsustainable, HI has a fall back option to source water from the Silvergrass Valley, located 35 km from the BS4 Project area. These options are still being investigated and a condition has been

included to ensure all investigations are completed by the end of the fifth operational year of the BS4 mine.

HI has committed to prepare a Borefield Management Plan with strategies for sustainable management of the borefield prior to groundwater abstraction and dewatering on the site. The objective of the plan is to maintain the quality and quantity of water so that existing and potential environmental values, including ecosystem maintenance are protected.

The Borefield Management Plan will include:

- A hydrogeological investigation to determine the current quantity and quality of the groundwater aquifers of the BS4 area;
- Modeling of the current groundwater system and the short and long-term hydrogeological impacts of mining;
- Development of a Water Operating Strategy, incorporating the results of the hydrogeological investigation and modelling, in consultation with the Water and Rivers Commission, that includes:
 - Monitoring of the groundwater abstraction;
 - Monitoring of the groundwater quality and quantity;
 - Maximise water efficiency;
 - Manage and minimise impacts on the groundwater aquifers; and
 - Reporting on the management actions and monitoring results.

Dewatering and groundwater abstraction activities on the site will be managed through groundwater licensing under the *Rights in Water and Irrigation Act 1914*. The Borefield Management Plan will be used in association with the groundwater license(s).

The orebody associated with the groundwater system is a high phosphorous Brockman deposit comprised of bedded hematite/goethite. The orebody also has a section of pyritic black shale on the southern boundary that extends the length of the proposed pits and is approximately 14 m thick. Pyritic black shale contains sulphide minerals that can react with air and water to produce acid drainage water. This can have impact through acidification of groundwater, release of heavy metals, contamination of ground and surface water and vegetation death.

It is not intended that this material will be mined or exposed during the mining operations as it is not target ore and is located along the pit boundary. In the event this material is unearthed, HI will employ strategies to ensure the material is encapsulated in waste dumps. To aid this contingency, HI has developed a Black Shale Management Plan to address this issue, will adopt the principals of the plan for the BS4 project and address acid rock drainage in the Construction and Operational EMPs. Another management measure to protect groundwater is HI's commitment to backfill mine voids to above the water table to maintain groundwater quality.

The main impact on the groundwater system from the BS4 Project will be a reduction in groundwater levels in the area immediately around the mine and water supply borefields, and a reduction in groundwater outflow to adjacent areas. This may result from both abstraction of groundwater for water supply and from mine dewatering.

This can lead to short and long term modification of aquifer hydraulics and impact phreatophytic vegetation.

Two phreatophytic vegetation types were identified with the BS4 area (C1, P1) associated with the Boolgeeda Creek area and near mine production bores to the south of the western pit. Abstraction and dewatering can reduce water levels beyond the reach of these groundwater dependant plant species. Vegetation type P1 may be impacted from localised drawdown of these production bores. However, both vegetation types occur in small populations and correspond to types identified in the Nammuldi/Silvergrass area, thus are represented outside of the BS4 project area. Whereas both vegetation types are considered to be of moderate conservation significance, the proposed activities are not likely to affect the overall conservation status of either vegetation type.

Whereas potential stygofauna habitat has been identified in the proposed Boolgeeda Borefield area, recent stygofauna surveying has found little evidence to suggest stygofauna exist in the BS4 area. However, surveying of new areas will be undertaken prior to any dewatering or abstraction (see section 3.2 Fauna).

From the groundwater investigation it appears that reduced groundwater levels and outflow will not have a significant impact on the surrounding environment due to the following:

- Groundwater levels throughout the BS4 area are naturally deep and there is no indication of shallow water table aquifers within the project area;
- The area is characterised by low rates of groundwater recharge and throughflow, therefore a reduction in outflow from the BS4 Project area to adjacent areas affects relatively small volumes of water;
- There is little evidence to suggest that stygofauna are present; and
- No significant populations of phreatophytic vegetation types will be affected.

The BS4 project is also not expected to have any impact on the one other groundwater user (Rocklea Station) in the area, as groundwater drawdown mapping indicates that this production bore is located well outside of the cone of depression.

Summary

Having particular regard to:

- Efficient use of mine dewater with no discharge to the environment;
- Potential backup source identified and undergoing investigation;
- Pyritic black shale will not be mined, however a Black Shale Management Plan will be prepared in the event it is encountered;
- No significant populations of groundwater-dependant vegetation will be impacted;
- Outflow rates to the environment will not be significantly reduced;
- No stygofauna populations are likely to be impacted, however additional surveying will be conducted in new areas;
- A proponent commitment to backfill mine pits to above the ground water level;
- A proponent commitment to prepare a Borefield Management Plan prior to dewatering and abstraction; and

- A condition to ensure groundwater investigations are complete by the end of the fifth operational year of the mine; the EPA considers the issue of groundwater has been adequately addressed and can meet the EPA's objectives.

3.4 Mine rehabilitation and closure

Description

The BS4 Project will disturb approximately 2,470 ha of land over the thirty year life of the project. If these areas are not appropriately decommissioned and rehabilitated, it could result in the reduction of the environmental values of the area. The project involves the creation of three mine pits, waste dumps, stockpiles and associated mine and transport infrastructure.

The project is located in a remote part of the Central Pilbara and is not near any:

- National parks (~90 km);
- Tourist routes;
- Towns (~60 km);
- Homesteads/ Stations (~55 km);
- Significant indigenous heritage areas; and
- European heritage areas.

A Preliminary Rehabilitation and Closure Management Plan (PRCMP) was prepared by HI and included with the PER (appendix G). It has been treated as a strategic plan consistent with current best practice for the mining industry. The PRCMP addresses the knowledge base, closure strategy, closure inventory, closure costs, closure schedule and review for the BS4 Project, and has been developed largely on the basis of the methodology and strategies used for closure plans at other Hamersley Iron mine sites.

HI has committed to backfill mine voids above the groundwater level as space becomes available and also to re-establish Priority flora species in rehabilitated areas.

Submissions

Key comments focused on:

- An additional objective is required in the Preliminary Rehabilitation and Closure Management Plan to ensure a similar diversity and quality of habitats exists after rehabilitation;
- Additional site specific surveys may be required for the local species list used for re-vegetation;
- Support for planned research into re-establishment of Priority species in rehabilitated areas; and
- Disagree with HI's Closure Assumption that all open pits and final voids do not require rehabilitation.

Assessment

The PRCMP will be reviewed and updated regularly throughout the life of the operation. The PRCMP addresses the rehabilitation and closure of the following main components:

- Mine pits;
- Waste dumps;
- Rail spur;
- Processing plant; and
- Other associated infrastructure.

During review of the PRCMP, a separate section should be included for the treatment of the low grade ore stockpiles if/when it becomes apparent that they will not be processed and require rehabilitation. A re-evaluation of some issues such as rehabilitation of mine voids and strategies to secure a similar diversity of species back into rehabilitated areas should be carried out periodically.

Rehabilitation and mine closure would be integrated with mine planning during the life of the project with the Final Rehabilitation and Closure Management Plan to be submitted at least two years prior to mine closure. Accounting methods will be used for managing financial closure provisions. The plan will also address post-closure environmental monitoring and reporting requirements.

A condition has been included to ensure mine rehabilitation and closure is carried out in accordance with the ANZMEC & Minerals Council of Australia - *Strategic Framework for Mine Closure* (2000).

Summary

Having particular regard to:

- PRCMP has been prepared and will be reviewed and updated over the life of the project;
- A FRCMP will be submitted at least two years prior to mine closure;
- A proponent commitment to progressively backfilled mine voids; and
- A proponent commitment to re-establish Priority flora species in rehabilitated areas; the EPA considers the issue of mine rehabilitation and closure has been adequately addressed and can meet the EPA's objectives.

3.5 Relevant environmental principles

In preparing this report and recommendations, the EPA has had regard for the object and principles contained in s4A of the *Environmental Protection Act (1986)*. Table 2 in Appendix 3 contains a summary of the EPA's consideration of the principles.

4. Conditions and Commitments

Section 44 of the *Environmental Protection Act 1986* requires the EPA to report to the Minister for the 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.

In developing recommended conditions for each project, the EPA's preferred course of action is to have the proponent provide an array of commitments to ameliorate the impacts of the proposal on the environment. The commitments are considered by the EPA as part of its assessment of the proposal and, following discussion with the proponent, the EPA may seek additional commitments.

The EPA recognises that not all of the commitments are written in a form which makes them readily enforceable, but they do provide a clear statement of the action to be taken as part of the proponent's responsibility for, and commitment to, continuous improvement in environmental performance. The commitments, modified if necessary to ensure enforceability, then form part of the conditions to which the proposal should be subject, if it is to be implemented.

4.1 Proponent's commitments

The proponent's commitments as set in the PER and subsequently modified, as shown in Appendix 4, should be made enforceable. These relate to:

- Environmental Management Plans;
- Priority Flora;
- Land Snails;
- Stygofauna;
- Groundwater Quality;
- Groundwater Resources;
- Rail Spur Drainage; and
- Aboriginal Heritage.

4.2 Recommended conditions

Having considered the proponent's commitments and the information provided in this report, the EPA has developed a set of conditions which it recommends be imposed if the proposal by Hamersley Iron to develop an open cut iron ore mine and infrastructure corridor is approved for implementation.

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

- (a) The proponent shall fulfill the commitments in the Consolidated Commitments statement set out as an attachment to the recommended conditions in Appendix 4;
- (b) DRF and Priority flora sampling of the rail spur and infrastructure corridors shall be carried out prior to ground disturbance and any DRF or Priority flora identified be managed;
- (c) Protection of the unique land snail population and associated habitat;
- (d) Completion of hydrogeological investigations of groundwater resources; and
- (e) Mining area shall be rehabilitated progressively.

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

- Works approval/licensing under part V of the *Environmental Protection Act 1986*; and
- Permits and licenses under the provisions of the *Rights in Water and Irrigation Act 1914*.

5. Conclusions

The EPA has considered the proposal by HI to develop a new iron ore mine in the Central Pilbara area.

The EPA notes in regard to flora and vegetation:

None of the vegetation types significantly affected by the proposal is unique to the study area or regionally significant. Those identified as having moderate conservation significance are represented elsewhere in the Pilbara bioregion, and it is not likely that the BS4 project will significantly affect these vegetation types conservation significance. A second round of PATN analysis planned for 2006 will provide greater clarity of the floristic groups present and their conservation status.

The single vegetation type identified as having high conservation significance (P11) within the local area and containing the Priority 1 flora *Ptilotus* sp. “Brockman”, is located outside of the active mining envelope and additional measures will be taken to prevent other disturbance. The Priority 4 flora *Eremophila magnifica* subsp. *magnifica* that will be subject to severe disturbance is represented elsewhere in the Hamersley subregion and removal of the population within the active mining envelope will not have a significant impact on the conservation status of the taxon.

However, even though the vegetation types and Priority flora species are known to occur outside the mining area, the EPA recommends the proponent determine the level of representation of these vegetation types and flora species inside secure conservation reserves.

It is also noted that Priority and DRF surveying of the rail spur and infrastructure corridors will be completed prior to any disturbance on the site. A separate condition has been included to ensure this work is completed.

The proponent has committed to prepare Construction and Operation EMPs to address all factors that can impact flora and vegetation. They will include ongoing surveys for Priority flora, vegetation monitoring and a weed hygiene plan.

The EPA notes in regard to fauna:

No habitat is unique to the study area and all are represented elsewhere in the Pilbara bioregion. Additionally, the majority of the sensitive fauna habitats identified in the BS4 project area (creekline vegetation and calcrete outcroppings) are located outside of the active mining envelope. The few areas that will be impacted are minimal and mining activity is unlikely to have significant impact on the conservation values of these habitats.

Of the four Priority fauna species recorded as being within the project area, none are considered Vulnerable or Endangered and all are represented outside of the BS4 project area. It is unlikely the conservation status of any of these Priority fauna will be

affected at a local or regional level. The three other Priority/Schedule fauna considered likely to inhabit the BS4 area have also been recorded in the nearby Nammuldi/Silvergrass area and it is considered unlikely the BS4 project will significantly affect the conservation status of these species.

However, even though the fauna habitats and Priority and Scheduled fauna are known to occur outside the mining area, the EPA recommends the proponent determine the level of representation of these species and habitats inside secure conservation reserves.

No stygofauna populations have been identified within the project area and there is little habitat suitable for stygofauna existing in and around it. HI has committed to undertake additional survey work in new areas containing potential stygofauna habitat, and manage any identified populations in consultation with CALM.

The three short-range endemic taxa of interest have been collected and submitted to the WA Museum for research/analysis. Presently, HI are funding a study in an effort to resolve the morphology and genetics of land snail species. A condition has been included to protect the unique *Rhagada* “Mt Brockman” population and associated habitat.

The proponent has committed to:

- Prepare Construction and Operation EMPs to address and manage all factors that can impact fauna. These will include habitat, fire and weed management; and
- Fund research into the resolution of the morphology and genetics of land snail *Rhagada* sp. “Mt Brockman”; and
- Conduct a third phase of stygofauna sampling in new areas containing potential stygofauna habitat.

The EPA notes in regard to groundwater:

The efficient use of mine dewater for dust suppression and in processing will result in no discharge to the environment. A potential backup water source has been identified and is still undergoing investigation to prove the preliminary findings. A condition has been included to ensure all groundwater investigations are completed by the end of the fifth operational year of the BS4 mine. HI has committed to prepare a Borefield Management Plan prior to abstraction/dewatering addressing all relevant factors including a monitoring program.

The groundwater levels throughout the BS4 area are naturally deep and there is no indication of shallow water table aquifers within the project area. Therefore reduced groundwater levels are not considered likely to have any significant impact on the project area. The area is characterised by low rates of groundwater recharge and throughflow, therefore a reduction in outflow from the BS4 Project area to adjacent areas affects relatively small volumes of water and is not considered likely to have significant impact on the greater environment.

The few small populations of groundwater dependant vegetation that may be impacted by the project are represented outside of the project area in the Nammuldi/Silvergrass

area. Any impact to these small populations is not likely to have a significant impact on the conservation status of these vegetation types.

No impacts on stygofauna populations are expected, based on present knowledge of hydrogeology and stygofauna distribution in the inland Pilbara, although further testing will be carried out in targeted dolomite areas prior to any abstraction/dewatering at the site.

The EPA notes that a band of pyritic black shale which has been identified along the southern pit boundary is not intended to be mined, and HI will prepare a contingency Black Shale Management Plan to address the problem in the event this material is unearthed. HI will also backfill mine voids to above the groundwater level so as to maintain groundwater quality in the area.

The proponent has committed to:

- Prepare a Borefield Management Plan prior to groundwater abstraction at the site; and
- Progressively backfill mine pits to above the ground water level.

The EPA notes in regard to mine rehabilitation and closure:

HI have prepared a Preliminary Rehabilitation and Closure Management Plan (PRCMP) which is being treated as a strategic plan consistent with current best practice for the mining industry.

The PRCMP will be reviewed and updated regularly throughout the life of the operation, with a Final Rehabilitation and Closure Management Plan to be submitted at least two years prior to mine closure. The plan will also address post-closure environmental monitoring and reporting requirements. A separate condition has been included to ensure this work is completed in accordance with ANZMEC & Minerals Council of Australia - *Strategic Framework for Mine Closure* (2000).

The proponent has committed to collect seed and material of Priority flora species within the disturbance area to be later used in rehabilitation works in the re-establishment of these species.

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

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 for the Hamersley Iron Brockman Syncline 4 Iron Ore Project.
2. That the Minister considers the report on the relevant 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, including the proponent's commitments; and
4. That the Minister imposes the conditions and procedures recommended in Appendix 4 of this report.

Appendix 1

List of submitters

Government:

Department of Conservation and Land Management

Department of Environment

Department of Indigenous Affairs

Western Australian Museum

Organisations and the Public:

G. Thompson

Wildflower Society of Western Australia

Appendix 2

References

ANZMEC and MCA (2000). *Strategic Framework for Mine Closure*. Australian and New Zealand Minerals and Energy Council and the Minerals Council of Australia, August 2000.

Aquaterra (2005) Brockman 4 Hydrogeology Pre-Feasibility Report. Unpublished Report for Hamersley Iron.

Atkins K. J. (2005). *Declared Rare and Priority Flora List for Western Australia*. Department of Conservation and Land Management.

Australian Vertebrate Species (CAVS) - Reptiles Version 8.1 - 15 June 1995 - Australian Biological Resources Study (ABRS).

Beard, J. S. (1975). *Pilbara. Explanatory Notes and Map Sheet 5, 1:1,000,000 Series Vegetation Survey of Western Australia*. Univ. West. Aust. Press: Nedlands.

Biota Environmental Sciences (2005). *A Vegetation and Flora Survey of the Brockman Syncline 4 Project Area, near Tom Price*. Unpublished Report to Hamersley Iron, July 2005. Project No. 271.

Biota Environmental Sciences (2005). *Fauna Habitats and Fauna Assemblage of the Brockman Syncline 4 Project Area, near Tom Price*. Unpublished Report to Hamersley Iron, July 2005. Project No. 271.

Department of Agriculture, Western Australia (2002). *Land Systems Mapping of the Pilbara region, WA*. Draft mapping.

Environment Australia (2000). Revision of the Interim Biogeographic Regionalisation for Australia (IBRA) and Development of Version 5.1, Summary Report. Environment Australia, November 2000.

Environmental Protection Authority (2000). Position Statement No. 2: Environmental Protection of Native Vegetation in Western Australia. December 2000.

Environmental Protection Authority (2002). Position Statement No. 3: Terrestrial Biological Surveys as an Element of Biodiversity Protection. March 2002.

Environmental Protection Authority (2003). Guidance Statement No. 54: Consideration of Subterranean Fauna in Groundwater and Caves During Environmental Impact Assessment in Western Australia. December 2003.

Environmental Protection Authority (2004). Guidance Statement No. 56: Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia. June 2004.

Environmental Protection Authority (2004). Guide to EIA Environmental Principles, Factors and Objectives. Version 2 (1 November 2004).

Environmental Protection Authority (2004). Preliminary Position Statement No. 9: Environmental Offsets. July 2004.

Environmental Protection Authority (2004). Guidance Statement No. 51: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia. June 2004.

Hamersley Iron Pty Ltd (2005). *Brockman Syncline 4 Iron Ore Project*, Public Environmental Review. August 2005.

Rio Tinto (2004). Rio Tinto Closure Standard.

Thoma, E. and Joder, A. (2003). *Brockman 4 Rare Flora Survey*. Hamersley Iron Pty Limited Environmental Division. Unpublished Report, June 2003.

Appendix 3

Summary of identification of relevant environmental factors and principles

Identification of Relevant Environmental Factors and Principles

Preliminary Environmental Factors	Proposal Characteristics	Government Agency and Public Comments	Identification of Relevant Environmental Factors
BIOPHYSICAL			
Flora and vegetation	<p>Approximately 2470 ha of native vegetation will be cleared or disturbed by the project.</p> <p>In accordance with Beard’s mapping, two broad vegetation associations exist in the area: <i>Eucalyptus leucophloia</i> (Snappy Gum) and <i>Acacia aneura</i> (Mulga).</p> <p>Fifty three (53) vegetation types were identified within the BS4 area with one (1) type identified as having high conservation significance and eighteen (18) as having moderate conservation status.</p>	<p><u>Department of Environment (DoE)</u></p> <ul style="list-style-type: none"> • Surveys are in accordance with requirements of EPA Guidance Statement 51. • Sampling restraints are likely are likely to underestimate flora diversity, more work for Priority taxa is required. • The statistical analysis of required to place plant communities into a regional context is not complete. The number of vegetation types of conservation significance may increase after further analysis of the plot data. • Accuracy of vegetation mapping would be limited because it is based on coarse land system maps. • Additional management work in the document (i.e. surveys for rare flora and preparation of management plans) should overcome many limitations of the preliminary surveys. • The botanical survey was conducted before the precise locations of disturbance were known. Further survey work is required to fully assess environmental impacts to flora and vegetation on areas to be cleared. <p><u>Department of Conservation and Land Management (CALM)</u></p> <ul style="list-style-type: none"> • Support the Biota recommendation that Hamersley Iron should conduct an assessment of the likely impact of groundwater drawdown on vegetation in the project area. 	<p>Considered to be a relevant environmental factor and is discussed under the factor of “Flora and vegetation”.</p>
Priority and Declared Rare Flora	<p>No Declared Rare Flora (DRF) occur within the project area, however six (6) Priority flora species occur within and around the project area.</p> <p>They will not be significantly impacted, except <i>Eremophila magnifica</i>, which has been identified as occurring in both the west pit and in west waste dump areas. This species will be greatly impacted by the project.</p>	<p><u>Department of Conservation and Land Management (CALM)</u></p> <ul style="list-style-type: none"> • The occurrence of the Priority 1 <i>Ptilotus</i> sp.”Brockman” within the project area requires significant consideration. • May be subject to both direct disturbance and indirect disturbance from dust, erosion and weeds. HI should adequately demonstrate the proposed operations will not significantly impact the conservation status of this species. • Given the potential conservation significance of <i>Ptilotus</i> sp. “Brockman” CALM recommends HI develop a separate species plan. <p><u>Public</u></p> <p>Recommends the population of <i>Ptilotus</i> should have a monitoring program as well as an exclusion fence.</p>	<p>Considered to be a relevant environmental factor and is discussed under the factor of “Flora and vegetation”.</p>

<p>Terrestrial fauna</p>	<p>Five (5) primary habitats were identified within the BS4 project area:</p> <ul style="list-style-type: none"> • Creeklines • Mulga shrublands • <i>Acacia</i> over <i>Triodia</i> • Gorge • <i>Triodia</i> hilltop <p>Areas of <i>Triodia</i> will be the most impacted by the project.</p> <p>One of the land snails found has been identified as belonging to the genus <i>Rhagada</i>. The specimens collected are presently un-described and may represent a new taxon (currently termed '<i>Rhagada</i> sp "Mt Brockman"').</p> <p>This species has been identified as occurring within the mine and rail spur areas and is considered likely to be impacted.</p> <p>Eight (8) specimens of poorly known taxonomy were also recorded.</p>	<p><u>Department of Environment (DoE)</u></p> <ul style="list-style-type: none"> • Have the unidentified millipede taxa been collected in other areas of the Pilbara, or only in the project area? • Will calcrete habitat be impacted by the project? • 75% of the total area of <i>Triodia</i>/gorges mapped within the Brockman 4 area will be impacted. How well is the habitat represented outside the project area? • A statement needs to be made how significant <i>Mygalomorph</i> spiders are in the Pilbara. <p><u>Department of Conservation and Land Management (CALM)</u></p> <ul style="list-style-type: none"> • CALM asks to be advised of the WA Museum identification of the two millipede species. Further research may be required in order to determine the conservation status, range and distribution of the millipede taxa in the broader region. <p><u>Western Australian Museum</u></p> <ul style="list-style-type: none"> • Three Land Systems have been identified as having significant species, however it is then determined that they will not be significantly impacted by disturbance. • The management of impacts to fauna in the PER seemed appropriate to the vertebrate faunal assemblage described. <p><u>Public</u></p> <ul style="list-style-type: none"> • One of the surveys should have been undertaken in summer and supported by a spring or autumn survey. • Baseline data has not been collected over several years and is not sufficient for some habitat types. • The quantity of trapping undertaken is insufficient to assess species richness, assemblage structure, range restricted species, ecosystem values, seasonal and temporal variations. 	<p>Considered to be a relevant environmental factor and is discussed under the factor of "Fauna".</p>
<p>Aquatic fauna</p>	<p>Twenty seven (27) bores were surveyed, five (5) in control sites outside the BS4 area and twenty five (25) inside the BS4 area.</p> <p>During the February sampling a single stygofauna specimen was found in a control site. This specimen was later identified as a Bathynellid.</p>	<p><u>Department of Environment (DoE)</u></p> <ul style="list-style-type: none"> • If the stygofauna sampling program determines that species found are of conservation significance, how will they be protected from impacts? <p><u>Department of Conservation and Land Management (CALM)</u></p> <ul style="list-style-type: none"> • CALM supports Hamersley Iron's planned additional sampling for stygofauna aimed at determining the conservation significance of taxa in the area. 	<p>Considered to be a relevant environmental factor and is discussed under the factor of "Fauna".</p>

		<p><u>Western Australian Museum</u></p> <ul style="list-style-type: none"> • It is likely that the operation will have serious impact upon any stygofauna that may occur in the water table. • As the drawdown associated with the project may lower the water table it is imperative that a comprehensive stygofauna survey is completed prior to activity. 	
Priority and Scheduled fauna	<p>Four (4) Priority fauna species were recorded during the field surveys of the project area.</p> <p>Four (4) Priority and four (4) Scheduled species are also historically known to occur within the project area.</p>	<p><u>Western Australian Museum</u></p> <ul style="list-style-type: none"> • The terrestrial vertebrate fauna section of the PER was found to be comprehensive and acknowledged that Threatened and Priority species were also considered. 	Considered to be a relevant environmental factor and is discussed under the factor of “Fauna”.
Groundwater	<p>Water supplies will be required during project construction and operation for construction, mine operation and the camp.</p> <p>Two main aquifers have been identified; the orebody aquifer and the Wittenoom Dolomite in the valley immediately to the south of the orebody.</p> <p>It is also necessary to develop the Boolgeeda dolomite borefield in approximately year 5-6 to achieve required rates for processing, as the dewatering source will not be capable of supplying the required volumes at a sustainable rate.</p> <p>In the event that the Boolgeeda borefield option proves to be unsustainable, a fall back option is to source water from the Silvergrass Valley, which is located 35 km from the BS4 Project area.</p> <p>Potential for drawdown to affect groundwater dependant vegetation and modify aquifer hydraulics and salinity.</p>	<p><u>Department of Conservation and Land Management (CALM)</u></p> <ul style="list-style-type: none"> • A comprehensive vegetation condition monitoring program will need to be included as part of the Borefield Management Plan. • No excess groundwater production and disposal is anticipated. In the event that modeling reveals a need to dispose of excess groundwater HI will be required to consult with both CALM and DoE. <p><u>Department of Environment (DoE)</u></p> <ul style="list-style-type: none"> • As part of the modeling the water demand and characteristics of the project, HI have not indicated whether they considered the surface discharge of pit five at Brockman 2 and whether this could be integrated into the Brockman 4 water supply. • Supply water will come from dewatering with additions from the Boolgeeda borefield; Silvergrass is identified as a fall back supply if Boolgeeda is unsustainable. • The dewatering quantities are identified in the water balance section; however, more detail is required for quantification in the Groundwater Operating Strategy. • The Borefield Management Plan will need to be approved prior to the granting of groundwater licensing. • The small communities of groundwater dependant vegetation should be considered. • HI commits to backfill mine voids to above the water table. 	Considered to be a relevant environmental factor and is discussed under the factor of “Hydrology”.
Surface water	The proposed rail transport route crosses a number of moderate sized surface	No comments received	Surface water quality is an issue which will be addressed through the EMP's for BS4

	<p>creek lines and the broad drainage system of Boolgeeda Creek.</p> <p>Construction of linear infrastructure through areas of surface sheet flow can result in vegetation mortality through upstream ponding; down stream drainage shadow effects and disruption to sheet flow. This increases risk of erosion and sedimentation.</p> <p>Potential for surface spills from stored chemicals, hydrocarbons etc contaminating creeks and drainage lines.</p>		<p>site.</p> <p>All facilities will be located away from seasonal pools and waterholes. Additionally, infrastructure such as the rail spur which will cross drainage lines will use culverts to ensure surface sheet flow is not interrupted.</p> <p>Other infrastructure such as the power supply line will be engineered so that surface sheet water is able to flow freely across the track.</p> <p>Drainage sumps will be constructed immediately around the processing area and product stockpiles to prevent contaminated water leaving the site. All sumps will be constructed to fully contain a 1 in 5 year rainfall event.</p> <p>Factor does not require further EPA evaluation.</p>
--	---	--	--

POLLUTION

<p>Pyritic black shale</p>	<p>The ore body contains a section of material that contains pyritic black shale on the southern boundary. This material extends the length of the proposed pits and is approximately 14m thick.</p> <p>Pyritic black shale contains sulphide minerals that can react with air and water to produce acid drainage water. This can have impact on the environment through acidification of groundwater, release of heavy metals, contamination of ground and surface water and vegetation death.</p>	<p><u>Department of Conservation and Land Management (CALM)</u></p> <ul style="list-style-type: none"> • HI has identified a section of pyritic black shale on the southern boundary. • Not anticipated to be mined or exposed, but concerned with lack of monitoring to determine short and long term effectiveness to encapsulated acid rock waste dumps. • Recommends HI investigate a long term monitoring program aimed at determining the effectiveness of acid rock drainage management techniques. <p><u>Department of Environment (DoE)</u></p> <ul style="list-style-type: none"> • Acid Rock Drainage has been identified as unlikely but possible. 	<p>It is not intended that this material will be mined or exposed during the mining operations. In the event this material is unearthed, HI has developed a Black Shale Management Plan to address the issue. Additionally, HI will adopt the principals of this plan for the BS4 project and address acid rock drainage in the Construction and Operational Environmental Management Plans.</p> <p>Factor does not require further EPA evaluation.</p>
<p>Weeds, Stock & Fire</p>	<p>Six (6) species of introduced flora occur within the project area and mostly inhabit ephemeral creek lines.</p> <p>Also evidence of degradation of native vegetation from grazing and trampling by stock. The area has historically been used for agricultural purposes.</p>	<p><u>Department of Conservation and Land Management (CALM)</u></p> <ul style="list-style-type: none"> • Supports the eradication of <i>Acetosa vesicaria</i> in the protected area. • Prefers a separate Weed Hygiene Management Plan prior to the construction phase of the project. 	<p>This issue will be addressed through the EMP's for the BS4 site. Control measures will be developed in consultation with CALM and implemented to prevent the spread and introduction of weeds into the project area. Additionally HI intends to eradicate the population of Ruby Dock (<i>Acetosa</i></p>

	<p>Fire is a natural process that occurs within the area from lightning strikes. Some ecosystems are particularly sensitive to changed fire regimes.</p>		<p><i>vesicaria</i>) within the project area.</p> <p>Factor does not require further EPA evaluation.</p>
Waste materials	<p>Approximately 415 Mt of overburden and waste rock will be removed and stockpiled during mining. If the waste dumps are not appropriately engineered, unstable landforms can result.</p> <p>Wastewater and sewage will be generated from the camp, plant and mine operations buildings. There is potential for wastewater to contaminate ground and surface water and for nutrient enriched water to negatively impact native vegetation.</p> <p>Hazardous substance stored or disposed incorrectly can potentially contaminate ground and surface water plus negatively impact flora and fauna.</p>	No comments received	<p>Overburden and waste rock will be used to progressively backfill mine voids to above to water table as space becomes free. However, some material will need to be stored external to the pits in waste dumps. Waste dumps will be purpose built to industry standards and contoured to blend with the surrounding environment.</p> <p>A Waste Management Plan has been developed for all HI sites and the principles will be applied to waste management on the BS4 site. The plan incorporates the reduce, reuse, recycle principle.</p> <p>All non-hazardous materials that cannot be reused or recycled will be disposed of to an on-site landfill. The landfill will be subject to approval by DoE and operated in accordance with Part V Regulations of EP Act 1986.</p> <p>Wastewater from the camp and mine operations buildings will be treated at an on-site package sewage treatment facility. The treated wastewater will be discharged via irrigation to the surrounds.</p> <p>Storage, handling and disposal of hazardous material will be incorporated into the EMP's for the BS4 project. Hydrocarbon and chemical waste will be removed from the site by a licensed contractor for disposal at a licensed facility.</p> <p>Factor does not require further EPA evaluation.</p>
Dust, Noise & Vibration	<p>Dust Dust will be generated from activities associated with construction and</p>	No comments received	<p>Dust will be addressed through the EMP's for the BS4 site. Management measures will include the standard measures such as</p>

	<p>operation of the mine. Dust has the potential to negatively impact on vegetation by blanketing foliage and reducing photosynthesis. In areas where dust generation is very high vegetation can be affected by repeated deposition of dust on foliage.</p> <p>The project area is located in an arid environment, which has a naturally high background dust level. No asbestiform fibres have been identified.</p> <p>Noise Activities associated with the construction and operation of the project have the potential to generate significant levels of noise.</p> <p>The project area is not located within close proximity to other dwellings. The nearest residence is a homestead 55km away, and the BS4 camp will be located approximately 10km away from the mine, 3km away from the airstrip and 2km away from the rail spur. No sensitive environments or animals have been identified within the project area or surrounds.</p> <p>Vibration Activities associated with the project have the potential to cause vibration. No dwellings or structures are located within close proximity to the mine. No sensitive environments or animals have been identified within the project area.</p>		<p>maintaining moisture content of ore in the processing plant and use of water carts on haul roads etc.</p> <p>Noise will be addressed through the EMP's for the BS4 site. Noise levels are required to be in compliance with <i>Environmental Protection (Noise) Regulations 1997</i>. This will be achieved through sufficient distance between areas of high noise and dwellings. Workers within the primary crusher area will be required to wear Personal Protective Equipment.</p> <p>Vibration will be addressed through the EMP's for the BS4 site. This will be achieved through sufficient distance between areas of vibration and dwellings.</p> <p>Factor does not require further EPA evaluation.</p>
Greenhouse gases	<p>Carbon Dioxide (CO₂) will be the only significant green house gas emission from the proposed activities. CO₂ will be produced by:</p> <ul style="list-style-type: none"> • Decomposition of cleared vegetation • Decomposition of putrescible solid waste • Combustion of diesel fuel in 	No comments received	<p>At the predicted emission levels this project will be a minimal contributor to State greenhouse gas emissions. Minimisation of greenhouse gases will be further considered during project design and operation by:</p> <ul style="list-style-type: none"> • Investigating alternative fuel options • Utilising energy efficient

	<p>vehicles</p> <ul style="list-style-type: none"> • Combustion of gas at the Dampier Power Station • Detonation of explosives <p>The BS4 project is predicted to generate approximately 111.8 kt CO₂ per annum.</p>		<p>technology</p> <ul style="list-style-type: none"> • Minimisation of land clearing where practicable • Minimise putrescible waste generation <p>Factor does not require further EPA evaluation.</p>
SOCIAL SURROUNDINGS			
<p>Infrastructure alignment</p>	<p>Rail spur A new rail spur will be constructed to transport ore past Brockman 2 to the Rosella Siding, then along the main line through to the port facilities at either Dampier or Cape Lambert. This will be achieved by extending the existing railhead at Brockman 2 south-west along the north-west perimeter of the Brockman Syncline, then cross over the ranges and continue in a south easterly direction towards the BS4 mine site, culminating in a load-out loop (a distance of 35 km including the load-out loop). The spur line will be located within close proximity to several ephemeral drainage lines.</p> <p>Power supply line A 66 kV sub-transmission network will be installed to supply power to the BS4 mine site from a new substation to be located approximately 12 km north-east of the Brockman 2 mine.</p> <p>Water supply pipeline The Boolgeeda borefield is located adjacent to the rail spur. The proposed Boolgeeda borefield will comprise up to eight production bores and two backup bores. The pipeline will supply water to the mine for construction and dust suppression from approximately year 5-6.</p>	<p><u>Department of Conservation and Land Management (CALM)</u></p> <ul style="list-style-type: none"> • Did proponent investigate alternate alignments for the proposed? • There appears to be more opportunity to limit ground disturbance by aligning rail, water pipeline, power lines and road along the same route. • CALM will need to review the detailed searches for Declared Rare Flora (DRF) and Priority species prior to commenting on the proposed infrastructure alignment. 	<p>The rail alignment has been largely dictated by the ruling grade and drainage requirements of the surrounding environment. Several alternate routes were investigated, however the final choice was deemed to being the best option environmentally and from an engineering aspect.</p> <p>The power supply line and water supply line have been approximately aligned to follow the rail spur route in an attempt to minimise the width of the infrastructure corridor.</p> <p>During the construction period the existing access road between Brockman 2 and BS4 will be upgraded and used during the construction of the rail spur, power supply and water supply lines. The White Quartz Road will be upgraded and used for access to the mining/processing area. After construction the rail spur access road will be used for line maintenance and inspection purposes, plus as a transport route between Brockman 2 and BS4. The White Quartz Road will become the main access route to the site.</p> <p>Factor does not require further EPA evaluation.</p>

	<p>Access roads Access to BS4 is currently via Brockman 2, which is accessed by an existing unsealed spur road from Hamersley Iron's Tom Price to Dampier Rail Access Road (proposed rail spur route). The BS4 Project area can also be accessed from Tom Price along the White Quartz Road.</p>		
Mine footprint	<p>The need for multiple grade stockpiles and waste dumps has increased the size of the mine footprint</p> <p>A reserve of approximately 600 Mt of high quality ore has been identified.</p> <p>Approximately 700 Mt of waste material will be moved over the life of the deposit, however approximately 285 Mt (40%) of this is low grade ore, which will be stockpiled separately to the waste rock material. This ore may be processed in the future.</p> <p>The remaining waste rock (415 Mt) will be used to progressively backfill mine voids as they become available. Of this approximately 265 Mt (64%) will be stockpiled external to the pits in waste dumps.</p>	No comments received	<p>HI has committed to progressively backfill mine voids as they become available in an attempt to reduce the size of the mine footprint as operations expand at the site. Additionally, the extent and location of the waste dumps and ore stockpiles is still subject to further detailed mine planning that will aim to consolidate the mine footprint.</p> <p>It is proposed that the majority of the waste dumps and stockpiles will be located on the northern side of the pits. This will keep waste and low grade ore closer to the other mine infrastructure should this material be needed for future processing and or/works. This will also aid in minimising the mine footprint.</p> <p>Factor does not require further EPA evaluation.</p>
Indigenous heritage	<p>Two indigenous groups have native title claims within the BS4 project area. The western portion is held by the Puutu Kuntj Kuurrama and Pinikura people and the remainder is held by the Eastern Guruma people.</p> <p>Previous heritage surveys have identified 27 archeological sites.</p> <p>Some sites will be disturbed in order for the BS4 project to proceed, however two (2) sites of significance located along</p>	<p><u>Department of Indigenous Affairs (DIA)</u></p> <ul style="list-style-type: none"> • 27 archeological sites have been identified within the Brockman Syncline 4 Iron Ore Project area. • Prefer that Aboriginal sites be avoided during development related activities. 	<p>None of the 27 sites have been determined to be sacred. HI will avoid disturbance of Indigenous heritage sites wherever possible. For areas where disturbance of sites is unavoidable HI will apply for clearance from the Minister for Indigenous Affairs under the <i>Aboriginal Heritage Act 1972</i> prior to commencement of any construction activities.</p> <p>Factor does not require further EPA evaluation.</p>

Visual amenity	<p>White Quartz Road will not be affected.</p> <p>The visual amenity of the site will be interrupted by the project. Open pits, waste dumps, stockpiles and industrial infrastructure will all diminish the aesthetics of the surrounding area.</p>	No comments received	<p>Not a significant issue as the project site is not near:</p> <ul style="list-style-type: none"> • National parks • Tourist routes • Towns • Homesteads/ Stations • Significant Indigenous heritage areas • European heritage areas <p>Factor does not require further EPA evaluation.</p>
OTHER			
Mine rehabilitation and closure	<p>The BS4 Project will disturb approximately 2,470 ha of land over a 30 year period.</p> <p>The EPA objective is to ensure, as far as practicable, that rehabilitation achieves a stable and functioning landform consistent with the surrounding landscape and other environmental values.</p>	<p><u>Department of Environment (DoE)</u></p> <ul style="list-style-type: none"> • An additional objective may be required to ensure a similar diversity and quality of habitats exists after rehabilitation. • As in pre-mining surveys, data needs to be evaluated in context of its likely uses. • Additional site specific surveys may be required for local species list used for re-vegetation. It is also recommended that floristic surveys analysis data from adjacent plots or transects is used to determine species turn over within vegetation types that will require re-vegetation. <p><u>Department of Conservation and Land Management (CALM)</u></p> <ul style="list-style-type: none"> • Supports Hamersley Iron’s planned research into re-establishment of Priority species in rehabilitated areas. • Supports HI’s planned closure and rehabilitation of the existing track through the <i>Ptilotus</i> sp. “Brockman” population and associated P11 vegetation community. <p><u>Public</u></p> <ul style="list-style-type: none"> • Disagree with HI’s Closure Assumption that all open pits and final voids do not require rehabilitation. • Disagree with HI’s proposal to have all closure activities (except monitoring) completed within 2 years of cessation of operations. Five (5) years is a more appropriate timeframe to complete rehabilitation works. 	<p>Considered to be a relevant environmental factor and is discussed under the factor of “Mine rehabilitation and closure”.</p>
Offsets	The proposal will cause permanent changes to the landscape due to mining on the site. The surface topography,	<p><u>Department of Environment (DoE)</u></p> <ul style="list-style-type: none"> • The proposed offsets concern the mitigation of impacts on certain species 	It has been determined that it is unlikely the project will result in a reduction in conservation status of significant species

	<p>vegetation and drainage lines will all be impacted by excavation and clearing.</p> <p>Approximately 2,470 ha of land will be in some way affected over the life of the project, including:</p> <ul style="list-style-type: none"> • 949 ha (38%) of mine pits • 529 ha (21%) of waste dumps • 264 ha (11%) of ore stockpiles • 300 ha (12%) of rail spur, embankments etc 	<p>(priority species, <i>Rhagada</i> sp “Mt Brockman” and stygofauna).</p> <p><u>Department of Conservation and Land Management (CALM)</u></p> <ul style="list-style-type: none"> • Supports the recommendations made by Biota that HI should conduct further research into flora species genetics and geographical distribution. • Supports further genetic research planned by HI to assist in resolving the taxonomy and distribution of the <i>Rhagada</i> sp. “Mt Brockman”. 	<p>within the project area.</p> <p>In accordance with EPA Position Statement No. 9:</p> <p>Avoid</p> <ul style="list-style-type: none"> • Priority 1 flora <p>Minimise</p> <ul style="list-style-type: none"> • Disturbance footprint • Waste generation • Greenhouse gases <p>Rectify</p> <ul style="list-style-type: none"> • Progressive and sustainable rehabilitation of disturbed areas. <p>Reduce</p> <ul style="list-style-type: none"> • Risk to Priority 1 population <p>Factor does not require further EPA evaluation.</p>
--	--	---	---

PRINCIPLES		
Principle	Relevant Yes/No	If yes, Consideration
1. The precautionary principle		
<p>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. In application of this precautionary principle, decisions should be guided by –</p> <ul style="list-style-type: none"> • careful evaluation to avoid, where practicable, serious or irreversible damage to the environment; and • an assessment of the risk-weighted consequences of various options. 	Yes	<p>In considering this principle, the EPA notes that:</p> <ul style="list-style-type: none"> • the loss of Priority flora associated with this proposal is unavoidable • the proponent has avoided flora populations of high conservation significance • the proponent has made all practical efforts to minimise clearing • the proponent has made commitments to fund further research into resolving the taxonomic status of poorly known species at the site
2. The principle of intergenerational equity		
<p>The present generation should ensure that the health, diversity and productivity of the environment is maintained and enhanced for the benefit of future generations.</p>	Yes	<p>In considering this principle, the EPA notes that:</p> <ul style="list-style-type: none"> • the proponent has agreed to ensuring efficient energy use • the proponent has agreed to minimise waste generation by encouraging

		<p>reuse, recycling and reduction of products.</p> <ul style="list-style-type: none"> • the proponent will be utilising mine dewater for processing and dust suppression thereby having no need for discharge. • the proponent will contribute to economic development in the Pilbara
3. The principle of the conservation of biological diversity and ecological integrity		
Conservation of biological diversity and ecological integrity should be a fundamental consideration.	Yes	<p>In considering this principle, the EPA notes that:</p> <ul style="list-style-type: none"> • none of the habitat types present in the project area are unique to the study area or are regionally significant • the conservation status of any Priority flora or Priority or Scheduled fauna will not be affected at a regional or sub-regional scale as a result of HI's proposal • the area of Priority 1 flora is to be protected • a third round of stygofauna surveying will be carried out prior to construction and groundwater abstraction

Appendix 4

Recommended Environmental Conditions and Proponent's Consolidated Commitments

RECOMMENDED CONDITIONS AND PROCEDURES

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

BROCKMAN SYNCLINE 4 IRON ORE PROJECT
60 km west-north-west of Tom Price
Shire of Ashburton

Proposal: Three open pits, dry processing plant, associated iron ore mine infrastructure and an extension to the Brockman 2 rail spur in the Central Pilbara area, as documented in schedule 1 of this statement.

Proponent: Hamersley Iron Pty Limited

Proponent Address: GPO Box A42 Perth, WA 6837

Assessment Number: 1543

Report of the Environmental Protection Authority: Bulletin 1214

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

1 Proposal Description

1-1 The proponent shall implement the proposal as documented and described in schedule 1 of this statement subject to the conditions and procedures of this statement.

2 Proponent Environmental Management Commitments

2-1 The proponent shall fulfil the environmental management commitments contained in schedule 2 of this statement.

3 Proponent Nomination and Contact Details

3-1 The proponent for the time being nominated by the Minister for the Environment under section 38(6) or (7) of the *Environmental Protection Act 1986* is responsible for the implementation of the proposal until such time as the Minister for the Environment has exercised the Minister's power under section 38(7) of the Act to revoke the nomination of that proponent and nominate another person as the proponent for the proposal.

- 3-2 If the proponent wishes to relinquish the nomination, the proponent shall apply for the transfer of proponent under section 38(6a) and provide the name and address of the person who will assume responsibility for the proposal, together with a letter from that person which states that the proposal will be carried out in accordance with the conditions and procedures of this statement, and documentation on the capability of that person to implement the proposal and fulfil the conditions and procedures.
- 3-3 The nominated proponent shall notify the Department of Environment of any change of the name and address of the proponent within 30 days of such change.

4 Time Limit of Approval to Commence

- 4-1 The proponent shall provide evidence to the Department of Environment that the proposal has been substantially commenced within five years from the date of this statement or the approval granted in this statement shall lapse and be void.
- 4-2 The proponent shall make an application for any extension of approval for the substantial commencement of the proposal to the Minister for Environment prior to the expiration date of this statement, which shall demonstrate that:
1. the environmental factors of the proposal reported in Bulletin 1214 have not changed significantly;
 2. new, significant, environmental factors have not arisen; and
 3. all relevant government authorities and stakeholders have been consulted.

5 Compliance Reporting

- 5-1 The proponent shall submit compliance reports in accordance with a schedule approved by the Department of Environment and with the compliance monitoring guidelines, and shall:
1. describe, or update, the state of implementation of the proposal;
 2. provide verifiable evidence of compliance with the conditions, procedures and commitments;
 3. review the effectiveness of corrective and preventative actions contained in the environmental management plans and programs;
 4. provide verifiable evidence of the fulfilment of requirements specified in the environmental management plans and programs;
 5. identify all confirmed non-conformities and non-compliances and describe the related corrective and preventative actions taken; and
 6. identify potential non-conformities and non-compliances and provide evidence of how these are being assessed for corrective action.

6 Performance Review

- 6-1 The proponent shall submit a Performance Review Report every six years after the start of production to the Environmental Protection Authority, which addresses:
1. the major environmental issues associated with implementing the project; the environmental objectives for those issues; the methodologies used to achieve these; and the key indicators of environmental performance measured against those objectives;

2. the level of progress in the achievement of sound environmental performance, including industry benchmarking, and the use of best available technology where practicable;
3. significant improvements gained in environmental management, including the use of external peer reviews;
4. stakeholder and community consultation about environmental performance and the outcomes of that consultation, including a report of any on-going concerns being expressed; and
5. the proposed environmental objectives over the next six years, including improvements in technology and management processes.

7 Vegetation

7-1 Prior to commencement of ground disturbance, the proponent shall carry out a wet season flora survey to determine the number and distribution of identifiable Declared Rare, Priority and significant flora species which may be impacted by the proposed activities, to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority and Department of the Conservation and Land Management.

7-2 In the event that any Declared Rare, Priority or significant flora species are recorded during the staged pre-land clearing surveys required by condition 7-1, the proponent shall prepare a Flora Management Plan in accordance with requirements of the Minister for the Environment on advice of the Environmental Protection Authority and the Department of Conservation and Land Management.

The objective of this Plan is to maintain the abundance, diversity, geographic distribution, conservation status and productivity of Declared Rare, Priority and significant flora species and ecosystem levels through the avoidance or management of adverse impacts and improvement in knowledge.

This Plan shall describe the significant, identified species of Declared Rare, Priority and significant flora, and describe significant vegetation associations and habitat areas along the rail spur and infrastructure corridor routes, and shall set out procedures to:

1. demarcate identified populations and/or individuals of conservation-significant species of flora and vegetation associations and habitat areas;
2. modify land clearing plans and evaluate alternative mine plans, to minimise or avoid impacts on the conservation-significant, identified species of flora and vegetation associations and habitat areas;
3. minimise impacts where proposed mining activities are likely to impact on flora, vegetation associations and habitat areas of conservation significance, and demonstrate that such impacts have been minimised;
4. monitor and record impacts on conservation-significant, identified species of flora and vegetation associations and habitat areas; and
5. implement appropriate contingency measures where impacts on conservation-significant, identified species of flora and vegetation associations and habitat areas are identified.

- 7-3 The proponent shall review and revise the Flora Management Plan required under condition 7-2 at intervals not exceeding four years.
- 7-4 The proponent shall implement the Flora Management Plan required under condition 7-2 and subsequent revisions required by condition 7-3.
- 7-5 The proponent shall make the Flora Management Plan required by condition 7-2 and subsequent revisions required by condition 7-3 publicly available.

Note: In the preparation of advice to the Minister for the Environment, the Environmental Protection Authority expects the proponent to obtain the advice of the Department of Conservation and Land Management.

8 Land Snails

- 8-1 Prior to the commencement of mining activities, the proponent shall prepare a Snail Management Plan which:
1. provides protection to the genetically distinct *Rhagada* sp. “Mt Brockman” snail population and the *Triodia* under Mulga vegetation community and drainage features which support it at survey site BROMD from impacts of the development/activities by locating the pipeline along an alternate track on the north of BROMD; and
 2. monitor the *Rhagada* sp “Mt Brockman” population at survey site BROMD to ensure that the development/activities do not adversely impact the population.
- 8-2 The proponent shall implement the Snail Management Plan as required by condition 8-1.
- 8-3 The proponent shall make the Snail Management Plan as required by condition 8-1 publicly available.
- 8-4 The proponent shall submit results of the Snail Management Plan to the Environmental Protection Authority, The Department of Conservation and Land Management and the Western Australian Museum.

9 Groundwater

- 9-1 The proponent shall complete all hydrogeological investigations, conducted in consultation with the Water and Rivers Commission, by the end of the fifth operational year of the Brockman Syncline 4 mine.
- 9-2 Within 3 months following completion of the hydrogeological investigations required by condition 9-1, the proponent shall sub the result to the Department of Environment.

10 Mine Rehabilitation and Closure

- 10-1 The proponent shall rehabilitate and decommission the project areas in accordance with the Preliminary Rehabilitation and Closure Management Plan in the Public Environmental Review document (Appendix G HI, 2005), or subsequent revisions of the Plan.

Note: In the preparation of advice to the Minister for the Environment, the Environmental Protection Authority expects the proponent to obtain the advice of the, Department of Industry and Resources, Department of Conservation and Land Management and the Water and Rivers Commission.

10-2 The proponent shall review and revise the Preliminary Rehabilitation and Closure Management Plan at intervals not exceeding five years, with the first revision due within five years of commissioning of the mine.

The objective of this plan is to ensure that closure planning and rehabilitation are carried out in a coordinated, progressive manner and are integrated with development planning, consistent with the Australian and New Zealand Minerals and Energy Council and the Minerals Council of Australia - *Strategic Framework for Mine Closure* (2000), current best practice, and the agreed land uses.

Each revision of the Preliminary Rehabilitation and Closure Management Plan shall set out procedures and measures to:

1. manage over the long term ground and surface water systems affected by the open pits and waste rock dumps;
2. progressively rehabilitate all disturbed mine and infrastructure corridor areas to stable landforms with cover of resilient, self-sustaining vegetation comprised of local provenance species as established by measurable criteria based on site survey data;
3. backfill the pits to minimise impacts on groundwater quality, subterranean fauna and surface drainage patterns, and to encourage appropriate revegetation;
4. identify contaminated areas, including provision of evidence of notification and propose management measures to relevant statutory authorities; and
5. develop management strategies and/or contingency measures in the event that operational experience and/or monitoring indicate that a closure objective is unlikely to be achieved.

10-3 The proponent shall make revisions of the Preliminary Rehabilitation and Closure Management Plan required by condition 10-2 publicly available.

Notes

1. Where a condition states "on advice of the Environmental Protection Authority", the Environmental Protection Authority will provide that advice to the Department of Environment for the preparation of written notice to the proponent.
2. The Environmental Protection Authority may seek advice from other agencies or organisations, as required, in order to provide its advice to the Department of Environment.
3. The Minister for the Environment will determine any dispute between the proponent and the Environmental Protection Authority or the Department of Environment over the fulfilment of the requirements of the conditions.
4. 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*.

The Proposal (Assessment No. 1543)

The proposal is to construct and operate an open-cut iron ore mine in the Central Pilbara, approximately 60 km west-north-west of Tom Price and 25 km south-west of the existing Brockman 2 mine, as shown in Figure 1 (attached). The project footprint will disturb approximately 2 470 ha of native vegetation, as shown in Figure 2 (attached). The processing plant will produce a nominal capacity of 20 Mt/pa of ore.

The proposal also includes:

- three new mine pits;
- a dry processing plant;
- associated mine infrastructure;
- an extension to the existing Brockman 2 rail spur; and
- a power transmission line.

The main characteristics of the proposal are summarised in Table 1 below.

Abbreviations:

e – equivalent

Fe – iron

ha – hectare

km – kilometre

kL/d – kilolitres per day

kV – kilo volts

m – metres

Mt – mega tonnes

Mt/pa – mega tonnes per annum

MW – mega watts

Table 1: Key proposal characteristics (Assessment No. 1543)

Element	Description
General	
Project life	Estimated 30 years
Area of disturbance	Approximately 2,470 ha
Potential ore reserves	600 Mt high-grade (>60% Fe) 280 Mt low-grade (>50% Fe)
Mining rate	Minimum 20 Mt/pa
Waste rock	420 Mt (approx 150 Mt of which will be used to backfill pits)
Green house gas emissions	5.59 kg CO _{2e} (per tonne of production per annum)
Mine and mining	
Pits and ore type	Three pits with high phosphorus Brockman ore. The deposit extends approximately 14 km in length, is 1 km wide and averages 150 m deep.

Element	Description
Ore below water table	Approximately 20 % of total ore (variable between each pit)
Stripping ratio	Ranges from 0.5:1 to 1.5:1 waste to ore depending on processing and stockpile strategies (average 1.2:1)
Waste rock disposal	Surface dumps until mined out pit voids become available, then backfilled to above pre-mine water table
Dewatering	
	Dewatering required to access ore from below the water table.
Infrastructure	
Water Supply	6,200 kL/d (plus additional 300 kL/d for the mine camp). Supplied from the Orebody and Wittenoom Dolomite aquifers. Boolgeeda borefield as an additional source via pipeline along infrastructure corridor.
Power Supply	13.5 MW supplied from the Dampier – Tom Price 220 kV transmission system via a 66 kV sub-transmission system. Power lines will approach the mine within the infrastructure corridor.
Processing Plant	A dry plant with a crushing and screening circuit for 20 Mt/pa of ore.
Product transport	By rail via a 35 km long rail spur from the project area to Brockman 2 mine then along the existing Brockman 2 rail spur and main railway to port.
Airstrip	Approximately 2 000 m airstrip
Workforce	
Construction Operation	Peak of 700 300 (plus approximately 40 during periodic shutdown maintenance periods).
Accommodation	A permanent village and contractor's camp, plus small rail spur camps.

Figures (attached)

Figure 1 - Site location

Figure 2 - Site layout

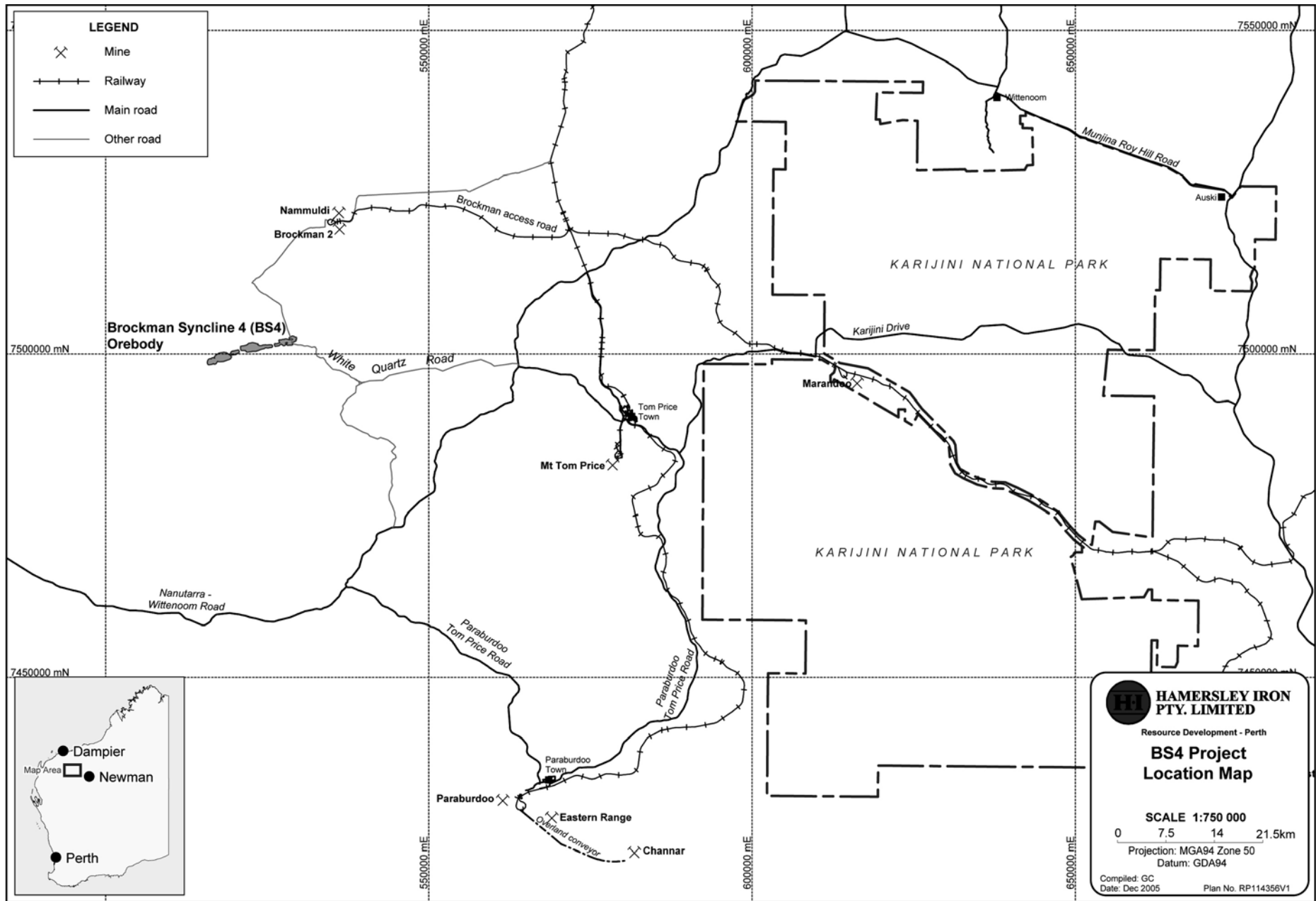


Figure 1: Site location of BS4 project area

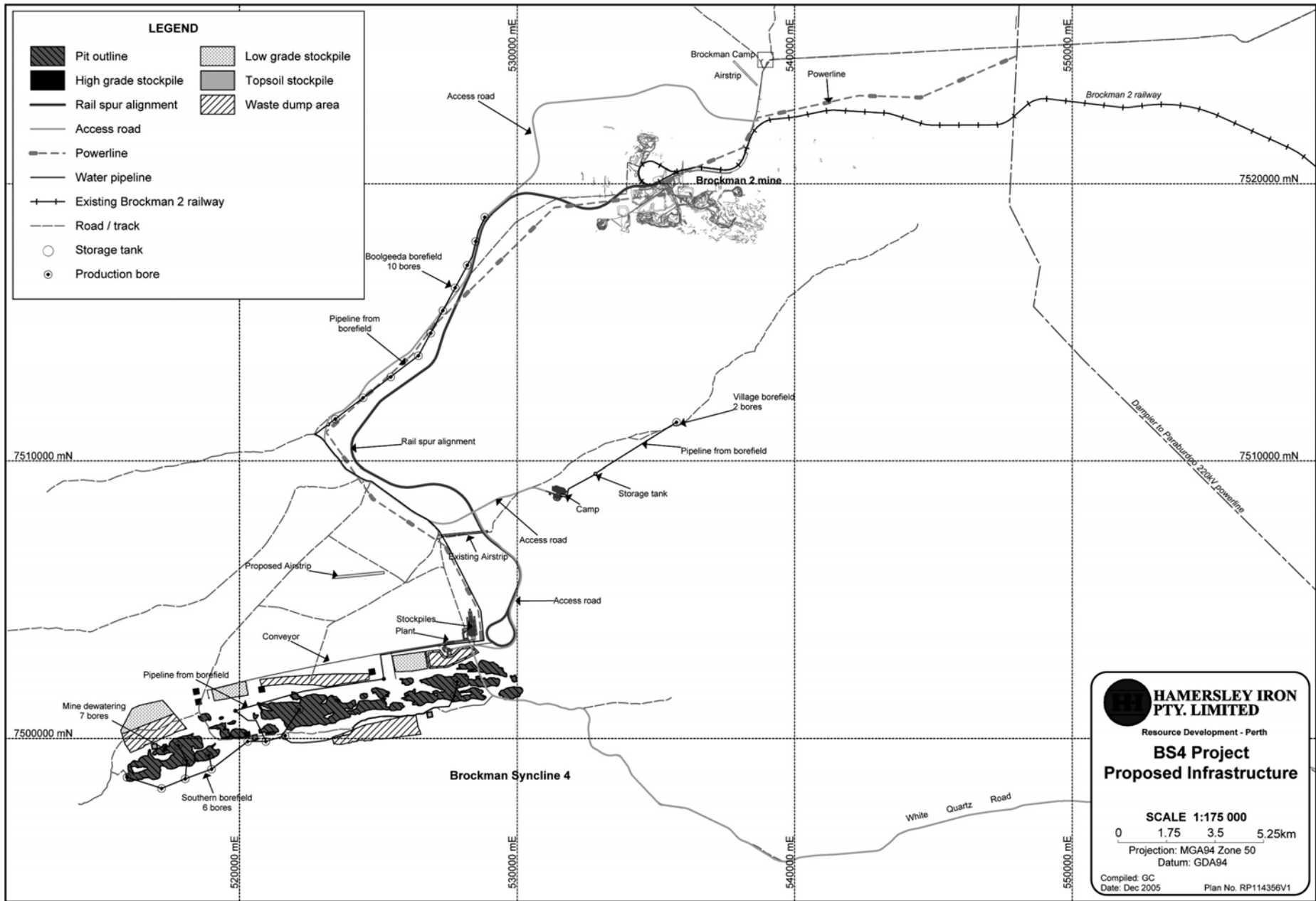


Figure 2: Site layout of BS4 mine

Proponent Environmental Management Commitments

January 2006

**BROCKMAN SYNCLINE 4 IRON ORE
PROJECT**

60 km west-north-west of Tom Price
(Assessment No. 1543)

HAMERSLEY IRON PTY LIMITED

Proponent Environmental Management Commitments (Assessment No. 1543)

Topic	Objective	Commitments	Timing	Advice
Environmental Management Plan (EMP)	Manage environmental impacts of the BS4 Project.	<ol style="list-style-type: none"> 1. Prepare separate EMP's for construction and operation of the BS4 Project that addresses relevant environmental issues for the Project, including: <ul style="list-style-type: none"> ▪ Flora (including Priority sp.); ▪ Fauna (including stygofauna); ▪ Weeds; ▪ Topsoil; ▪ Fire; ▪ Dust; ▪ Noise; ▪ Waste (non-mineral and mineralised waste); ▪ Hydrocarbons; ▪ Water (surface and groundwater); ▪ Acid rock drainage; ▪ Greenhouse gases; ▪ Rehabilitation; ▪ Aboriginal heritage; and ▪ Monitoring, reporting and auditing processes 	Prior to construction and operation.	CALM
Priority Flora	Re-establishment of Priority flora species in rehabilitation areas.	<ol style="list-style-type: none"> 2. Collect seed from existing Priority flora species in the BS4 project area for use in rehabilitation to re-establish Priority flora species. 3. Conduct research into the re-establishment of Priority flora species in rehabilitation areas. 	During operations	CALM

Topic	Objective	Commitments	Timing	Advice
Land Snails	Gain further information on the distribution and population diversity of land snails found in the Project area.	4. Fund a taxonomic, biogeographic and genetic study on <i>Rhagada</i> sp. land snails found in the BS4 Project area.	Within six months of commissioning.	CALM
Stygofauna	Identify and manage any subterranean fauna found within the BS4 project area.	5. Install sampling bores, incorporating slotted casing suitable for stygofauna sampling at alluvial creek systems in the valley north of the BS4 area (ie. Proposed Boolgeeda borefield). 6. In the event that results from sampling of the bores referred to in Commitment 4 indicate that stygofauna will be impacted by the BS4 project, prepare a Subterranean Fauna Management Plan. 7. Make the plan prepared in Commitment 6 publicly available.	Prior to ground disturbance.	CALM
Stygofauna	Sampling and study.	8. Incorporate the BS4 Project into the Hamersley iron stygofauna research program. 9. Collate results of the BS4 stygofauna sampling with other studies on the distribution and ecology of Pilbara stygofauna by BHP Billiton Iron Ore and Western Australian Museum.	During operations phase.	
Groundwater Quality	Prevent the formation of pit lakes derived from groundwater.	10. Backfill mined out pits to above pre-mine water table levels.	Ongoing during operations phase, closure and decommissioning.	DoIR

Topic	Objective	Commitments	Timing	Advice
Groundwater Resources	Sustainable management of borefields.	<p>11. Prepare a Borefield Management Plan incorporating a Water Operating Strategy that includes a monitoring program.</p> <p>12. Make the plan prepared under Commitment 9 publicly available.</p>	Prior to groundwater abstraction.	WRC
Rail Spur Drainage	Ensure rail spur drainage design appropriate.	13. Consult with CALM on detailed design plans for rail spur drainage.	Prior to construction.	CALM
Aboriginal Heritage	Protect/manage Aboriginal heritage sites in accordance with the Aboriginal Heritage Act 1972.	14. Complete Aboriginal heritage surveys of all areas not yet surveyed within the BS4 Project area, and avoid any Aboriginal heritage sites identified where practicable.	Pre-construction.	Aboriginal Groups, DIA

CALM – Department of Conservation and Land Management; DoIR – Department of Industry and Resources; DIA – Department of Indigenous Affairs; WRC – Water and Rivers Commission

Appendix 5

Summary of Submissions and Proponent's Response to Submissions

Brockman Syncline 4 Iron Ore Project, Public Environmental Review Proponent's Response to Submissions¹

October 2005

1. Infrastructure Alignment

1.1 The Department of Conservation and Land Management (CALM) is uncertain whether Hamersley Iron investigated alternative alignments for the proposed infrastructure to minimize impacts to conservation values. The only noted justification for the rail spur alignment between Brockman 2 and 4 is related to ruling grade and drainage requirements (p. 31 of the BS4 Project Public Environmental Review (PER)). Moreover, there appears to be further opportunity to limit ground disturbance impacts by aligning the rail, water pipeline, road, and power lines, along the same route (see Figure 3a of PER). Additionally, CALM needs to review detailed searches for Declared Rare Flora (DRF) and Priority species currently being conducted by 'Biota' (p. 45 of PER) before commenting on the proposed infrastructure alignment.

Hamersley Iron should demonstrate that the selected rail spur, water pipeline, road, and power line infrastructure alignments are the most suitable from an environmental perspective. The final rail spur, water pipeline, road, and power lines infrastructure routes should be determined in consultation with CALM.

Hamersley Iron will liaise with CALM during the detailed design of the BS4 Project infrastructure corridor for the rail spur, water pipeline, and road and power line infrastructure routes.

2. Vegetation and Flora

2.1 There appear to be discrepancies between Table 4-5 and Table 4-8 of the PER concerning uncommon plant community types, in particular H2 and H12. The conservation significance of these plant communities needs to be resolved in a regional context.

Hamersley Iron has checked Tables 4-5 and 4-8 and did not find any discrepancies. These tables respectively describe vegetation types of conservation significance and fauna habitat types, and the information presented is not necessarily related. As discussed in Section 4.8.4 of the PER, the conservation significance of the vegetation types identified in BS4 Project area, including H2 and H12, has been determined, and a second PATN analysis will clarify the floristic groups.

2.2 Hamersley Iron proposes to "strategically fence off" the population of Ptilotus sp Brockman (located on the southern edge of the proposed pit, as shown on Figure 15 of PER) "to preclude direct physical impact". This population needs to be monitored, and the research conducted as mentioned in the last dot point of Section 7.2.3 of PER. This all needs to be covered in a publicly available Environmental Management Plan (EMP). The actions need to be auditable. (Wildflower Society)

Hamersley Iron will monitor this population of *Ptilotus* sp Brockman within the BS4 Project area, and will conduct the research mentioned in the PER. Detailed, auditable actions for monitoring and research on this species will be included within the EMP.

¹ Note: The submissions are shown in *italics*, and Hamersley Iron's responses to the submission are in normal font.

2.3 The Wildflower Society would be interested in seeing aspects of the BS4 Project Environmental Management Plan as part of the targeted stakeholder review.

Hamersley Iron will provide the Wildflower Society with a copy of the draft BS4 Project EMP as part of the targeted stakeholder review.

2.4 The occurrence of the Priority 1 Ptilotus sp 'Brockman' within the Project area requires significant consideration in the environmental assessment and decision-making process. This species is presently undescribed and its conservation status is not fully understood. The 31 records of the species to the south of the proposed mine pit may represent a significant population. The species may be subject to both direct disturbance and indirect impacts from dust, erosion and weeds. This species may warrant consideration for listing as DRF.

CALM believes it is critical that Hamersley Iron adequately demonstrate that its proposed operations will not significantly impact on the conservation status of this species. In support of the BS4 Project flora and vegetation report recommendations, Hamersley Iron should conduct further research into species genetics and geographical distribution.

Given the potential conservation significance of Ptilotus sp 'Brockman', it is recommended that Hamersley Iron develop a separate species management plan. This management plan should include, although not be limited to, the following:

- *a description of the species, including its occurrence and distribution in the region;*
- *outline the conservation status of the species;*
- *identification and assessment of predicted impacts (direct and indirect) to populations within the Project area;*
- *identification of management measures aimed at avoiding and/or minimizing impacts to populations within the Project area. For example, appropriately-sized buffers around plant species and populations;*
- *identification of requirements for further research;*
- *a monitoring program to detect any impacts to the species caused by mining, including contingency measures if impacts are detected; and,*
- *provisions for regular reporting to CALM and the Department of Environment (DoE).*

CALM recognizes and supports research planned by the proponent into the re-establishment of Priority species in rehabilitated areas, particularly Ptilotus sp 'Brockman'. Additionally, the planned closure and rehabilitation of the existing access track through the Ptilotus sp 'Brockman' population and associated P11 vegetation community is strongly supported.

It is recommended that Hamersley Iron conduct further research into this species genetics and geographical distribution. Furthermore, a separate management plan needs to be developed for Ptilotus sp 'Brockman'.

Hamersley Iron will conduct further research into the genetics and geographical distribution of *Ptilotus* sp Brockman. A comprehensive management plan will also be developed for this species within the Construction EMP and Operational EMP.

2.5 *A statement should be provided that the flora surveys are in accordance with EPA Guidance Statement 51.*

This statement is made on page 9 of the BS4 Project flora and vegetation survey report.

2.6 *A relatively high diversity of flora was detected (367 native plants), but it is likely to be underestimated due to sampling constraints. Consequently, additional surveys for Priority taxa and significant plant communities will be required in areas of disturbance.*

The botanical survey was generally conducted to a high standard, but occurred before the precise locations of disturbance were known. Further survey work is required to fully assess environmental impacts of flora and vegetation at this time.

As discussed at page 45 of the PER, Hamersley Iron intends to conduct additional flora surveys for the BS4 Project in October/November 2005. Once this work is finalised, Hamersley Iron will forward the resultant reports to the EPA Service Unit and CALM.

2.7 *As in other pre-mining surveys, the quality of data provided needs to be evaluated in context of its likely uses. Permanent monitoring plots for revegetation reference sites could be designated using the existing survey quadrats. However, plant structural diversity is likely to be higher than can be indicated by vegetation maps. Additional site-specific information may be required to produce local species lists for seeding or planting and to formulate completion criteria to assess the success of revegetation. It is also recommended that floristic surveys analyse data from adjacent plots or transects to determine rates of species turnover within vegetation types in areas to be revegetated.*

Hamersley Iron notes this advice, and will take this into consideration in the development of the rehabilitation and revegetation monitoring programme for the BS4 Project.

3. Weed Management

3.1 *CALM supports the eradication of *Acetosa vesicaria* (Ruby Dock) in the Project area. CALM would prefer that a separate Weed Hygiene Management Plan be developed prior to the construction phase.*

Hamersley Iron will develop a weed hygiene management plan prior to the construction phase as part of the Construction EMP.

4. Fauna

4.1 *Section 4.9 of the PER dealing with terrestrial vertebrate fauna is comprehensive and, given the approach of a two-season sampling, provides a comprehensive list of vertebrate taxa found in the area. Threatened and Priority species that occur or are likely to occur in the area are also considered. The Annotated list in Appendix E of the PER also provides suitable information on the links between species habitat selection and preferences. If the report were to be improved it could be appropriate to provide a species accumulation curve of sampled vertebrate fauna to allow an assessment of the thoroughness of the sampling regime based on the spring and autumn sampling. (WA Museum)*

Hamersley Iron notes this advice, and has forwarded it through to its consultant Biota Environmental Sciences for its information and consideration in further fauna assessment surveys.

4.2 Section 7.3 of the PER presents an evaluation of the Land Systems approach to impacts of habitat disturbance to faunal species populations. Three Systems are identified as being restrictive or having significant species populations – these are then determined not to be significantly impacted by environmental disturbance. The management of impacts outlined in Section 7.3.3 seem to be appropriate to the vertebrate faunal assemblage described. (WA Museum)

Hamersley Iron notes this advice.

4.3 The fauna survey report for the Project does not fully comply with EPA Position Statement No. 3, Terrestrial Biological Surveys as an Element of Biodiversity Protection, EPA Guidance Statement No. 56, Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia, and best practice as it is now described in the literature for terrestrial fauna surveys undertaken for the purposes of preparing environmental impact assessments. This is in particular in regard to the adequacy of survey protocols, data analysis, write-up and impact assessment. The report should also have been independently peer reviewed.

Hamersley Iron considers that the level/standard of fauna survey work and reporting carried out for the BS4 Project was appropriate for the Project location and proposed level of impact. Draft copies of the fauna report were submitted to relevant officers in the EPA Service Unit and CALM for their consideration and peer review, well in advance of the PER being released for public review. No adverse comments were subsequently received from these agencies with regard to the level of survey effort, data analysis and/or impact assessment detailed in the fauna report, or on the standard of reporting.

4.4 Fauna survey methodology and results are generally comprehensive but no statement appears to be made that surveys are in accordance with EPA requirements as provided in Guidance Statement 56 and this Guidance Statement is not listed in the References.

The BS4 Project fauna studies followed an approach and methodology in accordance with the requirements of EPA Guidance Statement No. 56.

4.5 CALM wishes to be advised of the WA Museum identification of the two millipede taxa found on 'White Quartz Road'.

Hamersley Iron will forward CALM the results of the WA Museum's identification of the two millipede taxa found on the White Quartz Road.

4.6 Have the unidentified millipede taxa (pg 56 of the PER) been collected in other areas in the Pilbara, or are they only known from the BS4 Project area?

The general state of taxonomic resolution of this group in the Pilbara is relatively poor. In addition, millipedes have historically not been subject to thorough collections at the regional scale to provide this level of context. It is therefore difficult to answer this question with the available data. The collected specimens have been lodged with the WA Museum to assist with ongoing efforts to improve this state of affairs in regards to taxonomic resolution.

4.7 Regarding Table 4.8 of the PER, it is noted that 75 % of total area of *Triodia* hilltops/Gorges mapped within the BS4 Project area will be impacted. How well is this habitat represented outside the Project area?

The BS4 Project fauna assessment identified that, within the BS4 Project area, the *Triodia* hilltops/Gorges habitat was “widespread and abundant”. The only context available for wider regional consideration is the Agriculture WA land systems mapping. This habitat types falls within the Newman land system ‘*Rugged jaspilite plateaux, ridges and mountains supporting hard spinifex grasslands*’. This is also one of the more widespread land systems in the Hamersley subregion and the entire Pilbara bioregion at 1,993,741 ha. Less than 1 % of this wider extent would be affected by the BS4 Project.

4.8 It is not clear whether the area of outcropping calcrete which is noted as “may be an important habitat to land snail taxa” (pg 57 of the PER) is shown on maps or whether this area will be impacted by the Project

The extent of the calcrete outcrop is shown in Figure 2.4 of the fauna survey report, i.e. pg 17 of Appendix E of the PER. In terms of wider context, the rangelands mapping for this unit corresponds to the ‘Table’ land system: ‘*Low calcrete plateaux*’. The fauna survey report identified that “*The Project area intersects one land system, the Table Land System, which appears to be relatively uncommon in the Pilbara. The Table Land System is characterised by calcareous soils or calcrete outcrops that may represent important habitat for land snails. The current mine plan does not show any development located in this area*” (pg 72 of the fauna survey report).

4.9 Have any of the unidentified mygalomorph spiders (pg 58 of the PER) been collected outside the BS4 Project area, or are the specimens collected on these surveys the only specimens in collections? A statement needs to be made how significant these short range endemic species are in the Project area.

The situation with the mygalomorph spiders from the Pilbara region is similar to the millipede fauna. However, the taxonomy of this group is even more poorly resolved, and the WA Museum does not currently have a unified reference collection for this group to enable this question to be answered. To address this, Biota has been collaborating with the WA Museum to develop a reference collection of mygalomorph spiders, including the specimens collected from the BS4 Project area. This ongoing work will include both morphological and genetic investigations, and should serve to provide context to allow the questions raised in this submission to be more thoroughly answered.

5. Stygofauna

5.1 It is likely that the operation will have a serious impact upon any stygofauna that may occur in the water tables. The proposed draw-down may lower water levels. It is imperative that a comprehensive stygofauna survey is completed prior to approval. (WA Museum)

5.2 If the stygofauna sampling programme determines that species found within the BS4 Project area are of conservation significance, how will decisions be made to avoid impacts on them? A comprehensive stygofauna survey should be conducted as part of the environmental assessment before approval of the Project. What provisions are being considered to avoid water drawdown on any significant stygofauna species?

As described in Section 7.4.2 of the PER, Hamersley Iron has completed two comprehensive stygofauna surveys of the BS4 Project area. These surveys recorded only a single bathynellid specimen. A review of geological formations in the Project area also suggested that the formations in the central impact area are unlikely to support stygofauna. As a final check for stygofauna, Hamersley Iron has committed to conducting a third phase of sampling prior to any dewatering commencing for the BS4 Project. Based on these results, Hamersley Iron considers that the BS4 Project is unlikely to have a serious impact on stygofauna either at a local or regional level.

Hamersley Iron, and its consultant Biota Environmental Sciences, has liaised with the CALM stygofauna specialist, Dr Stuart Halse, to keep him fully informed on the stygofauna survey methodology and results, and discussed and reached agreement on the need for further sampling.

In the unlikely event that stygofauna are identified within the BS4 Project area during the third phase of sampling, Hamersley Iron will determine, in consultation with CALM, the potential impact of the BS4 Project on stygofauna, and what management options are available to avoid and/or minimise the Project's impact to this stygofauna.

6. Water Supply and Borefields

Comments from DoE North West Region (NWR) Office

6.1 The Proponent would need to apply to the DoE NWR for s26D licences to Construct or Alter Wells (under the Rights in Water and Irrigation Act 1914 (RIWA Act)) in the event further exploratory drilling for water is planned.

Hamersley Iron notes this advice and will apply for licences under the RIWA Act as required.

6.2 As part of modelling the water demand and supply characteristics of the Project, Hamersley Iron has not indicated whether it considered the surface discharge to Pit 5 at Brockman 2 mine, and whether this could be integrated into the BS4 water supply.

The proposed discharge of water to Pit 5 at Brockman 2 (B2) mine was not considered due to the relatively small volume (700 Ml pa) to be abstracted at B2 mine, and the large distance to pipe to BS4. Furthermore, the majority of the dewatering water from B2 will be utilised at the B2 plant and for dust suppression on the B2 mine.

6.3 More detailed hydrogeological investigations will be required to support a s5C licence application to take water (under the RIWA Act) in relation to the dewatering operations and mine water supply borefield(s).

Hamersley Iron will carry out further detailed hydrogeological investigations prior to application to the DoE for a s5C licence.

6.4 Hamersley Iron has committed to preparing a Water Management Plan. This Plan must also meet the requirements of a water use management operating strategy, including the elements of a water conservation plan, borefield contingency plan, monitoring program and detailed water balance/circuit diagram. Proof of legal access will also be required before any licence to take water is granted.

Hamersley Iron will meet the requirements of a water use management operating strategy when preparing the Water Management Plan, and include the elements required by DoE. Legal access is being pursued or has already been obtained, and will be secured for all relevant areas prior to submitting an application to take water.

6.5 CALM supports the recommendation in the BS4 Project fauna report that Hamersley Iron conducts an assessment of the likely impacts of groundwater drawdown on vegetation in the Project area. Phreatophytic vegetation types such as P1 and C1 will be particularly susceptible to groundwater drawdown. A comprehensive vegetation condition monitoring program will need to be included as part of the Borefield Management Plan and Groundwater Management Plan.

Hamersley Iron notes this advice and will include vegetation condition monitoring as part of the Borefield Management Plan and Groundwater Management Plan.

6.6 CALM notes that no excess groundwater production and disposal is anticipated. In the event that there is a need to dispose of excess groundwater extracted due to dewatering, Hamersley Iron needs to consult with CALM and DoE.

Hamersley Iron does not anticipate that there will be a need to dispose of excess groundwater. However, should this be required, Hamersley Iron would consult with CALM and DoE, and seek all necessary approvals.

7. Watercourses

7.1 Hamersley Iron will need to obtain a s17 Permit to Obstruct or Interfere with bed and banks under the RIWA Act, in the instances where the installation of culverts will require excavation works or disturbance to any named watercourses along the rail spur route. Specific surface flow and hydraulic studies, environmental risk management and rehabilitation plans would be required in order to properly assess any s17 Permit application. (DoE NWR Office)

Hamersley Iron notes this advice and will apply for s17 Permits under the RIWA Act as required. Such applications will include the information required by the DoE NWR Office.

8. Acid Rock Drainage

8.1 Hamersley Iron has identified that pyritic black shale extends the length of the proposed pits, however, it is not intended that this material will be mined or exposed during the mining operation.

In the event that acid rock drainage issues are encountered, it is recommended that Hamersley Iron develops a detailed long term monitoring program for determining the effectiveness of the encapsulation and management of acid rock waste. Such monitoring will increase CALM's confidence in Hamersley Iron's ability to achieve predicted environmental, rehabilitation and decommissioning outcomes.

In the event that acid rock drainage issues are encountered at the BS4 Project, Hamersley Iron will develop an appropriate long-term monitoring program.

9. Aboriginal Heritage

9.1 It is the preference of the Department of Indigenous Affairs that Aboriginal sites be avoided during development related activities. Where this is not possible, however, the proponent may seek the consent of the Minister for Indigenous Affairs under section 18 of the Aboriginal Heritage Act 1972.

Hamersley Iron notes this advice, and it also prefers to avoid Aboriginal sites wherever practicable. Hamersley Iron is also aware of the provisions in section 18 of the *Aboriginal Heritage Act 1972* and will comply with that requirement should avoidance of Aboriginal heritage sites not be possible.

10. Offsets

*10.1 The proposed offsets concern the mitigation of impacts on certain plant species (Priority species, *Rhagodia* sp. Mt. Brockman and stygofauna). These are valuable initiatives, but will not prevent a net loss of environmental assets. There should also be offsets which compensate for large-scale impacts to landforms and vegetation, as it is reasonable to expect that the diversity of vegetation types present after rehabilitation will be less than what was present before mining.*

The majority of secondary offsets listed in Table 6-3 of the PER are required for environmental impact assessment of the Project, so it is hard to also justify them as offsets.

While it is recognised that the BS4 Project will impact on vegetation and fauna habitat at a local level in the proposed disturbance areas, Hamersley Iron is committed to limiting the environmental impacts wherever possible. Based on the predicted environmental outcomes stated in the PER document, the protection of areas of vegetation determined to be of 'High conservation' significance and discussions with the EPA Service Unit assessment officers during preparation of the PER, Hamersley Iron considers that environmental offsets, in addition to those listed in Table 6-3 of the PER, are not required for the BS4 Project.

11. Closure and Rehabilitation

11.1 With regard to the Preliminary Rehabilitation and Closure Management Plan that was given in Appendix G of the PER, the Wildflower Society is concerned about the Closure Assumptions made in Section 4.4 of the Plan, particularly that:

- All open pits and final voids will not require rehabilitation (ie. ripping and seeding) to meet statutory requirements, unless backfilled with waste rock. Where backfilled it is assumed that open pit and final voids slopes will not require rehabilitation and that the final backfilled surface will be rehabilitated the same as waste rock dump surfaces; *and*,
- All closure activities, except monitoring, will be completed within two years of cessation of operations.

The Society is of the view that large areas of the operations, such as those mentioned in the first point above, should not be left un-rehabilitated and the EPA should be reassessing what is best practice in this regard.

In regard to the second point, the Society believes two years is an inappropriate time frame when it comes to doing rehabilitation work, particularly revegetation, and additional time should be specified for this aspect. Five years would be seen as a minimum and even longer may be required.

The closure assumptions given in Section 4.4 of the Preliminary Rehabilitation and Closure Management Plan, including those mentioned above, are intended to offer a *basis* for development of the Plan. This is because closure planning often occurs many years before actual closure works commence, as is the case with the BS4 Project. These assumptions are likely to be refined and modified over the current estimated 30 year life of the BS4 Project in accordance with best practice and regulations.

Hamersley Iron will make use of the opportunities to directly backfill voids (without sterilising minable ore) as they occur, and would rehabilitate the surfaces of such voids as considered necessary and appropriate.

With regard to the assumed timeframe for closure activities, Hamersley Iron will be progressively rehabilitating disturbed areas in the Project area where possible, and currently is aiming to meet this two year timeframe for closure activities. However, Hamersley Iron will take the time necessary to ensure complete and satisfactory closure of the Project on cessation of operations. Monitoring of rehabilitation will certainly continue beyond two years following cessation of operations.

11.2 The Rehabilitation objectives provided in Table 2 of the Preliminary Rehabilitation and Closure Management Plan are well chosen. However, an additional objective is required to ensure that there is a similar diversity and quality of habitats for plants and animals after rehabilitation.

A part of the objective in Table 2 of the BS4 Project Preliminary Rehabilitation and Closure Management Plan to establish 'sustainable endemic vegetation communities consistent with reconstructed landforms and surrounding vegetation' is to achieve a similar diversity and quality of habitats in rehabilitation areas. However, more specific completion criteria for rehabilitation and closure of the Project would be developed in consultation with relevant stakeholders during development of the Project's rehabilitation and closure management plan.