Nammuldi—Silvergrass Iron Ore Project, 55 km north-west of Tom Price

Hamersley Iron Pty Limited

Report and Recommendations of the Environmental Protection Authority

Environmental Protection Authority
Perth, Western Australia
Bulletin 997
October 2000

ISBN. 0 7307 6620 9
ISSN. 1030 - 0120
Assessment No.1247

Summary and recommendations

Hamersley Iron Pty Limited proposes to develop two iron ore deposits (Nammuldi and Silvergrass) near its current Brockman No. 2 iron ore mine. 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.

Relevant environmental factors

In the EPA's opinion, the following are the environmental factors relevant to the proposal, which require detailed evaluation in the report:

(a) riverine vegetation — impacts on vegetation arising from dewatering operations;

(b) subterranean fauna — impacts on fauna habitat due to dewatering operations; and

(c) Aboriginal culture and heritage — clearing and disturbance of land.

Conclusion

The EPA has considered the proposal by Hamersley Iron Pty Limited to develop two iron ore deposits near its current Brockman No. 2 iron ore mine.

The EPA notes that the proponent has given a substantial undertaking to backfill the mine pits to at least 1 metre above the mean pre-mine water table level and thus greatly reduce the long-term environmental impacts of the proposal. This leaves only the medium-term impacts of the proposal arising from mine pit dewatering to be considered by the EPA. These impacts are specifically related to the impact on riverine vegetation and stygofauna. With respect to the riverine vegetation, the EPA is confident, based on the information available, that the loss of vegetation close to the mine will not be regionally significant. With regard to stygofauna, the EPA is less certain of the potential impacts and has had to weigh up the risks associated with this level of uncertainty against the benefits to scientific knowledge which may be gained by additional studies as a result of this proposal proceeding. On balance, it is the EPA's judgement that these risks are acceptable when compared against the benefits of improved basic knowledge of stygofauna.

In addition, the EPA is pleased with the initiative which the proponent has shown in seeking to identify the concerns of the Aboriginal people of the area and the process it has outlined for addressing these concerns as the details of the mining operation are refined.

The EPA has concluded that the proposal is capable of being managed in an environmentally acceptable manner such that it is most unlikely that the EPA's objectives would be unduly compromised, provided there is satisfactory implementation by the proponent of the recommended conditions set out in Section 4, including the proponent's commitments.

Recommendations

1. That the Minister notes that the project being assessed is for the development of two iron ore deposits (Nammuldi and Silvergrass) near Hamersley Iron Pty Limited's current Brockman No. 2 iron ore mine, 55 kilometres north-west of Tom Price;
2. That the Minister considers the report on the relevant environmental factors 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 unduly 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;

4. That the Minister imposes the conditions and procedures recommended in Appendix 4 of this report.
5. That the Minister notes under 'Other Advice' that the EPA will be writing to the Minister for Resources Development and the Western Australian Museum recommending the initiation of a long-term study into subterranean fauna of the region.

Conditions

Having considered the proponent's commitments and the information provided in this report, the EPA has developed a set of conditions which the EPA recommends be imposed if the proposal by Hamersley Iron Pty Limited to develop two iron ore deposits near its current Brockman No. 2 iron ore mine, is approved for implementation.

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

(a) that the proponent be required to fulfil the commitments in the Consolidated Commitments statement set out as an attachment to the recommended conditions in Appendix 4;

(b) that the proponent be required to prepare and implement a Subterranean Fauna Sampling Plan;

(c) that the proponent be required to prepare and implement a Decommissioning and Rehabilitation Plan; and

(d) that standard conditions appropriate to mining operations of this scale and type be applied.

Contents

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 relevant to the proposal by Hamersley Iron Pty Limited, to develop two iron ore deposits (Nammuldi and Silvergrass) near its current Brockman No. 2 iron ore mine.

In 1991 the EPA assessed Hamersley Iron Pty Limited's proposal for the Brockman No. 2 Detrital Iron Ore Mine at the level of a Consultative Environmental Review. Environmental approval to implement the proposal was issued by the Minister for the Environment on 17 April 1991. This mine commenced operations in 1992.

As part of a staged approach to the development of Marra Mamba deposits in the area, in 1998 Hamersley Iron Pty Limited referred to the EPA a proposal for a trial mining operation in the Nammuldi area, adjacent to the Brockman No. 2 mine. Due to the relatively small scale of this operation and a number of commitments given by the proponent, the EPA set the level of assessment at "Informal Review with Public Advice".

In September 1998 Hamersley Iron Pty Limited referred this proposal to the EPA as the next stage of development. The level of assessment for this proposal was set at Consultation Environmental Review based on the size of the area to be affected (approximately 2 000 ha) and the fact that much of the orebody was below the water table. Mining below the water table in the Pilbara has a number of environmental consequences, related to the dewatering operations which must be carried out during mining and the possible long-term impacts of lakes which may form in the pits after mining.

Further details of the proposal are presented in Section 2 of this report. Section 3 discusses environmental factors 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 provides Other Advice by the EPA, Section 6 presents the EPA's conclusions and Section 7, the EPA's Recommendations.

A summary of submissions and the proponent's response to submissions is included in the appendices 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

The proposal is to develop two iron ore deposits (Nammuldi and Silvergrass) near Hamersley Iron Pty Limited's current Brockman No. 2 iron ore mine, 65 kilometres north-west of Tom Price. The project areas are indicated on the attached figures (Figures 1 and 2).

The main components of the project are:

- open-cut mines at Nammuldi (Marra Mamba, detritals) and Silvergrass (Marra Mamba);
- dewatering to access ore below the water table;
- an ore transport link from Silvergrass to Nammuldi;
- a wet or possibly dry processing plant at Nammuldi;
- crushing facilities at Silvergrass and at the eastern Nammuldi pits;
- tailings disposal (if wet processing occurs) into available mine void/s, plus a new tailings storage facility; and
- associated support infrastructure.

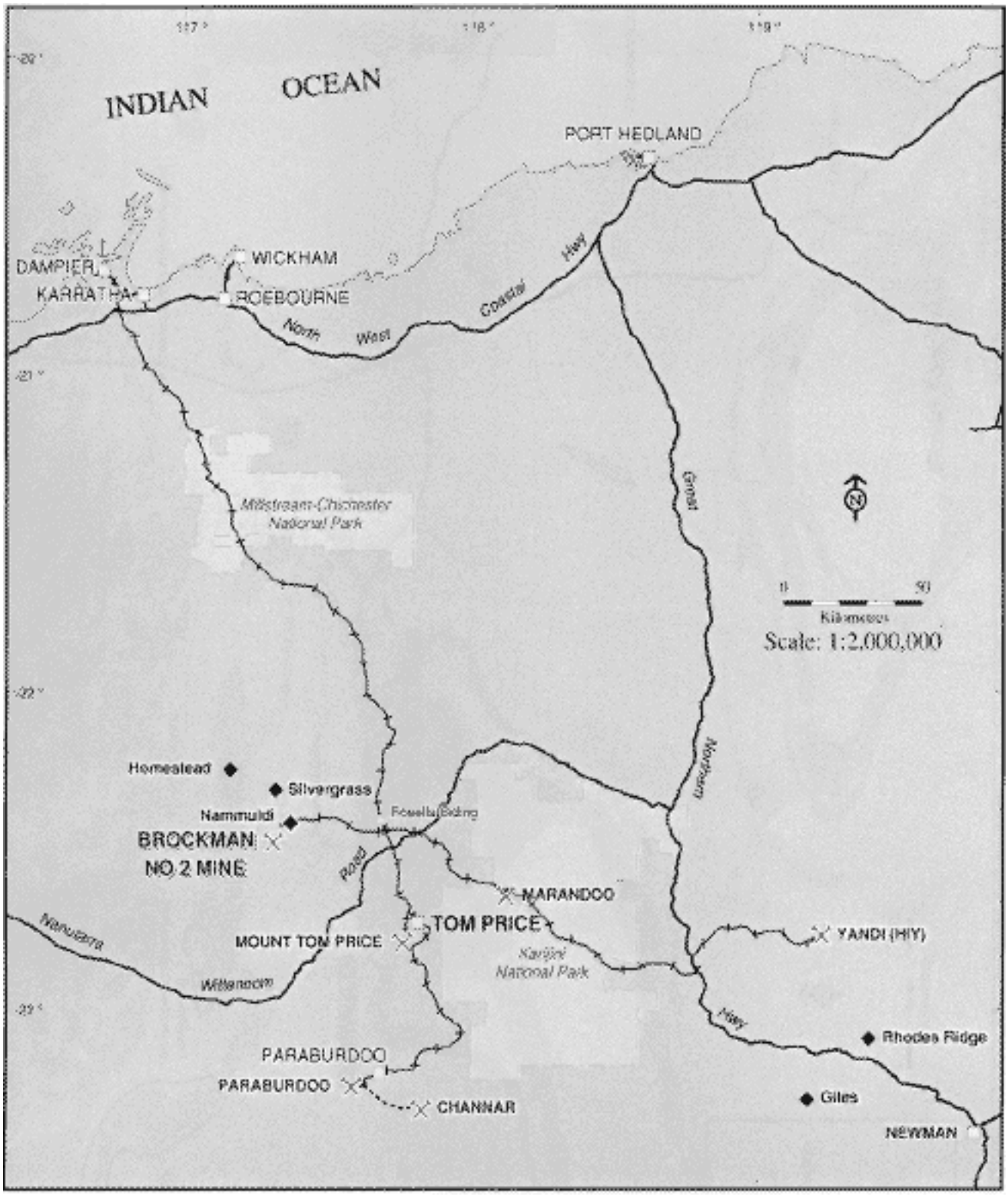
The rate of production of saleable ore will commence at 2-3Mt/a and could increase to about 20Mt/a.

Both deposits will involve mining below the watertable, with approximately 80% of the mineable Marra Mamba ore being below the watertable. A substantial dewatering operation will be required during mining. To manage long-term impacts associated with mining below the watertable, the proponent will backfill the mine pits with waste rock to at least 1 metre above the mean pre-mine water table level.

The proposal is early in its development phase and therefore no commencement date has been set. Provisional mine plans indicate a mine life of 10 years for Nammuldi and 7 years for Silvergrass. However, these estimates are dependent on the production rates and so mining may continue for up to 20 years.

Given the early phase of development, a number of options for various components of the project are presented, and the locations for some of the infrastructure are only indicative. The proponent's approach in presenting the proposal for assessment at this stage is for the key environmental issues and constraints to be identified. These would then be fed into an Environmental Management System (EMS) and an Environmental Management Plan (EMP) which would determine the options/locations chosen and provide the details of any specific environmental management required.

The main characteristics of the proposal are summarised in Table 1. A detailed description of the proposal is provided in Section 2 of the Consultative Environmental Review (Hamersley Iron Pty. Limited, 2000)



National Park
Railway
Channar conveyor
Major road
Iron ore mine
Iron ore deposit
Port
Major town

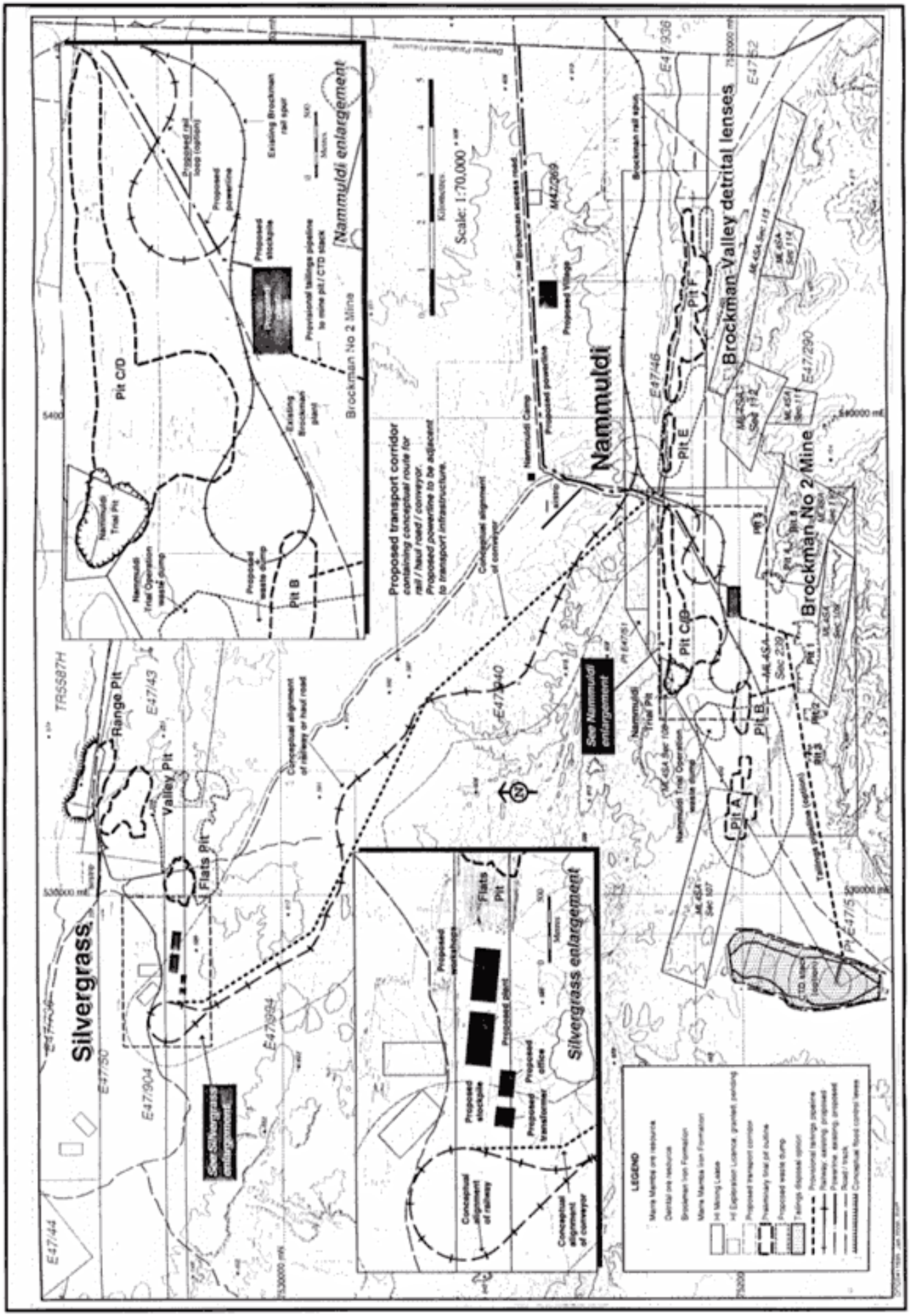


Figure 2. Proposal layout (Source: Hamersley Iron Pty Ltd, 2000).

Table 1. Summary of key proposal characteristics

Component	Project characteristic	Description
General	Area to be cleared	Around 2,000 hectares
Mine and mining	Pits and ore type	Nammuldi - Pits A, B, C/D, E and F (all Marra Mamba) and detritals near Pit F. Silvergrass - Range Pit, Valley Pit, Flats Pit - all Marra Mamba
	Area (mines and waste dumps)	About 1685 hectares: made up of mines 685 hectares, waste dumps 900 hectares (some waste will be returned to mine pits), haul roads 100 hectares
	Ore reserve	About 280 million tonnes (230 million tonnes of Marra Mamba and 50 million tonnes of detritals)
	Mining rates	Initially 2-3 million tonnes/annum and could increase to 20 million tonnes/annum
	Estimated mine life	15-20 years
	Ore below water table	About 80%
	Stripping ratio	3:1 (waste:ore) overall
	Waste rock disposal	About 750 million tonnes of waste rock to be generated. Some waste will be used to backfill voids to above pre-mine mean water table level, some used in construction works and the remainder left as out-of-pit waste dumps
	Pit voids	Voids to be backfilled to one metre above the mean pre-mine water table using waste ore and overburden. Pits will be backfilled to 575-581mRL at Nammuldi and 548-550mRL at Silvergrass
	Waste dumps	Waste dumps will be 40 metres high. Maximum batter slope of 20^{o} during rehabilitation.
	Proportion of waste to be backfilled	About 30%
Dewatering	General	Dewatering required to access below water table ore from most pits
	Arrangement	In-pit dewatering bores to achieve the bulk of dewatering, associated with in-pit sumps in the later stages of mining
	Combined rates	Maximum rate approximately 18 million litres /day
	Total volumes	Nammuldi about 31,000 million litres, Silvergrass about 30,000 million litres
	Discharge strategy	At Nammuldi, discharge will initially be into drainage lines, then to recharge via mined pit (if suitable pit available and it is feasible). At Silvergrass, discharge will be to Caves Creek
Processing and tailings	Plant	Wet or dry processing at Nammuldi, dry crushing plant at Silvergrass and a dry crushing plant around Pit E/F at Nammuldi.
	Tailings (if wet processing)	About 2 million tonnes/annum (dry), made up of clays and fine iron fraction – defined as high plasticity silt. Discharge into Brockman pits 1 & 3 and Nammuldi Pit B, plus a central thickened discharge facility
	Stockpiles	Product stockpiles at Nammuldi, crushed ore stockpile at Silvergrass
Infrastructure	Power	New extension off Dampier-Tom Price line
	Water	Dewatering will supply water for potable, processing and dust control purposes; decant water from tailings storage will supplement processing requirements
Transport	Ore from Silvergrass	Railway, haul road or conveyor
	Product transport	By rail to Dampier on existing rail network
Workforce	Workforce (approx.)	For construction about 400. Operations 150-190 on fly-in fly-out basis.
	Accommodation	Nammuldi Camp for construction, new Village for Nammuldi workforce

The potential impacts of the proposal initially predicted by the proponent in the CER document (Hamersley Iron Pty Limited, 2000) and their proposed management are summarised in Table S1 of the CER.

3. Relevant environmental factors

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 is summarised in Appendix 3. The reader is referred to Appendix 3 for evaluation of preliminary factors not discussed in detail in the main body of this report, including the reasons why these were not considered relevant factors.

It is the EPA's opinion that the following are the environmental factors relevant to the proposal which require detailed evaluation in this report:

(a) riverine vegetation — impacts on vegetation arising from dewatering operations;

(b) subterranean fauna — impacts on fauna habitat due to dewatering operations; and

(c) Aboriginal culture and heritage — clearing and disturbance of land.

The above relevant factors were identified from the EPA's consideration and review of all environmental factors (preliminary factors) generated from the CER document and the submissions received, in conjunction with the proposal characteristics.

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

3.1 Riverine vegetation

Description

Changes to the hydrological system of Caves Creek near the Silvergrass mining area will affect vegetation which is dependent on this system. In order to mine the orebodies in this area, the proponent will have to carry out extensive dewatering operations. During mining, this will result in significant drawdown of groundwater levels up to 3 km from the pits and a discharge of excess water into the creek downstream of the mine.

Discharge of excess water into Caves Creek will result in pooling of water downstream of the discharge point. Although the exact distance pooling will extend downstream will be dependent on a number of operational and climatic factors, it is expected that water will extend about 3 km downstream before it infiltrates into the creek alluvium. The pooling of water will result in a transient enhancement of those species which tolerate, or require, more long-term moisture. The original vegetation structure will eventually become re-established once discharge ends.

Drawdown is expected to cause some deaths in riverine vegetation in the short term over a distance of 2 km along Caves Creek. The particular phreatophytic species expected to be affected are *Eucalyptus camaldulensis* (River Gum) and *Eucalyptus victrix* (Coolabah). These are found in vegetation association B1 (Tall woodland of *Eucalyptus camaldulensis/E. victrix* over *Acacia citrinoviridis)* which is found along major creek lines. Because this landform is relatively scarce locally (although not regionally) it is considered one of three locally significant vegetation associations. During dewatering operations, it is estimated that over a distance of about 2 km, 5-10% of vegetation association B1 will become stressed and may die. Independent of any drawdown effects, approximately 10% of this vegetation association in the survey area will be cleared by other mining activities.

There are not expected to be any long-term impacts of mining on riverine vegetation, because of the proponent's undertaking to backfill the mine pits (to at least 1 m above the mean pre-mine

water table level) and the predicted return of groundwater to pre-mining levels within two years of the end of mining.

Submissions

The Water and Rivers Commission (WRC) believed that the only area of concern with regard to dewatering operations at both sites is the possible impact on riverine vegetation along Caves Creek. The dewatering will impact on a 6 km stretch of creek line and possibly cause significant drought stress along 2 km of this. The WRC also provided the following more detailed comments.

- A commitment is made to monitor the impact of dewatering on the riverine vegetation along Caves Creek. However, no management strategy is given should tree deaths be more severe than expected.
- Is the hydraulic connection between the creek alluvial material and the BIF [Brockman Iron Formation] aquifer being dewatered such that it is not possible to use dewatering discharge for periodic irrigation/flooding of the creek opposite the Range Pit?
- Hamersley Iron Pty Ltd should be given full credit for exploring the concept of in-pit tailings disposal and artificial recharge of the localised BIF aquifers.
- Is it possible that at some time during the life of the project the project water requirements will exceed that which could be supplied by dewatering? If so, where will the additional water be sourced from?

The Department of Conservation and Land Management (CALM) noted that there is a large area of *Livistona* palm downstream of the discharge point. While it is probably too far away to be adversely affected, the possible effects of dewatering should be considered.

Assessment

The area considered for assessment of this factor is that area covered by riverine vegetation along the length of Caves Creek from its beginning at the confluence of Wackilina and Barnett Creeks down to where it reaches Palm Springs.

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

(a) maintain the abundance and diversity of species, and geographic distribution and productivity of vegetation communities; and

(b) maintain the quantity of groundwater so that existing and potential uses, including ecosystem maintenance, are protected.

In reply to the comments of the WRC and CALM the proponent provided the following points in response.

- Commitment 6 is expanded to read:

  The proponent will develop and implement a riverine monitoring program to determine the extent of any impacts on vegetation that may occur as a result of dewatering the Silvergrass mine pits and from mine dewatering discharges into Caves Creek. It will also assess, and where appropriate implement, feasible options (such as periodic irrigation/flooding) to reduce significant impacts.

- The mining schedule will be planned to provide sufficient water for processing requirements (if wet processing is adopted) from dewatering, while minimising mining costs through efficient mine planning. Hamersley will undertake further studies on water balances and (if required) alternative water sources. Options would include piping a portion of dewatering discharge water from Silvergrass; maximising water make-up from tailings; and a new borefield.
- Dewatering activities will be at least 25 km away and unlikely to have any impact on Palm Springs.

The EPA notes that dewatering discharge will result in temporary changes to vegetation structure for some distance below the discharge point. However, these changes are not so extensive in either area or duration, for the impacts to be significant at a regional scale.

The EPA also notes the modelled impacts on riverine vegetation. The proponent has defined drawdown as a 5 m lowering of the groundwater level based on recorded natural fluctuations. Initial modelling predicts drawdown at a distance of 3 km around Silvergrass. Based on this initial modelling, it is estimated that following prolonged dewatering at Silvergrass, some (5-10%) *E. camaldulensis* and some (>5%) *E. victrix* trees will be severely drought stressed and may die, over a distance of about 2 km along Caves Creek

Based on the above, it is clear that the EPA's objective for this factor will not be completely achieved at the local scale. That is, the groundwater requirements for phreatophytic vegetation will not be completely maintained within the area of drawdown near the Silvergrass mining area.

However, the EPA believes that the predicted impacts on riverine vegetation due to drawdown are not of regional significance. Vegetation association B1 is found all along the length of Caves Creek within the surveyed area. Caves Creek is more than 60 km long from its beginning to Palm Springs. It is therefore inferred that the B1 association is well represented outside of the survey areas, where it is beyond the influence of dewatering impacts.

The EPA considers that the proximity of the orebody (Range Pit) to Caves Creek makes it impractical to meet the EPA's groundwater objective at the local scale (ecosystem maintenance). Range Pit is adjacent to Caves Creek and in order to access the ore the proponent will have to lower the groundwater level for some distance along Caves Creek, and thus deprive riverine vegetation which is dependent on this groundwater. The proponent has given a commitment to assess options to reduce impacts on vegetation and to implement these if appropriate. The EPA accepts that such options may not be appropriate based on the effectiveness and feasibility of the options. Options are likely to involve some form of irrigation of phreatophytic vegetation within the affected area. This would result in some recirculation of water in the dewatering operation. If it cannot be demonstrated that the health of riverine vegetation will be substantially improved by such a scheme, then the installation, operation, and maintenance of the scheme could be a waste of resources and give rise to additional environmental impacts.

Summary

Having particular regard to the:

(a) limited predicted impact on riverine vegetation at the local scale, particularly vegetation association B1;

(b) impracticability of meeting the EPA's objective for groundwater at the local scale, but noting that it will be met at the regional scale; and

(c) proponent's commitment to monitoring riverine vegetation and groundwater,

it is the EPA's opinion that the proposal does not unduly compromise the EPA's objectives for this factor at the regional scale provided the proponent's commitments are made legally enforceable.

3.2 Subterranean fauna

Description

On the basis of sampling work carried out to date, stygofauna do occur in the Marra Mamba aquifer of the project area and are also hypothesised to occur in the alluvium of Caves Creek.

Subterranean fauna includes both troglobites (terrestrial) and stygofauna (aquatic). Both of these are important because of their species richness, evolutionary history and adaptations, and the evidence they can provide for continental drift. Hence they are significant in terms of Australian faunal biodiversity (EPA, 1997).

Stygofauna sampling of the project area was carried out on three occasions over the period 1998-9. Although the results were quite variable, sampling in the Marra Mamba aquifers at Nammuldi and Silvergrass found amphipods (provisionally identified as being from the Melitidae and Bogidiellidae families), copepods, worms, and collembola. Identification to a species level will not be available until late 2000 or early 2001.

Sampling for troglobitic fauna was not undertaken as the proponent believes (based on drilling programmes) that there are no underground caves in the project area.

Based on recent findings with respect to stygofauna in the Pilbara, stygofauna can occur in the alluvium of ephemeral and permanent creeks. On this basis, stygofauna are also hypothesised to occur in the alluvium of Caves Creek.

Any stygofauna present will be affected by the dewatering operations through the lowering of the water table around the pits and by pooling of water in Caves Creek. Lowering of the watertable will result in direct loss of habitat during mining, while pooling may affect habitat through indirect effects of pooled water on the underlying alluvium aquifer habitat. Obviously, habitat within the orebody itself will be altered permanently, in that it will be replaced by whatever aquifer develops within the waste rock of the backfilled mine pits.

Submissions

The Western Australian Museum commented that subterranean fauna have been identified within the project area but the fauna is not placed within a hydrological context nor within the context of what is known of the Pilbara stygofauna. Sampling carried out to date in the Pilbara has found fauna unique to each separate calcrete area sampled and non-uniform fauna distributions within some of these areas. The limited sampling carried out for this project is unlikely to have revealed more than a small fraction of the contained stygal biodiversity.

Further comment made by the WA Museum include the following.

- The CER document lacks information on the vertical profile in the 'quality' of the groundwater.
- With regard to water contaminants, stygofauna are especially vulnerable owing to the typically limited spatial distribution of each species and their sensitivity to contaminants. For example, Magnafloc LT35 is quickly bound to naturally occurring dissolved organic carbon which is the very basis of the food chain for stygofauna and which typically occurs at very low concentrations in groundwater.
- The objective of Commitment 8 to understand population dynamics of the stygofauna is not plausible. The stygofauna sampling programme proposed will merely record the distribution and taxonomy of the fauna. However, there are complex issues involved in determining the impact on stygofaunal communities, as often subtle changes in groundwater conditions can have marked impacts on communities. While sampling is a necessary precursor to more detailed studies on the response of stygofaunal communities to impacts, it is not in itself adequate to resolve the management issues.
- If the species diversity in the region of this project is comparable to that found in some other sites in the Pilbara, then the risk of species extinction resulting from extensive dewatering (Fig. 19 of the CER) operations is not inconsiderable.

The WRC submitted that the proposed strategy for dealing with the stygofauna issue is questionable. It would appear that the proponent's approach is to identify what Schedule 1 species are present. However, the strategy does not describe what will occur if Schedule 1 species are found. It may be more practical to accept that all stygofauna that occur in the area impacted by dewatering will die but conduct a sampling program aimed at showing that those species to be killed (irrespective of whether they are Schedule 1 or not) also occur outside of the impacted area. This would ensure that mining activity does not cause the extinction of these species (no mater how common or unique) from the area (regional locality).

Assessment

The area considered for assessment of this factor is the potential subterranean fauna habitat within the alluvium of Caves Creek and the Marra Mamba Iron Formation throughout the project region.

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

(a) ensure that subterranean fauna are adequately protected, in accordance with the *Wildlife Conservation Act 1950*;

(b) maintain the abundance, diversity and geographical distribution of subterranean fauna; and

(c) improve our understanding of subterranean fauna through appropriate research including sampling, identification, and documentation.

The proponent in its response to submissions on this factor advised that:

- the methodology for the 1999 and 2000 stygofauna sampling was discussed with State and National specialists in this area. Input from these specialists was incorporated in the design and implementation of the sampling program;
- until an adequate treatment of the taxonomy of the Pilbara stygofauna is available in the formal scientific literature, it will not be possible to place specimens in a regional context, nor to test assertions that distributions are non-uniform;
- Hamersley is committed to further developing understanding of Pilbara stygofauna through surveys and assistance of taxonomic or ecological studies, in concert with government and other Pilbara miners;
- no evidence of vertical stratification in water quality was seen from groundwater studies;
- the EMP will address management of the tailings facilities, including containment of residual concentrations of flocculant/coagulants within the formed structures; and
- by conducting repeat sampling, the monitoring programme will look at local abundance over time. This data will provide a start for assessment of how factors such as seasonality affect abundance and composition of the fauna.

The EPA considers that the main impacts on stygofauna will be through the loss of habitat during mining as a result of dewatering operations. Other issues, such as water quality, are secondary to the loss of potential habitat and can be managed to a level commensurate with their potential impact via standard practices. The EPA expects the proponent to set water quality objectives under the project EMP which will take into account potential impacts on stygofauna and put in place appropriate management. In considering the loss of habitat, the EPA will apply the precautionary principle, in that it assumes all stygofauna within the affected habitat will be lost. This position is taken because there is insufficient data on the ability of stygofauna to either migrate out of the affected volumes during operations, or to recolonise these volumes after operations.

The Western Australian Museum has raised some concerns in regard to stygofauna which cannot be conclusively resolved at this time due to a limited understanding of subterranean fauna in the Pilbara region. Therefore in its assessment of this proposal the EPA must weigh up the risks associated with this limited understanding against the benefits which may be gained by additional studies as a result of this proposal proceeding.

In order to quantify the risks associated with the proposal the EPA makes the following assumptions in relation to stygofauna:

1. that impacts on stygofauna in the alluvium of Cave Creek will be local to the discharge operations;
2. that there is a uniform distribution of stygofauna along some stretches of the alluvium of Caves Creek; and

3. that the stygofauna habitat and fauna of the Marra Mamba aquifer is unlikely to be unique to the areas immediately surrounding the proposed mine pits.

The EPA understands that these assumptions are open to debate and that alternative views have been expressed. However, it believes that there is insufficient data to conclusively prove or disprove either side of this argument at this time. The basis for the EPA making these assumptions is presented below.

The first assumption is based on the expected extent of pooling in Caves Creek as a result of dewatering discharges to the creek and the quality of water discharged. It is expected that water will extend about 3 km downstream before it infiltrates into the creek alluvium. The water being discharged is uncontaminated groundwater. This water is relatively fresh (typically with Total Dissolved Solids < 900 mg/L) and of neutral pH (typically 7.0 - 7.8). Hence, impacts will most likely be restricted to those areas of the alluvium which are directly affected by pooling.

The EPA believes the second assumption is reasonable, because there exists a mechanism for the transport of stygofauna along Caves Creek. Although the alluvium habitat may not be connected along the entire length of Caves Creek, creek flow after major rainfall events will provide a pathway for the transport of fauna downstream. Because this pathway exists, it is reasonable to assume that there is some movement of fauna along the creek and so uniformity of distribution.

The last assumption is based on the expected distribution of the Marra Mamba aquifer in the region. The Marra Mamba aquifer is basically the aquifer associated with the orebody and which must be drawn down to allow safe mining operations within the mine pits. As such, there is expected to be some correlation at a regional level between this type of aquifer and the Marra Mamba Iron Formation. From Figure 3 it can be seen that the Marra Mamba Iron Formation is well represented within the region local to the proposal (based on a 50 km radius around the proposal) and that the Nammuldi and Silvergrass areas are not isolated from this wider distribution. Given this wider distribution of potential habitat, it does not seem likely that stygofauna found in the proposed mining areas is unique to these areas.

Based on the above assumptions, the EPA considers that the risk of stygofauna species extinction as a result of this proposal is small. Furthermore, the collection of additional data during the life of the operation will add to basic knowledge of stygofauna within the Pilbara region. It is therefore the EPA's judgement that there is a reasonable balance between the risk that the EPA's objective will be compromised and the additions to fundamental taxonomic data that will accrue.

Because this proposal will not be implemented immediately, there is the scope to obtain much of this data before the operation commences. The EPA therefore recommends that an intensive study be conducted, prior to dewatering operations commencing, to test the EPA's assumptions and to provide additional baseline information for incorporation into the management measures of the EMP.

As is evident from the above assessment, the EPA is concerned at the lack of knowledge of subterranean fauna species and their distribution through the Pilbara. This issue is discussed further in Section 5.

Summary

Having particular regard to the:

(a) limited results of survey work to date;

(b) proponent's commitment to continue to contribute to fundamental taxonomic knowledge on stygofauna; and

(c) reasonable assumptions in the absence of conclusive data;

it is the EPA's judgement that the balance of the risk that the EPA's objective is compromised against the benefits of improved basic knowledge of stygofauna is acceptable, provided an intensive study to improve knowledge is conducted.

Figure 3. Regional distribution of Marra Mamba Iron Formation (Source: Hamersley Iron Pty Ltd, 2000).

3.3 Aboriginal culture and heritage

Description

Aboriginal people with an interest in the project area are the Eastern Gurama people and related family groups represented by the Maliwartu Aboriginal Corporation.

Heritage surveys of some, but not all, of the project areas have been conducted. Some archaeological and ethnographical sites have either been identified through the limited survey work carried out to date, or are inferred to occur based on the limited data.

Archaeological sites are those areas which have previously been inhabited by Aboriginal people and where some physical evidence of this prior occupation remains. To date, archaeological site surveys of the project area have only been conducted to a level adequate for the proponent's activities so far. As a result, some areas have been surveyed in sufficient detail to allow site clearance and some have not been surveyed at all. A number (11 at Nammuldi and 4 at Silvergrass) of sites have been surveyed which may be impacted by mining operations. The significance of these sites will be finalized through consultation with the Eastern Gurama people before any disturbance.

Ethnographic sites are areas which have a living cultural significance to Aboriginal people today, by virtue of being sacred, ritual, or ceremonial sites of importance and special significance. Ethnographic surveys have been carried out at Nammuldi and no sites were found. Surveys have not been conducted of the Silvergrass area or the transport corridors, however, some burial sites at Silvergrass are likely to have ethnographic significance.

In addition to these site surveys the proponent has also undertaken a study of the environmental-cultural areas (areas that consist of natural resources utilised by Aboriginal people, such as specific plants, rocks, and animals). This study involved consultation, and a site visit, with the Eastern Gurama representatives. The outcomes of this study were:

- information provided by the Eastern Gurama people regarding the use of resources is considered confidential for cultural reasons;
- Eastern Gurama people consider all components of the land to be of equal importance;
- some resources have more uses than others; and
- resources within some areas of the project area are gathered for use.

Due to the first point above, specific predicted impacts could not be provided in the CER document. The proponent intends to address such impacts through the establishment of a land use agreement with the Eastern Gurama native title claimants.

Submissions

The Aboriginal Affairs Department noted that the proponent is maintaining high consideration of Aboriginal heritage and cultural issues. Generally a site avoidance strategy has been adopted to deal with Aboriginal sites of significance. However, it is stressed that in the instance where a site cannot be avoided it will be necessary for a Section 18 permit to be obtained in accordance with the *Aboriginal Heritage Act 1972*.

The Gurama Maliwartu Aboriginal Corporation commented that there will need to be firm control of contractors employed by the proponent during the construction of project infrastructure. In the past, contractors have disturbed sacred sites and driven vehicles over sensitive environmental areas.

Assessment

The area considered for assessment of this factor is the overall project area (as contained on Figure 2).

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

- ensure that the proposal complies with the requirements of the *Aboriginal Heritage Act 1972*; and
- ensure that changes to the biological and physical environment resulting from the project do not adversely affect cultural associations with the area.

The proponent in its response to submissions on this factor advised that:

- it was aware of its obligations under the *Aboriginal Heritage Act 1972*; and
- contractors employed by Hamersley will undergo a site induction containing environmental and Aboriginal heritage components.

The proponent has also given a number of commitments specific to the management of this factor. These are:

12. Additional surveys – Aboriginal sites: Hamersley will involve the Maliwartu Aboriginal Corporation in additional archaeological and ethnographic surveys to identify sites, and their significance, within the Project area that are likely to be disturbed in accordance with a heritage survey protocol as agreed with the Maliwartu Aboriginal Corporation.

14. Consultation on Section 18 application: Hamersley will consult with the Maliwartu Aboriginal Corporation and Eastern Gurama Elders on Aboriginal sites in the Project area before any Section 18 application is developed in keeping with an agreed protocol.

16. Aboriginal social and cultural issues associated with the environment: Hamersley will consult with the Maliwartu Aboriginal Corporation to identify and assess any social and cultural aspects of the physical and biological environment impacted. This will be addressed through the establishment of a Land Use Agreement.

Both archaeological and ethnographic sites are subject to the *Aboriginal Heritage Act 1972*. This Act prevents the disturbance of such sites unless consented to by the Minister for Aboriginal Affairs (under Section 18 of the Act) after receiving recommendations from the Aboriginal Cultural Material Committee.

Although there is limited baseline information available to the EPA with regard to Aboriginal heritage sites and the predicted impacts on Aboriginal peoples' use of the land, the EPA is pleased with the approach that the proponent has adopted to ensure that any impacts are identified and managed in consultation with the Aboriginal people. From the information presented in the CER the EPA understands that the proponent has already begun to involve the representative Aboriginal people in identifying those aspects of the project area, and the project itself, which are relevant to potential impacts on Aboriginal culture and heritage. From the content of the Gurama Maliwartu Aboriginal Corporation's submission, it would seem that the people have a good understanding of the proposal and its potential impacts, and also a good relationship with the proponent.

Through Commitment 16 the proponent puts forward a process where the views of the Eastern Gurama people will be taken into account before any impacts on the environment occur. The EPA expects that the establishment of a Land Use Agreement prior to construction will provide Aboriginal people with sufficient input into the project to protect their cultural associations with the land.

In addition, the EPA notes that there were no objections to the proponent's proposed process for resolving future issues which might arise, and that there were no specific issues raised which require further EPA involvement at this time.

Summary

Having particular regard to the:

(a) proponent's commitments in relation to this factor; and

(b) submission on behalf of the Eastern Gurama people;

it is the EPA's opinion the proposal is capable of being managed to meet the EPA's objectives for this factor provided the proponent's commitments are made legally enforceable.

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 CER and subsequently modified, as shown in Appendix 4, should be made enforceable.

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 the EPA recommends be imposed if the proposal by Hamersley Iron Pty Limited to develop two iron ore deposits near its current Brockman No. 2 iron ore mine, is approved for implementation.

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

(a) that the proponent be required to fulfil the commitments in the Consolidated Commitments statement set out as an attachment to the recommended conditions in Appendix 4;

(b) that the proponent be required to prepare and implement a Subterranean Fauna Sampling Plan;

(c) that the proponent be required to prepare and implement a Decommissioning and Rehabilitation Plan; and

(d) that standard conditions appropriate to mining operations of this scale and type be applied.

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

- requirements of the Department of Minerals and Energy for the proponent to comply with the provisions of the *Mines Safety and Inspection Act 1995* with respect to public safety and the management of mining voids, waste dumps, decommissioning of plant infrastructure and final rehabilitation;

- requirements of CALM for the proponent to comply with the provisions of the *Wildlife Conservation Act 1950* with respect to disturbance of Priority flora species and Threatened fauna;

- requirements of the Department of Environmental Protection to comply with the provisions of the Part V of *Environmental Protection Act 1986* with respect to the discharge of groundwater and the construction and operation of prescribed premises, including tailings storage facilities; and

- requirements of the Aboriginal Affairs Department for the proponent to comply with the provisions of the *Aboriginal Heritage Act 1972*.

5. Other Advice

In assessing the factor of "Subterranean fauna" the EPA has been hampered by the lack of baseline information on subterranean fauna within the State, and in particular, the Pilbara region. Because this field is relatively new within the State it does not have the same level of baseline information that has been built up for the terrestrial and aquatic environments. Since survey work requires the establishment of wells, most of the information to date relates only to areas where wells (boreholes) have been established as part of some proposed or existing development. As a result, most of the baseline information comes from areas which to some extent are likely to be adversely affected by development and little, or none, comes from areas far removed from potential development impacts. Furthermore, as subterranean fauna surveys are carried out for each development, new types of fauna populations are found to occur. This may reflect underlying inhomogeneity in the distribution of fauna, or may simply be a result of the small number of areas studied to date.

In the longer-term this situation would be remedied through a greater understanding of the distribution and composition of subterranean fauna communities within the region, and through an improved understanding of the response of subterranean fauna communities to impacts associated with these types of development (primarily, mining and groundwater abstraction). This can partly be achieved through the initial surveys and continued monitoring required of new developments. But it will also require a broader and longer-term programme of study of subterranean fauna. The EPA believes that this study should be initiated by government and be jointly funded by government and prospective developers in the region. The EPA will write to the Minister for Resources Development and the Western Australian Museum recommending that such a study be initiated.

6. Conclusions

The EPA has considered the proposal by Hamersley Iron Pty Limited to develop two iron ore deposits near its current Brockman No. 2 iron ore mine.

The EPA notes that the proponent has given a substantial undertaking to backfill the mine pits to at least 1 metre above the mean pre-mine water table level and thus greatly reduce the long-term environmental impacts of the proposal. This leaves only the medium-term impacts of the proposal arising from mine pit dewatering to be considered by the EPA. These impacts are specifically related to the impact on riverine vegetation and stygofauna. With respect to the riverine vegetation, the EPA is confident, based on the information available, that the loss of vegetation close to the mine will not be regionally significant. With regard to stygofauna, the EPA is less certain of the potential impacts and has had to weigh up the risks associated with this level of uncertainty against the benefits to scientific knowledge which may be gained by additional studies as a result of this proposal proceeding. On balance, it is the EPA's judgement that these risks are acceptable when compared against the benefits of improved basic knowledge of stygofauna.

In addition, the EPA is pleased with the initiative which the proponent has shown in seeking to identify the concerns of the Aboriginal people of the area and the process it has outlined for addressing these concerns as the details of the mining operation are refined.

The EPA has concluded that the proposal is capable of being managed in an environmentally acceptable manner such that it is most unlikely that the EPA's objectives would be unduly compromised, provided there is satisfactory implementation by the proponent of the recommended conditions set out in Section 4, including the proponent's commitments.

7. Recommendations

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

1. That the Minister notes that the project being assessed is for the development of two iron ore deposits (Nammuldi and Silvergrass) near Hamersley Iron Pty Limited's current Brockman No. 2 iron ore mine, 55 kilometres north-west of Tom Price;
2. That the Minister considers the report on the relevant environmental factors 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 unduly 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;
4. That the Minister imposes the conditions and procedures recommended in Appendix 4 of this report.
5. That the Minister notes under 'Other Advice' that the EPA will be writing to the Minister for Resources Development and the Western Australian Museum recommending the initiation of a long-term study into subterranean fauna of the region.

Appendix 1

References

EPA (1997), *Extensions to Exmouth Marina Harbour, Landcorp: Report and recommendations of the Environmental Protection Authority*. Environmental Protection Authority Bulletin 868, 1997. Perth.

Hamersley Iron Pty. Limited, (2000). Nammuldi-Silvergrass Iron Ore Project — Consultative Environmental Review, unpub.

Appendix 2

List of submitters

Organisations:

Aboriginal Affairs Department
Department of Conservation and Land Management
Department of Minerals and Energy
Department of Resources Development
Gurama Maliwartu Aboriginal Corporation
Shire of Ashburton
Water and Rivers Commission
Western Australian Museum

Appendix 3

Summary of identification of relevant environmental factors

Appendix 3: Summary of Identification of Relevant Environmental Factors

Preliminary Environmental Factors	Proposal Characteristics	Government Agency and Public Comments	Identification of Relevant Environmental Factors
BIOPHYSICAL			
Terrestrial Flora — Vegetation communities	Direct disturbance of 2 000 ha of vegetation through clearing and impacts on riverine vegetation through dewatering operations. Vegetation surveys have been carried out for most of the project areas. Three vegetation associations of local significance have been identified, these are: • B1-Tall woodland of *Eucalyptus camaldulensis/E. victrix* over *Acacia citrinoviridis*; • A3-*Eucalyptus leucophloia* and mixed shrubs over *Triodia wiseana/T. pungens*; and • A8-*E. leucophloia/Eucalyptus socialis* over *Triodia angusta.* Impacts on A3 and A8 due to clearing will be minor (< 2%). Drawdown of groundwater levels around and in Caves Creek will cause drought stress in phreatophytic vegetation. It is estimated that over a distance of about 2 km, (5-10%) of vegetation association B1 will become stressed and may die.	**WRC** The only area of concern with regard to dewatering operations at both sites is the possible impact on riverine vegetation along Caves Creek. The dewatering will impact on a 6 km stretch of creek line and possibly cause significant drought stress along 2 km of this. A commitment is made to monitor the impact of dewatering on the riverine vegetation along Caves Creek. However, no management strategy is given should tree deaths be more severe than expected. Is the hydraulic connection between the creek alluvial material and the BIF [Brockman Iron Formation] aquifer being dewatered such that it's not possible to use dewatering discharge for periodic irrigation/flooding of the creek opposite the Range Pit? **CALM** There is a large area of *Livistona* palm downstream of the discharge point. While it is probably too far away to be adversely affected (25 km), the possible effects of dewatering should be considered. Of the ore transport options, the conveyor option has the least environmental impact and is preferred.	Excluding association B1, which will be dealt with separately, the predicted impacts on vegetation are not expected to be of regional significance. Most vegetation associations will continue to be well represented in the survey areas after clearing associated with the project. Those associations where clearing will remove a substantial proportion of this type in the survey area, are known to be widespread in the larger region. Most vegetation of the area is not dependent on groundwater and will be unaffected by groundwater drawdown. It is acknowledged in the CER that the conveyor option has the least environmental impact, but that the final choice will be based on economics, long term planning requirements, and environmental considerations. Given that none of the ore transport options give rise to impacts which cannot be managed to an acceptable level, the final choice of an option is a decision which should be made under the planning elements of the project EMP/EMS. It is expected that this choice will be made in consultation with key government agencies such as CALM. The impacts of dewatering on riverine

Preliminary Environmental Factors	Proposal Characteristics	Government Agency and Public Comments	Identification of Relevant Environmental Factors
			vegetation (particularly association B1) are of concern and requires further evaluation. **Considered to be a relevant environmental factor and is discussed under the factor of "Riverine vegetation".**
Terrestrial Flora — Declared Rare and Priority Flora	Surveys of most project areas have been conducted. Five Priority 3 species were recorded. Only one of these, *Goodenia stellata*, will be directly affected. Two out of three populations of this species in the project area are near the mine pit and will be cleared. This species occurs in a range of other locations in the Pilbara. The other priority species are sufficiently distant from planned facilities for there to be no direct impact and for indirect impacts to be manageable through careful design and management.	No comments received.	There will be no impacts on Declared Rare Flora and impacts on Priority listed species can be managed to acceptable levels. The proponent has committed to the development of a project EMP which will enable the planning of infrastructure to acknowledge environmental constraints such as priority flora and avoid these where feasible. Additional surveys will be undertaken by the proponent for remaining unsurveyed areas before detailed designs are finalized. Appropriate Priority species flora will be included in rehabilitation areas. **Factor does not require further EPA evaluation.**
Terrestrial Fauna	Fauna of the project area is typical of that found in other areas in the Pilbara. Fauna will be directly affected through increased road kills, loss of habitat through clearing, creation of barriers to fauna movement by project infrastructure, and changes in the hydrological cycle due to		Although there will be some impacts on locally significant habitats there are not expected to be any regionally significant impacts on fauna. The proponent will manage impacts on fauna by: • minimising clearing of habitats to that which is feasible; • progressively clearing areas; • encouraging fauna colonisation through

Preliminary Environmental Factors	Proposal Characteristics	Government Agency and Public Comments	Identification of Relevant Environmental Factors
	dewatering operations.	**CALM** Of the ore transport options, the conveyor option has the least environmental impact and is preferred.	rehabilitation; and • by including fauna protection issues in the workforce induction programme. As discussed under the factor "Terrestrial Flora — Vegetation communities", it is appropriate to leave the final choice of ore transport options to the implementation of the project EMP and EMS. **Factor does not require further EPA evaluation.**
Terrestrial Fauna — Specially Protected (Threatened) Fauna	A number of species of conservation significance (either priority listed or with insufficient knowledge on distribution at this time) have been found or are expected to occur in the project area. For most species impacts will be restricted to a reduction in habitat and displacement from these areas. However, the mining area does contain mounds of the Pebble-mound Mouse (*Pseudomys chapmani*, Priority 4) and a maternity roost of the Ghost Bat (*Macroderma gigas*, Priority 3) occurs within 2.5 km of a mine pit.	No comments received.	It is noted that the taxonomic status of two species of reptile (*Ctenotus aff. helenae* and *Ctenotus add. robustus)*found in the project areas is unresolved at this time, but that the proponent is treating these as species of conservation significance in the meantime. From monitoring at its Marandoo Mine the proponent believes that impacts on the pebble-mound mouse will be restricted to those whose mounds are cleared. This will reduce local abundance but not significantly affect the regional population of this species. The maternity roost of the Ghost bat may be affected by light spill and noise from mining operations. The proponent has given a commitment to develop a specific management plan for the Ghost Bat which will monitor impacts on the bat and review management measures to be developed in the EMP. **Factor does not require further EPA**

Preliminary Environmental Factors	Proposal Characteristics	Government Agency and Public Comments	Identification of Relevant Environmental Factors
			evaluation.
Subterranean Fauna	On the basis of sampling work carried out to date, stygofauna do occur in the Marra Mamba aquifer of the project area and are also hypothesised to occur in the alluvium of Caves Creek. Stygofauna will be affected by the dewatering operations through the lowering of the water table around the pits and by pooling of water in Caves Creek.	**WA Museum** Subterranean fauna have been identified within the project area but the fauna is not placed within a hydrological context nor within the context of what is known of the Pilbara stygofauna. Sampling carried out to date in the Pilbara has found fauna unique to each separate calcrete area sampled and non-uniform fauna distributions within some of these areas. The limited sampling carried out for this project is unlikely to have revealed more than a small fraction of the contained stygal biodiversity. (a) The CER document lacks information on the vertical profile in the 'quality' of the groundwater. (b) With regard to water contaminants, stygofauna are especially vulnerable owing to the typically limited spatial distribution of each species and their sensitivity to contaminants. For example, Magnafloc LT35 is quickly bound to naturally occurring dissolved organic carbon which is the very basis of the food chain for stygofauna and which typically occurs at very low concentrations in groundwater. (c) The objective of Commitment 8 to understand population dynamics of the stygofauna is not plausible. The stygofauna sampling programme proposed will merely record the distribution and taxonomy of the fauna. However, there are complex issues involved in determining the impact on stygofaunal communities, as often subtle changes in groundwater conditions can have marked impacts on communities. While sampling is a necessary precursor to more detailed studies on the response of stygofaunal communities to impacts, it is not in itself adequate to resolve the management issues. (d) If the species diversity in the region of this project is comparable to that found in some other sites in the Pilbara, then the risk of species extinction resulting from extensive dewatering (Fig. 19 of the CER) operations is not inconsiderable. **WRC** The proposed strategy for dealing with the stygofauna issue is questionable. It would appear that the proponent's approach is to identify what Schedule 1 species are present. However, the strategy	**Considered to be a relevant environmental factor.**

Preliminary Environmental Factors	Proposal Characteristics	Government Agency and Public Comments	Identification of Relevant Environmental Factors
		does not describe what will occur if Schedule 1 species are found. It may be more practical to accept that all stygofauna that occur in the area impacted by dewatering will die but conduct a sampling program aimed at showing that those species to be killed (irrespective of whether they are Schedule 1 or not) also occur outside of the impacted area. This would ensure that mining activity does not cause the extinction of these species (no mater how common or unique) from the area (regional locality).	
Watercourses	The Silvergrass project area is adjacent to Caves Creek. The creek will be affected by dewatering operations and the construction of levees around the mine pits. Dewatering at Nammuldi will create semi-permanent flow in drainage channels. Drainage lines in the transport corridor could be affected by the construction of road or rail embankments.	**WRC** The concepts of artificial recharge and in-pit tailings disposal should be pursued and the Commission believes that the Nammuldi operations could serve as an excellent case study for further promotion of this approach elsewhere in the Pilbara. The idea of recharging water in Nammuldi Pit A is particularly attractive. **Public** The creation of wetlands by dewatering will cause an increase in mosquito populations. This will need monitoring in view of the potential for the increase in disease for workers.	The dewatering points at Nammuldi and Silvergrass will be designed to prevent erosion of the watercourses. Dewatering rates at Silvergrass are well within the maximum flow rates which naturally occur within the Caves Creek. Therefore the changes to the flow regime of the creek during operation should not have any long term impact on the creek. At Nammuldi, discharge into drainage channels will be necessary initially, but options to dispose of water via groundwater recharge will be investigated as pits become available. The EPA considers that recharge at Nammuldi is preferable, but accepts that a final decision should be made through the EMP/EMS process after a more detailed investigation of the feasibility and environmental benefits of groundwater recharge. Flood control levees at Silvergrass will result in a marginally longer time for flood waters to pass, but with little consequence to vegetation. The transport corridor will traverse defined drainage lines rather than areas subject to sheet flow. Culverts and down-slope water

Preliminary Environmental Factors	Proposal Characteristics	Government Agency and Public Comments	Identification of Relevant Environmental Factors
		CALM Of the ore transport options, the conveyor option has the least environmental impact and is preferred.	spreading systems will be able to be effectively used to maintain drainage patterns. Based on similar dewatering operations at the Yandi (HIY) mine, the proponent does not believe mosquitos will be a significant health issue. However, it will make qualitative assessments of mosquito populations and take necessary actions to ensure the health and safety of its workforce. As discussed under the factor "Terrestrial Flora — Vegetation communities", it is appropriate to leave the final choice of ore transport options to the implementation of the project EMP and EMS. **Factor does not require further EPA evaluation.**
Groundwater	Dewatering operations during mining will significantly lower the water table surrounding the pits. Groundwater modelling predicts groundwater drawdown to a distance of 300-1000 m at Nammuldi and to a distance of 3 km at Silvergrass. The water table is expected to re-establish to near original levels within two years of the end of mining.	**WRC** The CER covers all the relevant issues and it suggests some exciting management strategies. The main water related issue is the possible impact of dewatering on the riverine vegetation along a 2 km stretch of Caves Creek and the impact of the dewatering discharge on the creek vegetation. The commission provides the following more detailed comments. • Hamersley Iron Pty Ltd should be given full credit for exploring the concept of in-pit tailings disposal and artificial recharge of the localised BIF aquifers. • Is it possible that at some time during the life of the project the project water requirements will exceed that which could be supplied by dewatering? If so, where will the additional water be sourced from?	As a result of the proponent's decision to backfill pits, there are not expected to be any long-term impacts on groundwater levels. It is possible that water requirements may exceed dewatering in certain scenarios, but there also exist a number of alternative water balance schemes which would be considered before a new borefield would be requested. A detailed water balance will depend on the choice of processes (wet versus dry, the final mining schedule, and production rates). Potential shortfalls in water can be

Preliminary Environmental Factors	Proposal Characteristics	Government Agency and Public Comments	Identification of Relevant Environmental Factors
			remedied by altering the mining schedule, piping discharge water from Silvergrass, and maximising water return from the tailings. It is noted that the groundwater drawdown during operations is only of significance due to impacts on groundwater dependent vegetation. There are few other users of groundwater in the area and these will be maintained where necessary. **Considered to be a relevant environmental factor and is discussed under the factors of "Riparian vegetation" and "Subterranean fauna".**
Landform	Permanent changes to landform will include: • mine pits — 685 ha backfilled to above water table with establishment of vegetation on pit floors; • waste dumps — 600 ha, 40 m high, battered to 20° slope and revegetated; • out –of-pit tailings storage area — 290 ha and 8 m high; and rehabilitated • transport corridor cuttings and fill.	**CALM** It is questioned whether one metre of soil cover above the pre-mine water table is sufficient, and whether instead the soil cover should be at least one metre above the maximum water table? If one metre above the mean value is selected, appropriate species will need to be grown on these moister sites. **WRC** The Commission applauds the proponent's commitment to backfill the mine voids and agrees that the final backfill level be set once additional data is available regards potential capillary action. **DME** The proponent states that pits will be backfilled to at least 1 m above the level of the pre-mining mean water table and pit floors will be rehabilitated. The DME suggests that it may also be appropriate to batter the inner walls of the pits to a slope of 20° (or less) from the horizontal. These walls could then be rehabilitated in a similar fashion to waste dump slopes. This may negate the need for perimeter bunding at completion of mining of the pits. **Public** To what extent will evaporites be deposited downstream of the	The proponent has given a commitment to develop a detailed closure plan within two years of commissioning the project. Most of the comments can be addressed through the development of this plan. Backfilling the pits to 1 m above the pre-mine water table level is a major undertaking by the proponent primarily to address long-term impacts on groundwater. This os expected to be substantially achieved. However, there is some scope to further improve rehabilitation through further consideration of the exact level of backfilling. In its closure plan commitment (Commitment 5) the proponent specifically acknowledges that the final level will be reviewed taking into account capillary rise and mean water levels (to prevent the development of surface

Preliminary Environmental Factors	Proposal Characteristics	Government Agency and Public Comments	Identification of Relevant Environmental Factors
		discharge into Caves Creek? Will the formation of a hard crust on the dried out area, adversely affect revegetation? The Eastern Gurama people wish to be consulted during the development of the closure plan.	salinity). By this time the proponent will have carried out work to characterise the waste material in relation to its ability to facilitate or limit capillary rise. The proponent's proposal to backfill the pits is a significant undertaking in itself, but it also creates the potential for improved rehabilitation of the pit void as suggested by the DME. This potential should be fully evaluated in the closure plan. Crusting on the edges of discharge pools in Caves Creek will be removed by flushing whenever there is major creek flow event, and will therefore not cause any long term impacts on revegetation. The proponent has replied that it will consult with the Eastern Gurama people in the development of the closure plan. For mining proposals of this type and scale a decommissioning condition is routinely applied which requires the preparation of preliminary decommissioning plan early in the life of the project and a final detailed plan towards its end. The proponent's firm commitment to develop a closure strategy makes the first requirement redundant in this case. However, the requirement for a final plan remains (refer to draft Condition 7). **Factor does not require further EPA evaluation.**

Preliminary Environmental Factors	Proposal Characteristics	Government Agency and Public Comments	Identification of Relevant Environmental Factors
POLLUTION			
Particulates / Dust	Construction activities, mining, ore handling, ore transport, ore processing, and product handling can all generate dust.	No comments received.	Product handling at Dampier will be incorporated into the dust management systems at the proponent's Dampier operations. From recent experience the proponent believes that the Marra Mamba ore type is not especially dusty and therefore impacts on the Dampier airshed should be minimal. No asbestiform materials occur within the materials to be mined. Standard dust suppression measures will be applied to the mine site and processing facility. **Factor does not require further EPA evaluation.**
Greenhouse gases	Carbon dioxide (CO_2) will be the only significant greenhouse gas emission from the proposal. CO_2 will be generated by initial clearing of land, power requirements for mine and processing, emissions from earthmoving equipment, and ore transport. Approximately 200 kt(CO_2)/a will be produced.	**Public** With regard to Greenhouse Gas Emissions, there may be scope for the Eastern Gurama People to assist with mitigation measures, such as increased planting of suitable tree types. This concept needs further discussion and/or development with the people.	At the predicted emission levels this project will be a moderate contributor to State greenhouse gas emissions. Through Rio Tinto Limited the proponent (which is a wholly owned subsidiary of Rio Tinto Limited) was a founding signatory of the Greenhouse Challenge and has taken an active role in programmes since then. This proposal will be incorporated into Rio Tinto's emissions reporting and abatement programmes. The proponent advises that discussion with representatives of the Eastern Gurama People will occur as part of the Land Use

Preliminary Environmental Factors	Proposal Characteristics	Government Agency and Public Comments	Identification of Relevant Environmental Factors
			Agreement negotiations. **Factor does not require further EPA evaluation.**
Groundwater quality	Depending on the closure options the final mine void had the potential to expose groundwater to evaporation and thereby increased salinity. Seepage from tailings storage facilities can seep into the groundwater. The tailings are not contaminated with toxic substances. Only flocculants and coagulants will be added to the tailings material. Hydrocarbon spills can enter the groundwater.	No comments received.	The undertaking to backfill pits to at least 1 m above the level of the pre-mining water table addresses the major potential impact on groundwater quality. That of increased salinity due to increased rates of evaporation in the final pit void. The residual chemicals in the tailings (flocculants and coagulants) will be at a low level and are, by design, not particularly mobile in groundwater. Therefore no significant impacts on groundwater quality are expected. Proper management of hydrocarbons on the mine-site will be included in the project EMP. **Factor does not require further EPA evaluation.**
Surface water quality	Surface run-off from project areas may pick up pollutants and or high sediment levels. Dewatering discharge at both Nammuldi and Silvergrass will reflect groundwater quality in the aquifers being dewatered. In the early years of operation tailings decant water may be treated to remove sediment then disposed of off-site.	**Public** Will bunds constructed to a 100 year flood standard be sufficient to prevent release of contaminates into the drainage areas downstream of the project. A 150 year flood event occurred in 1975 (“Cyclone Joan”) and the bunds may not be adequate to prevent the flooding of fuel and ammonium nitrate storage areas during a similar event.	The siting of fuel and ammonium nitrate storage facilities will take into account the risk of flooding of these facilities. Sedimentation basin will be established to reduce sediment levels from surface run-off. Surface run-off from project areas will be handled and treated according to the risk of contamination within the area. The proponent recognises the need to prevent spillage of flocculants and

Preliminary Environmental Factors	Proposal Characteristics	Government Agency and Public Comments	Identification of Relevant Environmental Factors
			coagulants into the surface water systems. Any off-site discharge of water will be subject to licence conditions under Part V of the *Environmental Protection Act 1986*. These conditions will specify appropriate limits for pollutants likely to be generated on-site. **Factor does not require further EPA evaluation.**
Solid waste	About 750 Mt of waste rock will be generated, some of which will be used to back fill the mine pits. The remainder will be left as waste dumps. Due to the geology of the orebody, this material has little potential to generate acid mine drainage. No pyritic shales will be mined. About 2 Mt/a of tailings will be generated (if wet processing used). A number of options are proposed for the storage of tailings, these are: 5 in-pit disposal; 6 Central Thickened Discharge (CTD); and 7 impoundment within waste rock dumps. The tailings are not contaminated with toxic substances. Miscellaneous wastes (plastics, wood, tyres, domestic waste, etc.) not suitable for recycling will be	**DME** Although no acid producing material is expected to be mined, the DME would expect the proponent to compile an EMP to manage any acid producing material should it be encountered as mining progresses **WRC** It should be noted that effective dewatering of the tailings material is an important aspect of any in-pit tailings disposal operation.	The proponent has responded that if acid producing material is encountered a management plan will be developed. The final choice of Tailings Storage Facility has not yet been made. As a result no detailed plans for the location and design of the facilities has been put forward at this stage. The tailings material, being non-toxic, does not in itself present a high level of environmental risk. The key issues to be addressed by future design are therefore related to the location of the facility (for the CTD option) and the management of surface run-off from the facility. Based on characterisation of the environment of the project area so far, there does not seem to be any major environmental constraints to the location of a CTD facility. However, site-specific survey work would need to be reviewed when making a final decision. It would be appropriate for this to occur as part of the EMP/EMS process for the proposal. It is expected that as part of the site-selection

Preliminary Environmental Factors	Proposal Characteristics	Government Agency and Public Comments	Identification of Relevant Environmental Factors
	disposed of in a properly constructed and licensed landfill.		process under this process, that the relevant government agencies will be consulted. Management of run-off will specifically need to demonstrate that the facility will adequately contain sediments. This can be achieved through appropriate engineering of the facilities. This too could be reviewed as part of the EMP/EMS process. In addition, the proponent will require a Works Approval under Part V of the *Environmental Protection Act 1986* to construct the facility. **Factor does not require further EPA evaluation.**
Noise	Mining activities, operation of the processing plant, and transport of product will generate noise. However, the project area and transport routes are remote from residences.	No comments received.	The Nammuldi accommodation camp is 5 km from the Nammuldi plant and 3 km from Pit E. The Village will be 3.5 km further east of the Nammuldi Camp. Hamersley Station homestead is the nearest noise sensitive premises and is about 40 km from mining at Silvergrass. No noise impacts are expected. **Factor does not require further EPA evaluation.**

Preliminary Environmental Factors	Proposal Characteristics	Government Agency and Public Comments	Identification of Relevant Environmental Factors
SOCIAL SURROUNDINGS			
Aboriginal culture and heritage	Aboriginal people with an interest in the project area are the Eastern Gurama people and related family groups represented by the Maliwartu Aboriginal Corporation. Heritage surveys of some, but not all, of the project areas have been conducted. Some archaeological and ethnographical sites have either been identified through the limited survey work carried out to date, or are inferred to occur based on the limited data. The proponent has informed the EPA that specific information of enviro-cultural areas and the use of resources by the Eastern Gurama people is confidential and so predicted impacts cannot be provided in the CER.	**AAD** The proponent is maintaining high consideration of Aboriginal heritage and cultural issues. Generally a site avoidance strategy has been adopted to deal with Aboriginal sites of significance. However, it is stressed that in the instance where a site cannot be avoided it will be necessary for a Section 18 permit to be obtained in accordance with the *Aboriginal Heritage Act 1972.* **Public** There will need to be firm control of contractors employed by the proponent during the construction of project infrastructure. In the past, contractors have disturbed sacred sites and driven vehicles over sensitive environmental areas.	**Considered to be a relevant environmental factor.**

Appendix 4

Recommended Environmental Conditions and Proponent's Consolidated Commitments

Statement No.

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

NAMMULDI-SILVERGRASS IRON ORE PROJECT, 55 KM NORTH-WEST OF TOM PRICE

Proposal: The mining of Marra Mamba iron ore deposits at the Nammuldi (including some detrital ore) and Silvergrass areas, and basic processing of the mined material into a saleable iron ore product with a production rate up to 20 Million tonnes per annum. This includes transport infrastructure to connect the mining areas to an existing rail network to transport ore to the port of Dampier.

The proposal details are documented in Schedule 1 of this statement.

Proponent: Hamersley Iron Pty. Limited
Proponent Address*:* 152-158 St George's Terrace, PERTH WA 6837
Assessment Number*:* 1247
Report of the Environmental Protection Authority: Bulletin 997

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

Procedures

1 Implementation

1-1 Subject to these conditions and procedures, the proponent shall implement the proposal as documented in schedule 1 of this statement.

1-2 Where the proponent seeks to change any aspect of the proposal as documented in schedule 1 of this statement in any way that the Minister for the Environment determines, on advice of the Environmental Protection Authority, is substantial, the proponent shall refer the matter to the Environmental Protection Authority.

1-3 Where the proponent seeks to change any aspect of the proposal as documented in schedule 1 of this statement in any way that the Minister for the Environment determines, on advice of the Environmental Protection Authority, is not substantial, those changes may be effected.

2 Proponent Commitments

2-1 The proponent shall implement the consolidated environmental management commitments documented in schedule 2 of this statement.

2-2 The proponent shall implement subsequent environmental management commitments which the proponent makes as part of the fulfilment of conditions and procedures in this statement.

3 Proponent

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 in respect of the proposal.

3-2 Any request for the exercise of that power of the Minister referred to in condition 3-1 shall be accompanied by a copy of this statement endorsed with an undertaking by the proposed replacement proponent to carry out the proposal in accordance with the conditions and procedures set out in the statement.

3-3 The proponent shall notify the Department of Environmental Protection of any change of proponent contact name and address within 30 days of such change.

4 Commencement

4-1 The proponent shall provide evidence to the Minister for the Environment within five years of the date of this statement that the proposal has been substantially commenced.

4-2 Where the proposal has not been substantially commenced within five years of the date of this statement, the approval to implement the proposal as granted in this statement shall lapse and be void. The Minister for the Environment will determine any question as to whether the proposal has been substantially commenced.

4-3 The proponent shall make application to the Minister for the Environment for any extension of approval for the substantial commencement of the proposal beyond five years from the date of this statement at least six months prior to the expiration of the five year period referred to in conditions 4-1 and 4-2.

4-4 Where the proponent demonstrates to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority that the environmental parameters of the proposal have not changed significantly, then the Minister may grant an extension not exceeding five years for the substantial commencement of the proposal.

5 Compliance Auditing

5-1 The proponent shall submit periodic Compliance Reports, in accordance with an audit program prepared in consultation between the proponent and the Department of Environmental Protection.

5-2 Unless otherwise specified, the Chief Executive Officer of the Department of Environmental Protection is responsible for assessing compliance with the conditions, procedures and commitments contained in this statement and for issuing formal, written advice that the requirements have been met.

5-3 Where compliance with any condition, procedure or commitment is in dispute, the matter will be determined by the Minister for the Environment.

Conditions

6 Subterranean Fauna Sampling Plan

6-1 Within twelve months following the issuing of the formal authority to decision-making authorities under section 45(7) of the Environmental Protection Act 1986, or at least three years prior to commencing dewatering operations at either the Nammuldi or Silvergrass area, the proponent shall develop a Subterranean Fauna Sampling Plan for the respective area to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection and the Western Australian Museum.

The objective of this Plan is:

- to increase scientific knowledge about subterranean fauna to assist in the conservation of this element of the environment.

This Plan shall address:

1 subterranean fauna surveys of the areas to be affected by dewatering operations to assist in establishing the conservation significance of any species within the affected areas;

2 characterisation of subterranean fauna habitats to be affected by dewatering and identification of similar subterranean fauna habitats outside the affected areas;

3 subterranean fauna surveys of similar habitats outside the areas to be affected by dewatering operations to assist in establishing the conservation significance of fauna within the areas to be affected; and

4 specific measures to record and preserve biological information on any species collected in the project area.

6-2 The proponent shall implement the approved Subterranean Fauna Sampling Plan required by condition 6-1.

6-3 The proponent shall make the Subterranean Fauna Sampling Plan required by condition 6-1 publicly available, to the requirements of the Environmental Protection Authority.

6-4 The results from the Subterranean Fauna Sampling Plan shall be submitted to the Environmental Protection Authority and the Western Australian Museum.

6-5 Should the Environmental Protection Authority consider, based on the results of the Subterranean Fauna Sampling Plan, that its objective would be compromised, then the proponent shall develop an action plan to the requirements and timing of the Environmental Protection Authority.

7 Decommissioning Plan

7-1 At least six months prior to the anticipated date of decommissioning, or at a time agreed with the Department of Environmental Protection, the proponent shall prepare a Final Decommissioning Plan designed to ensure the site is left in a suitable condition, with no liability to the State, to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection.

The Final Decommissioning Plan shall address:

1 removal or, if appropriate, retention of plant and infrastructure;

2 rehabilitation of all disturbed areas to a standard suitable for the agreed new land use(s); and

3 identification of contaminated areas, including provision of evidence of notification to relevant statutory authorities.

7-2 The proponent shall implement the Final Decommissioning Plan required by condition 7-1 until such time as the Minister for the Environment determines that decommissioning is complete.

7-3 The proponent shall make the Final Decommissioning Plan required by condition 7-1 publicly available, to the requirements of the Environmental Protection Authority.

8 Performance Review

8-1 Each six years following the commencement of construction, the proponent shall submit a Performance Review to the Department of Environmental Protection:

- to document the outcomes, beneficial or otherwise;
- to review the success of goals, objectives and targets; and
- to evaluate the environmental performance over the six years;

relevant to the following:

1 environmental objectives reported on in Environmental Protection Authority Bulletin 997;

2 proponent's consolidated environmental management commitments documented in schedule 2 of this statement and those arising from the fulfilment of conditions and procedures in this statement;

3 environmental management system environmental management targets;

4 environmental management programs and plans; and/or

5 environmental performance indicators;

to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection.

Note: The Environmental Protection Authority may recommend changes and actions to the Minister for the Environment following consideration of the Performance Review.

[Note: Where a proposal is subject to an Agreement Act requiring a Triennial Report, the above condition should be modified to allow the Performance Review to coincide with a Triennial Report.]

Note

1 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.

Schedule 1

1. The Proposal

The proposal is to develop two iron ore deposits (Nammuldi and Silvergrass) near Hamersley Iron Pty. Limited's current Brockman No. 2 iron ore mine, 65 kilometres north-west of Tom Price. The project areas are indicated on the attached figures (Figures 1 and 2).

The main components of the project are:

- open-cut mines at Nammuldi (Marra Mamba, detritals) and Silvergrass (Marra Mamba);
- dewatering to access ore below the water table;
- an ore transport link from Silvergrass to Nammuldi;
- a wet or possibly dry processing plant at Nammuldi;
- crushing facilities at Silvergrass and at the eastern Nammuldi pits;
- tailings disposal (if wet processing occurs) into available mine void/s, plus a new tailings storage facility; and
- associated support infrastructure.

The rate of production of saleable ore will commence at 2-3Mt/a and could increase to about 20Mt/a.

Both deposits will involve mining below the water table, with approximately 80% of the mineable Marra Mamba ore being below the watertable. A substantial dewatering operation will be required during mining. To manage long-term impacts associated with mining below the water table, the proponent will backfill the mine pits with waste rock to at least 1 metre above the mean pre-mine water table level.

The proposal is early in its development phase and therefore no commencement date has been set. Provisional mine plans indicate a mine life of 10 years for Nammuldi and 7 years for Silvergrass. However, these estimates are dependent on the production rates and so mining may continue for up to 20 years.

Key Characteristics Table

Component	Project characteristic	Description
General	Area to be cleared	Around 2,000 hectares
Mine and mining	Pits and ore type	Nammuldi - Pits A, B, C/D, E and F (all Marra Mamba) and detritals near Pit F. Silvergrass - Range Pit, Valley Pit, Flats Pit - all Marra Mamba
	Area (mines and waste dumps)	About 1685 hectares: made up of mines 685 hectares, waste dumps 900 hectares (some waste will be returned to mine pits), haul roads 100 hectares
	Ore reserve	About 280 million tonnes (230 million tonnes of Marra Mamba and 50 million tonnes of detritals)
	Mining rates	Initially 2-3 million tonnes/annum and could increase to 20 million tonnes/annum
	Estimated mine life	15-20 years
	Ore below water table	About 80%
	Stripping ratio	3:1 (waste:ore) overall
	Waste rock disposal	About 750 million tonnes of waste rock to be generated. Some waste will be used to backfill voids to above pre-mine mean water table level, some used in construction works and the remainder left as out-of-pit waste dumps
	Pit voids	Voids to be backfilled to one metre above the mean pre-mine water table using waste ore and overburden. Pits will be backfilled to 575-581mRL at Nammuldi and 548-550mRL at Silvergrass
	Waste dumps	Waste dumps will be 40 metres high. Maximum batter slope of 20^{o} during rehabilitation.
	Proportion of waste to be backfilled	About 30%
Dewatering	General	Dewatering required to access below water table ore from most pits
	Arrangement	In-pit dewatering bores to achieve the bulk of dewatering, associated with in-pit sumps in the later stages of mining
	Combined rates	Maximum rate approximately 18 million litres /day
	Total volumes	Nammuldi about 31,000 million litres, Silvergrass about 30,000 million litres
	Discharge strategy	At Nammuldi, discharge will initially be into drainage lines, then to recharge via mined pit (if suitable pit available and it is feasible). At Silvergrass, discharge will be to Caves Creek
Processing and tailings	Plant	Wet or dry processing at Nammuldi, dry crushing plant at Silvergrass and a dry crushing plant around Pit E/F at Nammuldi.
	Tailings (if wet processing)	About 2 million tonnes/annum (dry), made up of clays and fine iron fraction – defined as high plasticity silt. Discharge into Brockman pits 1 & 3 and Nammuldi Pit B, plus a central thickened discharge facility
	Stockpiles	Product stockpiles at Nammuldi, crushed ore stockpile at Silvergrass
Infrastructure	Power	New extension off Dampier-Tom Price line
	Water	Dewatering will supply water for potable, processing and dust control purposes; decant water from tailings storage will supplement processing requirements
Transport	Ore from Silvergrass	Railway, haul road or conveyor
	Product transport	By rail to Dampier on existing rail network
Workforce	Workforce (approx.)	For construction about 400. Operations 150-190 on fly-in fly-out basis.
	Accommodation	Nammuldi Camp for construction, new Village for Nammuldi workforce

Schedule 2

Proponent's Consolidated Environmental Management Commitments

4 September 2000

NAMMULDI-SILVERGRASS IRON ORE PROJECT, 55 KM NORTH-WEST OF TOM PRICE (1247)

HAMERSLEY IRON PTY. LIMITED

Environmental Management Commitments (1247)

Commitment	Objective	Action	Phase	Sign-off (advice from)	Compliance
Commitment 1: Environmental Management Plan (EMP)					
The proponent will prepare and implement an EMP for the Project that will outline the: • environmental performance objectives for relevant environmental factors; • management of environmental impacts from construction and operation; • monitoring of key environmental aspects; • reporting and auditing procedures The EMP will be prepared in consultation with relevant Government agencies and will be subjected to a targeted public review.	Manage environmental impacts of the Project	Develop and implement EMP to manage the Project	Prior to construction	DEP (DME, WRC, CALM)	EMP developed
Commitment 2: Environmental Management System					
The proponent will develop and subsequently implement an Environmental Management System for the Project that incorporates the following elements: • environmental policy and associated corporate commitment • mechanisms and processes to ensure – planning to meet environmental requirements – implementation and operation of actions to meet environmental requirements – measurement and evaluation of environmental performance – review and improvement of environmental outcomes	Manage environmental impacts of the Project and fulfil requirements of all Project commitments and conditions	Develop and implement the EMS	Prior to commissioning (the EMP will be used during construction)	DEP	EMS developed and implemented
Commitment 3: Annual Environmental Reporting					
The proponent will include the Project in its consolidated annual and triennial environmental reporting to Government once construction commences	Report on the environmental performance of the Project and its compliance status with environmental requirements	Prepare and submit annual environmental report	By 30 March each year	DRD (DEP, DME, WRC, CALM)	Submission of AER each year

Commitment	Objective	Action	Phase	Sign-off (advice from)	Compliance
Commitment 4: Closure Plan					
The proponent will prepare a detailed closure plan for the Project. The plan will address closure actions to be taken toward: • mine voids • waste dumps • tailings storage facilities • transport linkage between Silvergrass and Nammuldi • processing plants • associated infrastructure and will provide the basis for the development of an eventual 'walk-away' closure strategy for the Project. As part of this closure plan, final backfill levels in pit voids will be assessed, taking account of mean water table levels and capillary rise relationships.	Prepare a detailed closure plan for the decommissioning and rehabilitation of the Project	Develop plan	Within two years of Project commissioning	DEP (DME, WRC)	Closure plan approved by the DEP
Commitment 5: Additional surveys – biological					
The proponent will undertake additional biological (flora, vegetation and fauna) surveys of those areas not already surveyed where Project infrastructure is planned, such as the tailings storage facility (central thickened discharge area), the Village and the power line from the Dampier - Tom Price line. If relevant, appropriate actions will be taken during design to avoid significant areas.	Identify , assess and avoid environmental impacts of development in areas not already surveyed	Undertake additional required biological surveys	Prior to construction	DEP (CALM)	Additional biological surveys and incorporation into design
Commitment 6: Riverine vegetation monitoring					
The proponent will develop and implement a riverine monitoring program to determine the extent of any impacts on vegetation that may occur as a result of dewatering the Silvergrass mine pits and from mine dewatering discharges into Caves Creek. It will also assess, and where appropriate implement, feasible options (such as periodic irrigation/flooding) to reduce significant impacts.	Assess and reduce the extent of any impacts on vegetation along Caves Creek through remedial actions	Monitor status of riverine vegetation	All	DEP (CALM, WRC)	Completion of monitoring and undertaking remedial actions
Commitment 7: Rare Fauna					
The proponent will prepare and implement a management plan for the Ghost Bat as part of the EMP, plus any fauna species that are present in the Project area which may be listed in future revisions of the Western Australian Rare and Endangered List or the Commonwealth Critically Endangered List.	Manage Ghost Bat and future listed Rare/Endangered fauna species	Prepare and implement management plans	Prior to construction/As required	DEP (CALM)	Plans approved and implemented

Commitment 8: Stygofauna					
The proponent will prepare and implement a co-ordinated program of stygofauna sampling within and around the Project area to improve the current understanding of stygofauna that occur in the Pilbara	Understand the distribution and population dynamics of stygofauna population and share the findings with the general research community	Undertake sampling	All	DEP (WAM, CALM)	Completion of sampling
Commitment 9: Caves Creek stream flow					
The proponent will monitor stream flows in Caves Creek and make the data available to the Water and Rivers Commission and utilise the data in project design	Improve understanding of Caves Creek flow regime for detailed design purposes	Establish monitoring facilities and utilise data	Pre-construction Ongoing	DEP (WRC)	Data obtained and utilised in project design
Commitment 10: Groundwater monitoring and modelling					
The proponent will prepare and implement a groundwater monitoring plan (including monitoring water levels in Palm Springs) and incorporate the outcomes to improve the groundwater modelling predictions	Improve confidence in the predictive modelling and dewatering strategy	Prepare plans, collect data and revisit model	Ongoing	DEP (WRC)	Refined numerical modelling
Commitment 11: Recharge options					
The proponent will investigate the feasibility of groundwater recharge options at Nammuldi for handling water generated from mine dewatering that will otherwise be discharged via surface drainage	Optimise recharge to local and regional aquifers	Conduct recharge feasibility studies	Ongoing	DEP (WRC)	Completion of studies
Commitment 12: Additional surveys – Aboriginal sites					
The proponent will involve the Maliwartu Aboriginal Corporation in additional archaeological and ethnographic surveys to identify sites, and their significance, within the Project area that are likely to be disturbed in accordance with a heritage survey protocol as agreed with the Maliwartu Aboriginal Corporation	Identify any heritage sites in those areas not already surveyed	Undertake additional surveys	Prior to construction	AAD	Additional surveys conducted
Commitment 13: Mechanism for future Aboriginal site surveys					
Additional Aboriginal site surveys will be undertaken in accordance with a heritage survey protocol as agreed with the Maliwartu Aboriginal Corporation	Agree on a survey protocol	Establish survey protocol	Prior to construction	The proponent/ Maliwartu	Agreed protocol in place

Commitment 14: Consultation on Section 18 application					
The proponent will consult with the Maliwartu Aboriginal Corporation and Eastern Gurama Elders on Aboriginal sites in the Project area before any Section 18 application is developed in keeping with an agreed protocol	Consult with the Maliwartu Aboriginal Corporation on sites	Conduct meaningful consultation	Prior to construction	The proponent/ Maliwartu	Project design minimises impact on sites
Commitment 15: Submission of Section 18 application					
The proponent will make a written application to the Minister for Aboriginal Affairs (for consideration by the Aboriginal Cultural Materials Committee) pursuant to the *Aboriginal Heritage Act* if any identified Aboriginal site (as defined in the Act) in the Project area is required to be disturbed.	Obtain consent to disturb nominated Aboriginal sites	Submit written application	Prior to construction	AAD	Consent issued by Minister
Commitment 16: Aboriginal social and cultural issues associated with the environment					
The proponent will consult with the Maliwartu Aboriginal Corporation (and the Native Title Claimants it represents) to identify and assess any social and cultural aspects of the physical and biological environment impacted. This will be addressed through the establishment of a Land Use Agreement.	Obtain agreement with the Native Title Claimants	Negotiate Land Use Agreement	Prior to construction	The proponent/ Maliwartu	Registration with NNTT

List of abbreviations:

AAD	Aboriginal Affairs Department
CALM	Department of Conservation and Land Management
DEP	Department of Environmental Protection
DME	Department of Minerals and Energy
DRD	Department of Resources Development
EMP	Environmental Managment Plan
EMS	Environmental Managment System
NNTT	National Native Title Tribunal
WRC	Water and Rivers Commission
WAM	Western Australian Museum
AER	Annual Environmental Report

Appendix 5

Summary of Submissions and

Proponent's Response to Submissions

Nammuldi Silvergrass Iron Ore Project

Consultative Environmental Review

Hamersley's responses to issues raised during public review of CER

MINE DEWATERING - IMPACTS ON VEGETATION

(d) The Water and Rivers Commission advises that the CER covers all the relevant issues and that it suggests some exciting management strategies. The main water related issue is the possible impact of dewatering on the riverine vegetation along a 2km stretch of Caves Creek and the impact of the dewatering discharge on the creek vegetation. The commission provides the following more detailed comments.

Comments noted. The potential impact of dewatering on the riverine vegetation along Caves Creek and the impact of dewatering discharge on the creek vegetation are addressed in Section 4.2.3 of the CER.

1.a) Hamersley Iron Pty Ltd should be given full credit for exploring the concept of in-pit tailings disposal and artificial recharge of the localised BIF aquifers. The concepts of artificial recharge and in-pit tailings disposal should be pursued and the Commission believes that the Nammuldi operations could serve as an excellent case study for further promotion of this approach elsewhere in the Pilbara. The idea of recharging water in Nammuldi Pit A is particularly attractive.

Comments noted.

1.b) Is it possible that at some time during the life of the project the project water requirements will exceed that which could be supplied by dewatering? If so, where will the additional water be sourced from?

Water requirements for the Project depend on whether a wet process is adopted, the final mining schedule, the production rate for the wet process plant and the amount of water make-up from the tailings storage facilities. There is potential for water requirements to exceed water supplied from dewatering under certain scenarios.

The mining schedule will be planned to provide sufficient water for processing requirements (if wet processing is adopted) from dewatering, while minimising mining costs through efficient mine planning. Hamersley will undertake further studies on water balances and (if required) alternative water sources. Options would include piping a portion of dewatering discharge water from Silvergrass; maximising water make-up from tailings; and a new borefield.

Should Hamersley be unable to maintain sufficient supply by adjusting the dewatering schedule and maximising water efficiencies (including return from tailings), an application will be made to the Water and Rivers Commission for a borefield licence to supply make-up water (likely to be around 4ML/d).

1.c) The only area of concern with regard to dewatering operations at both sites is the possible impact on riverine vegetation along Caves Creek. The dewatering will impact on a 6km stretch of creek line and possibly cause significant drought stress along 2 km of this. A commitment is made to monitor the impact of dewatering on the riverine vegetation along Caves Creek. However, no management strategy is given should tree deaths be more severe than expected. The only strategy appears to be that the natural, periodic flow within the creek will serve to keep the vegetation alive. Is the hydraulic connection between the creek alluvial material and the BIF aquifer being dewatered such that it's not possible to

use dewatering discharge for periodic irrigation/flooding of the creek opposite the Range Pit?

Commitment 6 has been revised to incorporate the assessment of feasible options to reduce significant impacts. The revised commitment is stated below. The revised summary of environmental commitments is attached.

Commitment 6: Riverine vegetation monitoring

Hamersley will develop and implement a riverine monitoring program to determine the extent of any impacts on vegetation that may occur as a result of dewatering the Silvergrass mine pits and from mine dewatering discharges into Caves Creek and assess feasible options to reduce significant impacts.

2. The Department of Conservation and Land Management notes that there is a large area of Livistona palm downstream of the discharge point. It is probably too far away to be adversely affected, but the effects of dewatering should be considered.

The CER (Section 3.2.1) notes that Palm Springs contains a regionally significant population of Millstream Palms (*Livistonia alfredii)*. However, as CALM suggests, the site is sufficiently remote from the effects of dewatering as to make any impact highly unlikely.

The nearest dewatering (at Silvergrass) is 30km away and has a relatively small predicted drawdown (Table 4.5 and Figure 19 of the CER). Although the exact site on Caves Creek for the discharge of dewatering from the Silvergrass pits is yet to be determined, it has been provisionally located about 5km west of the Range and Valley Pits (Page 15, Section 2.3.1 of the CER) about 25km from Palm Springs.

3. To what extent will evaporites be deposited downstream of the discharge into Caves Creek? Will the formation of a hard crust on the dried out area, adversely affect revegetation?

The area of ponding from discharges to Caves Creek will depend on the extent of rains in the catchment, the time of the season and the rate of dewatering and discharge from the Range and Valley pits. The outer edges of the ponding may develop evaporites and some crusting. The short duration of dewatering at the Silvergrass pits (three years each) and the periodic flushing from creek flow will alleviate the extent of evaporites and crusting. The impact on revegetation after cessation of discharges should be limited after the first creek flow that is expected to remove the crusting and evaporites.

4. The creation of wetlands by dewatering will cause an increase in mosquito populations. This will need monitoring in view of the potential for the increase in disease for workers.

There has been no significant increase in mosquito populations at Yandi where several wetlands have been created from dewatering discharges. The discharge point is about 5km from the mine pits at Silvergrass and about 4km from the planned infrastructure at Silvergrass. These distances will help alleviate any potential for health implications for the workforce based at Silvergrass. Hamersley will make qualitative assessments on the status of any mosquito populations from time to time and undertake necessary actions to ensure the health and safety of its workforce.

SUBTERRANEAN FAUNA

5. The Western Australian Museum raises the following concerns with regard to how the issue of subterranean fauna is dealt with in the CER document

5.a) Subterranean fauna have been identified within the project area but the fauna is not placed within a hydrological context nor within the context of what is known of the Pilbara stygofauna. Sampling carried out to date in the Pilbara has found fauna unique to each separate calcrete area sampled and non-uniform fauna distributions within some of these areas. The limited sampling carried out for this project is unlikely to have revealed more than a small fraction of the contained stygal biodiversity.

As stated in Section 3.2.2 of the CER (Page 35), the methodology for the 1999 and 2000 stygofauna sampling was discussed with state (Western Australian Museum: Bill Humphrey) and national (Australian Museum: Buz Wilson) specialists in this area. Input from these specialists was incorporated in the design and implementation of the stygofauna sampling program.

Further, the amount of stygofauna monitoring undertaken makes the area of the Project one of the most comprehensively monitored areas in the Pilbara. Some sites have now been monitored on four occasions. Additional monitoring of Nammuldi and Silvergrass was undertaken in May 2000. Further survey work and analysis is planned for mid to late 2000.

Until an adequate treatment of the taxonomy of the Pilbara stygofauna is available in the formal scientific literature, it will not be possible to place specimens in a regional context, nor to test the assertion that distributions are non-uniform. Hamersley is committed to further developing the understanding of Pilbara stygofauna through surveys and assistance to taxonomic or ecological studies, in concert with government and other Pilbara miners.

5.b) The CER document lacks information on the vertical profile in the 'quality' of the groundwater.

No evidence of vertical stratification in water quality was seen from groundwater studies. The groundwater quality measured in all bores sampled at Nammuldi and Silvergrass is described as fresh (Total Dissolved Solids [TDS] < 1000mg/L). At Nammuldi, the TDS in bores range between 340 and 600mg/L. At Silvergrass, the TDS in bores range between 720mg/L and 860mg/L.

Slight variations in water quality can be influenced by a combination of local permeability and proximity to the recharge zone (outcrop and/or creek alluvium). Further detail on the water quality profile will be investigated as part of the ongoing monitoring of the piezometer network.

5.c With regard to water contaminants, stygofauna are especially vulnerable owing to the typically limited spatial distribution of each species and their sensitivity to contaminants. For example, Magnafloc LT35 is quickly bound to naturally occurring dissolved organic carbon which is the very basis of the food chain for stygofauna and which typically occurs at very low concentrations in groundwater.

Commitment 1 (Table 5.1, Section 5) of the CER provides for an Environmental Management Plan (EMP). This EMP will address management of the tailings facilities, including containment of residual concentrations of flocculant/coagulants within the formed structures.

5.d) The objective of Commitment 8 to understand population dynamics of the stygofauna is not plausible. The stygofauna sampling programme proposed will merely record the distribution and taxonomy of the fauna. However, there are complex issues involved in determining the impact on stygofaunal communities, as often subtle changes in groundwater conditions can have marked impacts on communities. While sampling is a necessary precursor to more detailed studies on the response of stygofaunal communities to impacts, it is not in itself adequate to resolve the management issues.

By conducting repeat sampling (using the same sampling effort and techniques) Hamersley's monitoring programme will look at local abundance of stygofauna over time (ie population dynamics). This data will be a start in providing a basis for a factual assessment of how factors such as seasonality and its associated changes in water depth and chemistry affect the abundance and composition of the fauna.

The dynamic nature of the EMP will allow it to be amended to reflect any subsequent increase in the understanding of stygofauna ecology.

5.e) If the species diversity in the region of this project is comparable to that found in some other sites in the Pilbara, then the risk of species extinction resulting from extensive) dewatering (Fig. 19) operations is not inconsiderable.

Refer to responses to Issue 5.a) on lack of context for such statements.

6. The Water and Rivers Commission believes that the proposed strategy for dealing with the stygofauna issue is questionable. It would appear that the proponent's approach is to identify what Schedule 1 species are

present. However, the strategy does not describe what will occur if Schedule 1 species are found. It may be more practical to accept that all stygofauna that occur in the area impacted by dewatering will die but conduct a sampling program aimed at showing that those species to be killed (irrespective of whether they are Schedule 1 or not) also occur outside of the impacted area. This would ensure that mining activity does not cause the extinction of these species (no mater how common or unique) from the area (regional locality).

Refer also responses to Issues 5.a) to 5.e).

DECOMMISSIONING AND FINAL REHABILITATION

7. The Department of Conservation and Land Management questions whether one metre of soil cover above the pre-mine water table is sufficient, and whether instead the soil cover should be at least one metre above the maximum water table? If one metre above the mean value is selected, appropriate species will need to be grown on these moister sites.

Commitment 4 (Table 5.1 of the CER) indicates that Hamersley will develop a closure plan within two years of mine commissioning for the decommissioning and rehabilitation of the Project that will provide the basis for the eventual walk-away closure strategy. As part of this closure plan, Hamersley will make an assessment on the final backfill levels in pit voids, taking account of water table levels and the risk of capillary rise.

In preparing the closure plan, Hamersley will have available more water level data providing a clearer picture of the behaviour of the watertable. Hamersley has continued to monitor watertable levels since the completion of the hydrogeological investigation. The suggestion of backfilling to a metre above the maximum groundwater level will be considered during the closure plan development.

8. The Water and Rivers Commission applauds the proponent's commitment to backfill the mine voids and agrees that the final backfill level be set once additional data is available regards potential capillary action. It should be noted that effective dewatering of the tailings material is an important aspect of any in-pit tailings disposal operation.

Noted and agreed. Hamersley has been obtaining assistance in tailings management from MPA Williams and Associates and from Rio Tinto's Research and Technology Development group. This work is continuing.

9. The Department of Minerals and Energy (DME) notes that in Section 4.7.3 of the CER (post mining impacts), the proponent states that pits will be backfilled to at least 1 m above the level of the pre-mining mean water table and pit floors will be rehabilitated. The DME suggests that it may also be appropriate to batter the inner walls of the pits to a slope of 20° (or less) from the horizontal. These walls could then be rehabilitated in a similar fashion to waste dump slopes. This may negate the need for perimeter bunding at completion of mining of the pits.

Hamersley will consider this approach in developing a closure plan for government approval.

10. The Eastern Gurama people wish to be consulted during the development of the closure plan.

Hamersley will consult with the Eastern Gurama people in the development of the closure plan. Consultation will be undertaken in accordance with agreed processes to be developed under the Land Use Agreement currently being negotiated between Hamersley and the Maliwartu Aboriginal Corporation (representing the Eastern Gurama people).

ABORIGINAL HERITAGE AND CULTURE

11. The Aboriginal Affairs Department believes that the proponent is maintaining high consideration of Aboriginal heritage and cultural issues. It notes that generally a site avoidance strategy has been adopted to deal with Aboriginal sites of significance. However, it is stressed that in the instance where a site cannot be avoided it will be necessary for a Section 18 permit to be obtained in accordance with the Aboriginal Heritage Act 1972.

Noted and agreed. In the event that an Aboriginal site cannot be avoided, Hamersley will prepare and submit a Section 18 application for clearance from the Minister for Aboriginal Affairs. Hamersley has already made several commitments relating to Section 18 permits, namely:

Commitment 14: Consultation on Section 18 application

Hamersley will consult with the Maliwartu Aboriginal Corporation and Eastern Gurama Elders on Aboriginal sites in the Project area before any Section 18 application is developed in keeping with an agreed protocol.

Commitment 15: Submission of Section 18 application

Hamersley will make a written application to the Minister for Aboriginal Affairs (for consideration by the Aboriginal Cultural Materials Committee) pursuant to the *Aboriginal Heritage Act* if any identified Aboriginal site (as defined in the Act) in the Project area is required to be disturbed.

12. There will need to be firm control of contractors employed by the proponent during the construction of project infrastructure. In the past, contractors have disturbed sacred sites and driven vehicles over sensitive environmental areas.

During construction and operation, all Contractors employed by Hamersley will undergo a site induction containing environmental and Aboriginal heritage components.

The environmental component of the site induction will address general environmental awareness, flora and fauna protection and avoidance of particular areas. Keeping to defined tracks is one area that is stressed at induction, for both environmental and Aboriginal site protection. Site Environmental representatives enforce these issues during construction and operation.

The Aboriginal heritage component of the site induction will cover Aboriginal site protection and avoidance and the legal obligations under the *Aboriginal Heritage Act*. Any Aboriginal site located near construction areas that is to be protected will be fenced and/or sign-posted. This is supplemented with providing Aboriginal heritage awareness training from time to time. Hamersley and consultant archaeologists also conduct site clearance surveys with custodians and then provide advice direct to Contractors when ground disturbance is required beyond previously surveyed areas.

This strategy was most effective at Hamersley's most recent major construction project (Yandicoogina). The same approach will be adopted, subject to the requirements of the final Land Use Agreement.

OTHER

13. The Department of Minerals and Energy advises that although no acid producing material is expected to be mined, it would expect the proponent to compile an EMP to manage any acid producing material should it be encountered as mining progresses.

The issue of acid mine drainage is addressed in Section 4.11.3 of the CER. In the event that acid producing material is encountered, similar procedures as those that are in place at some

other Hamersley operations will be adopted. This approach will include the development of a management plan.

14. The Department of Conservation and Land Management advises that of the ore transport options, the conveyor option has the least environmental impact and is preferred.

Noted. A comparative assessment of the options was provided in Table 1.1 of the CER. From an environmental perspective, the conveyor option has some advantage; however, resolution of the final option for transporting ore from Silvergrass to Nammuldi will need to take economic and long term planning requirements into account, as well as environmental considerations.

15. The Shire of Ashburton asks that a copy of Council's Policy TD016 — Transient Workforce Accommodation be forwarded to the proponent and advises that any changes to the existing Nammuldi Camp and any new facilities would be subject to the requirements of the policy.

The Policy has been received and noted by Hamersley.

16. Will the EMS be approved by an external authority and will external audits of the proponent's compliance be undertaken? Often external audits can improve the existing system, especially as new or changing standards are developed or some non-compliances are ignored or considered minor.

Hamersley will establish an EMS that meets the ISO14001 standard. External certification of the EMS is not essential for an effective EMS; at this stage, Hamersley has no plans to seek certification of its EMS. Once rolled-out, periodic audits (internal or external) of the EMS and its effectiveness and implementation will be undertaken.

17. With regard to Greenhouse Gas Emissions, there may be scope for the Eastern Guruma People to assist with mitigation measures, such as increased planting of suitable tree types. This concept needs further discussion and/or development with the people.

The Land Use Agreement being negotiated between Hamersley and the Maliwartu Aboriginal Corporation will provide the avenue for this and other types of activity. Any such activity will need to provide real and lasting benefits.

18. Will bunds constructed to a 100 year flood standard be sufficient to prevent release of contaminates into the drainage areas downstream of the project. A 150 year flood event occurred in 1975 ("Cyclone Joan") and the bunds may not be adequate to prevent the flooding of fuel and ammonium nitrate storage areas during a similar event

The degree of acceptable risk was set at a 100 year design event. The structure will be designed so that they will be stable and floodwaters do not overtop embankments.

Fuel and ammonium nitrate storage facilities have not yet been sited at Silvergrass, but the risk of inundation will be taken into account in the siting of these facilities.

19. The Department of Resources Development (DRD) supports the whole-of-project approach to environmental approval of this type of mining, but notes that under the Iron Ore (Hamersley Range) Agreement Act 1963 the proponent is required to submit more detailed development proposals. Such proposals would still be subject to the provisions of the Environmental Protection Act 1986. The proposals would include an updated Environmental Management Plan that the DRD believes may on occasions be subject to targeted public review, but which would not require formal assessment.

Comments noted.

20. The Department of Environmental Protection (DEP) believes that the linkage between environmental data collection and the management of impacts should be made clearer in the commitments. (issue abbreviated)

Amended commitments attached.