Yandicoogina iron ore mine and railway

Hamersley Iron Pty. Limited

Report and recommendations
of the Environmental Protection Authority

Environmental Protection Authority
Perth, Western Australia
Bulletin 809
April 1996

THE PURPOSE OF THIS REPORT

This report contains the Environmental Protection Authority's environmental assessment and recommendations to the Minister for the Environment on the environmental acceptability of the proposal.

Immediately following the release of the report there is a 14-day period when anyone may appeal to the Minister against the Environmental Protection Authority's report.

After the appeal period, and determination of any appeals, the Minister consults with the other relevant ministers and agencies and then issues his decision about whether the proposal may or may not proceed. The Minister also announces the legally binding environmental conditions which might apply to any approval.

APPEALS

If you disagree with any of the contents of the assessment report or recommendations you may appeal in writing to the Minister for the Environment outlining the environmental reasons for your concern and enclosing the appeal fee of $10.

It is important that you clearly indicate the part of the report you disagree with and the reasons for your concern so that the grounds of your appeal can be properly considered by the Minister for the Environment.

ADDRESS

Hon Minister for the Environment
12th Floor, Dumas House
2 Havelock Street
WEST PERTH WA 6005

CLOSING DATE

Your appeal (with the $10 fee) must reach the Minister's office no later than 5.00 pm on 18 April, 1996.

Environmental Impact Assessment Process Timelines

Date	Timeline commences from receipt of full details of proposal from proponent for public review	Time (weeks)
20/11/95	Proponent document released for public comment	
18/12/95	Public comment period closed	4
2/1/96	Issues raised during public comment period summarised by EPA and forwarded to the Proponent	2
15/1/96	Proponent response to the issues raised received	2
4/4/96	EPA reported to the Minister for the Environment	12

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Summary and recommendations

This report and recommendations provides the Environmental Protection Authority's advice to the Minister for the Environment on the environmental acceptability of the proposal by Hamersley Iron Pty Limited (the proponent) to develop the Yandicoogina Iron Ore Mine and Railway.

The proposed mine site is located in the Hamersley Ranges of the Central Pilbara region of Western Australia. The project involves the establishment of an open cut mine, associated mine infrastructure, and the construction of a 90 kilometre section of rail to link the mine with Hamersley Iron's existing rail network.

The deposit to be mined is known as the Channel Iron Deposit, which is within the major aquifer in the area.

BHP Iron Ore has an existing operation along the Channel Iron Deposit, and has received approval from the Minister for the Environment to develop a second mine. This assessment has therefore, also considered the cumulative impact of this proposed third mine along the Channel Iron Deposit.

A number of environmental topics generated by the proposal were considered by the Environmental Protection Authority. From these, the Environmental Protection Authority has identified the major environmental issues requiring detailed evaluation as:

- impacts of mining on the groundwater and those elements of the environment dependent upon it, particularly phreatophytic vegetation;
- the potential for the proposal to adversely impact on surface water systems, particularly Marillana Creek;
- the preparation and implementation of an appropriate monitoring and management programme; and
- the probable rehabilitation and decommissioning scenarios for the operation.

The Environmental Protection Authority considers that the major environmental issues identified during the assessment could be adequately managed through the proposal design and the proponent's environmental management commitments.

Although the proponent has made a commitment to prepare an Environmental Management Programme, the Environmental Protection Authority considers that the programme for the management and monitoring of environmental impacts should also include the provision for regular review. This review should specifically address the implementation of the management programme, and its effectiveness in achieving the objectives upon which the Environmental Protection Authority's assessment is based.

The Environmental Protection Authority also considers it important that the rehabilitation and decommissioning strategy be identified as early in the project life as possible, so that rehabilitation can be best integrated with mine planning.

Following evaluation of the major issues, the Environmental Protection Authority has concluded that the proposal is environmentally acceptable subject to the proponent's commitments and the recommendations in this assessment report.

Recommendation No.	Summary of recommendations
1	That the proposal is environmentally acceptable, subject to the successful implementation of the proponent's commitments (included in Appendix 4 of this report).

2	That the proponent should prepare and implement an Environmental Management Programme which includes the provision for regular review of the EMP.
3	That the proponent should prepare and implement a plan which describes the process for decommissioning and rehabilitation of the lease and which manages salinity in the mined out pits and any regional effects from mining the channel iron deposit, including development of a 'walk away' solution.

1. Introduction and background

1.1 Purpose of this report

This report and recommendations provides the Environmental Protection Authority's (EPA's) advice to the Minister for the Environment on the environmental acceptability of the proposed Yandicoogina Iron Ore Mine and Railway. The proposal is situated in the Central Pilbara region of Western Australia, approximately 90 kilometres north west of Newman.

1.2 Background

Hamersley Iron Pty Ltd (Hamersley) as the nominated proponent for the project, proposes to develop an open-cut mining operation on Exploration Licences 47/6 and 47/7.

The location of the project, shown in Figure 1, is approximately 90 kilometres north-west of Newman and 280 kilometres south of Port Hedland.

As is evident from Figure 1, the Pilbara region of Western Australia supports a large number of iron ore mining operations.

The iron ore deposit proposed for mining occurs within the Channel Iron Deposit (CID), a single, continuous, high grade orebody in excess of 70 kilometres long, which infills a palaeodrainage system, and forms the major aquifer in the area.

A number of tenements are held over the CID by BHP Iron Ore (BHPIO) and Hamersley (see Figure 2). In 1991 BHPIO commenced operations of an open cut iron ore mine known as Yandi E2, approximately 12 kilometres west of Hamersley's proposal area. This operation mines the CID and consequently affects the same aquifer systems potentially affected by Hamersley's operation. In December 1995, the Environmental Protection Authority reported on a proposal by BHPIO to duplicate that operation at the Central Mesa 1 and 2 mines (EPA, 1995). The Minister for the Environment has subsequently released a Statement that this proposal can now be implemented. The current proposal by Hamersley therefore represents the third operation of this type along the Channel Iron Deposit.

In view of the substantial scale of the proposal, the requirement for dewatering during construction and operational phases, the potential for rare and endangered flora and fauna, and the uncertainty of environmental impacts in the long term, the EPA determined that the proposal should be formally assessed. Hamersley submitted a Consultative Environmental Review (Hamersley, 1995) following guidelines provided by the Department of Environmental Protection (DEP) on behalf of the EPA. The Consultative Environmental Review (CER) was released for a four week public review period ending 18 December 1995.

1.3 Structure of this report

This document has been divided into 7 sections.

Section 1 describes the historical background to the proposal and its assessment, and describes the structure of this report. Section 2 briefly describes the proposal; more detail is provided in the proponent's Consultative Environmental Review (Hamersley, 1995). Section 3 explains the method of assessment and provides an analysis of submissions received on the proposal.

Section 4 includes the evaluation of the key environmental issues associated with the proposal. In each sub section, the objectives of the assessment and the policy and technical framework relating to that issue are defined. The likely effect of the proposal, the advice to the Environmental Protection Authority from submissions, and the proponent's response to submissions are discussed.

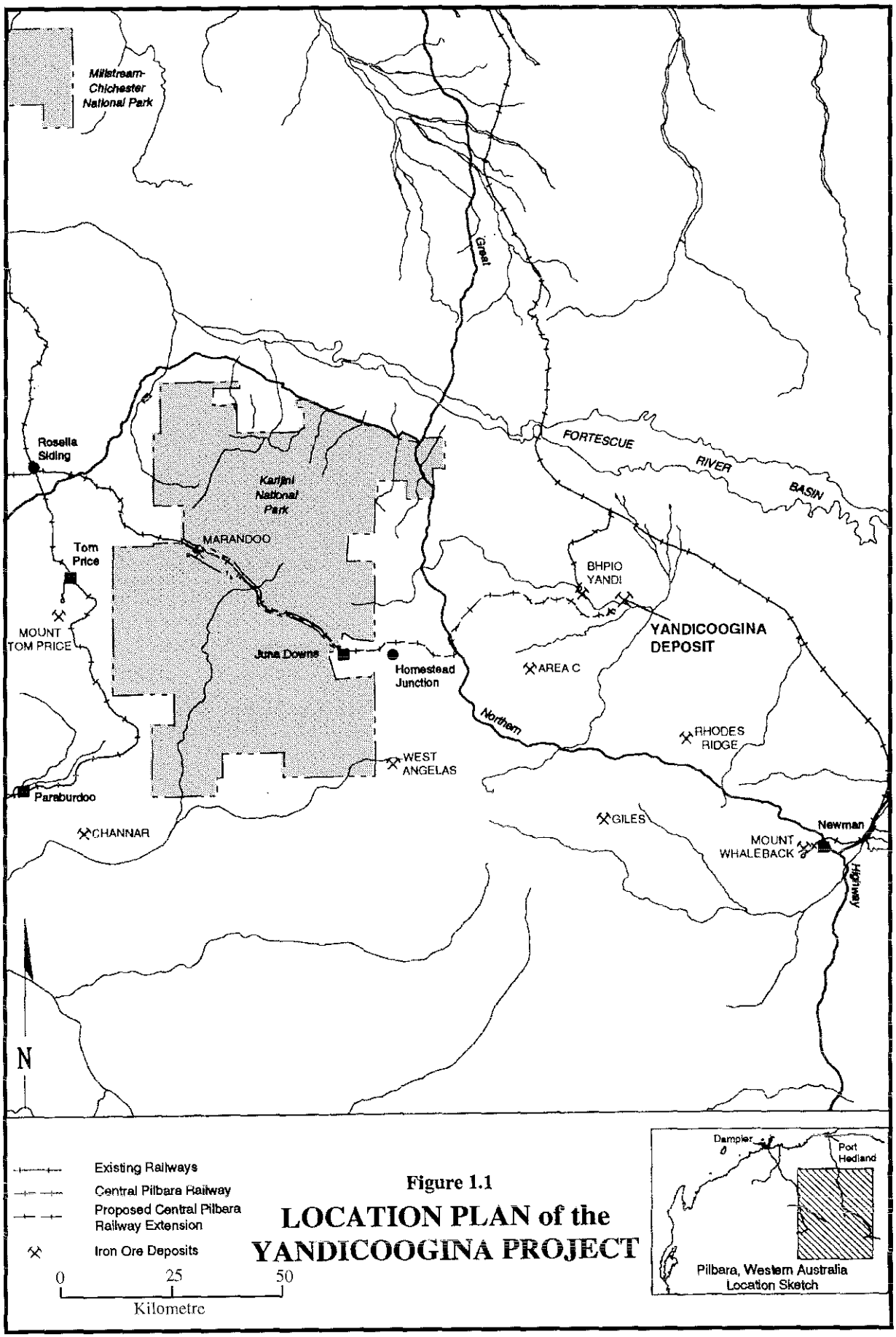


Figure 1. Location plan of the Yandicoogina project. (Source: Hamersley, 1995)

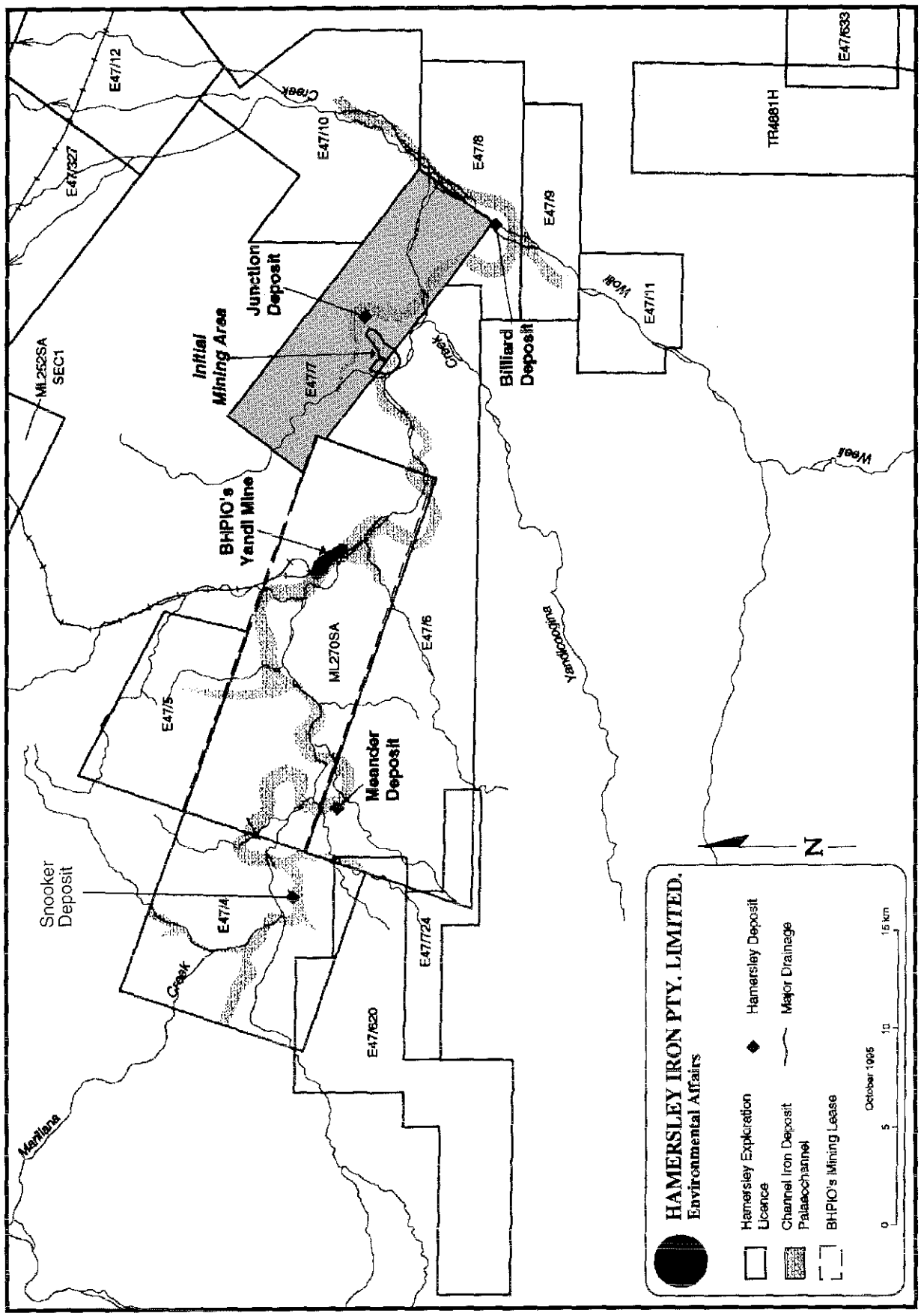


Figure 2. Mineral tenements over the CID. (Source: Hamersley, 1995)

The adequacy of the proponent's response is considered in terms of project modifications and environmental management commitments in achieving an acceptable outcome. The Environmental Protection Authority's analysis and recommendations with respect to the identified issues are contained in this section. Where inadequacies are identified, recommendations are made to achieve the environmental assessment objectives.

Section 5 summarises the conclusions and recommendations. Section 6 describes the recommended environmental conditions. References cited in this report are provided in Section 7.

2. Summary description of proposal

The proposal requires the construction of conventional mine support facilities, the establishment of an open cut mining operation, construction of a 90 kilometre rail section, and a conveyor system to link the rail loadout facilities with the crushing and screening plant. The proposed mine layout is illustrated in Figure 3, and the proposed railway alignment is shown in Figure 4. Additional details regarding the proposal can be obtained from the proponent's CER (Hamersley, 1995).

The resource to be mined is known as the Channel Iron Deposit (CID) which infills an ancient palaeodrainage channel, and forms the major aquifer in the area. As 70% of the ore to be mined occurs below the water table, a significant dewatering operation is required. Key features of the proposal are summarised below.

Summary of key characteristics associated with the mining proposal

(sourced from Hamersley, 1995)

Aspect	Characteristic of the proposal
Initial mining rate	5 - 10 Mt/a
Design capacity	15 Mt/a
Mine pit characteristics	65 m deep (approx.); 40 m below present water table. 70% of the orebody is below the water table, which must be lowered by 40 metres over a 2 kilometre section.
Dewatering requirements	30,000 m^3/day (initially) reducing to 10, 000 - 15,000 m^3/day (maintenance)
Minesite water requirements to be met from dewatering (dust suppression, domestic requirements)	< 5,000 m^3/day
Dewatering discharge	10,000 m^3/day (maintenance)
Proportion of overburden to be placed out of pit	15 %
Proportion of void to be filled with overburden	40 - 50 % of pre-mine volume
Initial clearing for mine	40 - 50 hectares
Area cleared at end of mine life	300 hectares
Vegetation impacts from associated infrastructure, particularly railway	900 hectares

Aspect	Characteristic of the proposal
Associated transport infrastructure	90 km railway section from rail loadout to Juna Downs 3 km conveyor from mine site to rail loadout
Associated minesite infrastructure	Construction camp and mining village Relocated airstrip Offices and workshop Explosives stores Communications hut
Best case scenario for long term impacts on riverine vegetation (post mining)	No eventual loss of riverine tree stands as annual recharge of the alluvial aquifer through rainfall and surface flow provides sufficient water for trees
Worst case scenario for long term impacts on riverine vegetation (post mining)	Trees dependent on water in the CID die within the area of vegetation situated in Marillana Creek - CID association either side of the mine pit. Regionally less than 4% of the creekline. Physical extent confined to patches within an area of approx. 100 hectares.
Distance to nearest pastoral station homestead	25 km
Distance to mine accommodation village (closest residents)	5 km
Marillana Creek catchment area (above Hamersley's proposal area)	1, 900 km^2 (approx.)
Weeli Wolli Creek catchment area (including. the Marillana/Yandicoogina catchment)	4, 150 km^2 (approx.)
Fortescue Valley catchment area	31, 200 km^2 (approx.)
Channel Iron Deposit aquifer, estimated throughflow	2, 800 m^3/day (approx.)
Shallow alluvial aquifer, estimated throughflow	10 m^3/day

3. Identification of environmental issues

3.1 Method of assessment

The purpose of the environmental impact assessment process is to determine whether a proposal is environmentally acceptable, or under what conditions it could be environmentally acceptable.

The environmental impact assessment process for this proposal followed the administrative procedures shown in Appendix 1.

The first step in the assessment method was the identification of the potential environmental issues requiring consideration. A list of topics (or possible issues) was identified by the Department of Environmental Protection, on behalf of the Environmental Protection Authority, through the preparation of guidelines. These guidelines were referred to the proponent,

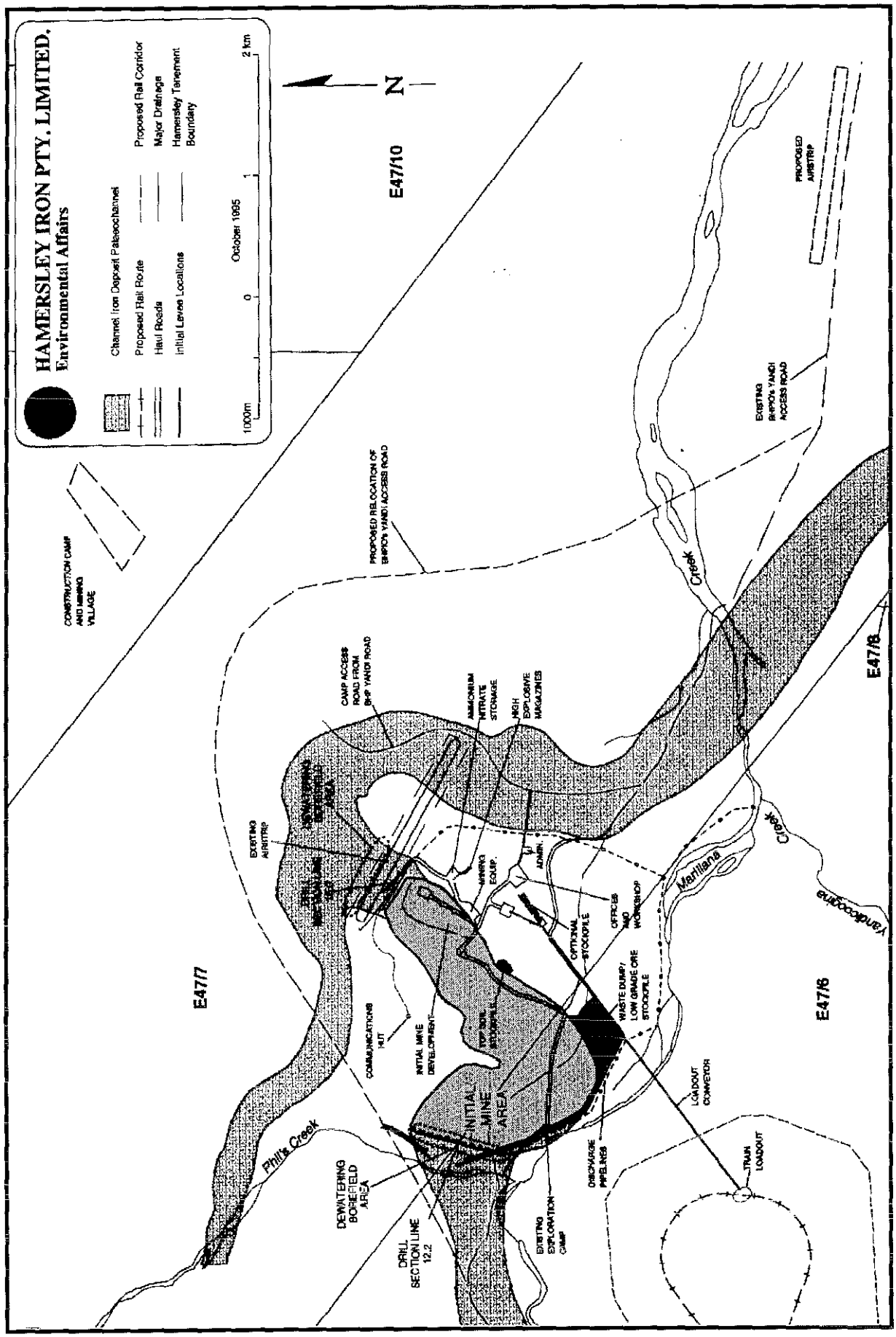


Figure 3. Conceptual plan of mine facilities. (Source: Hamersley, 1995)

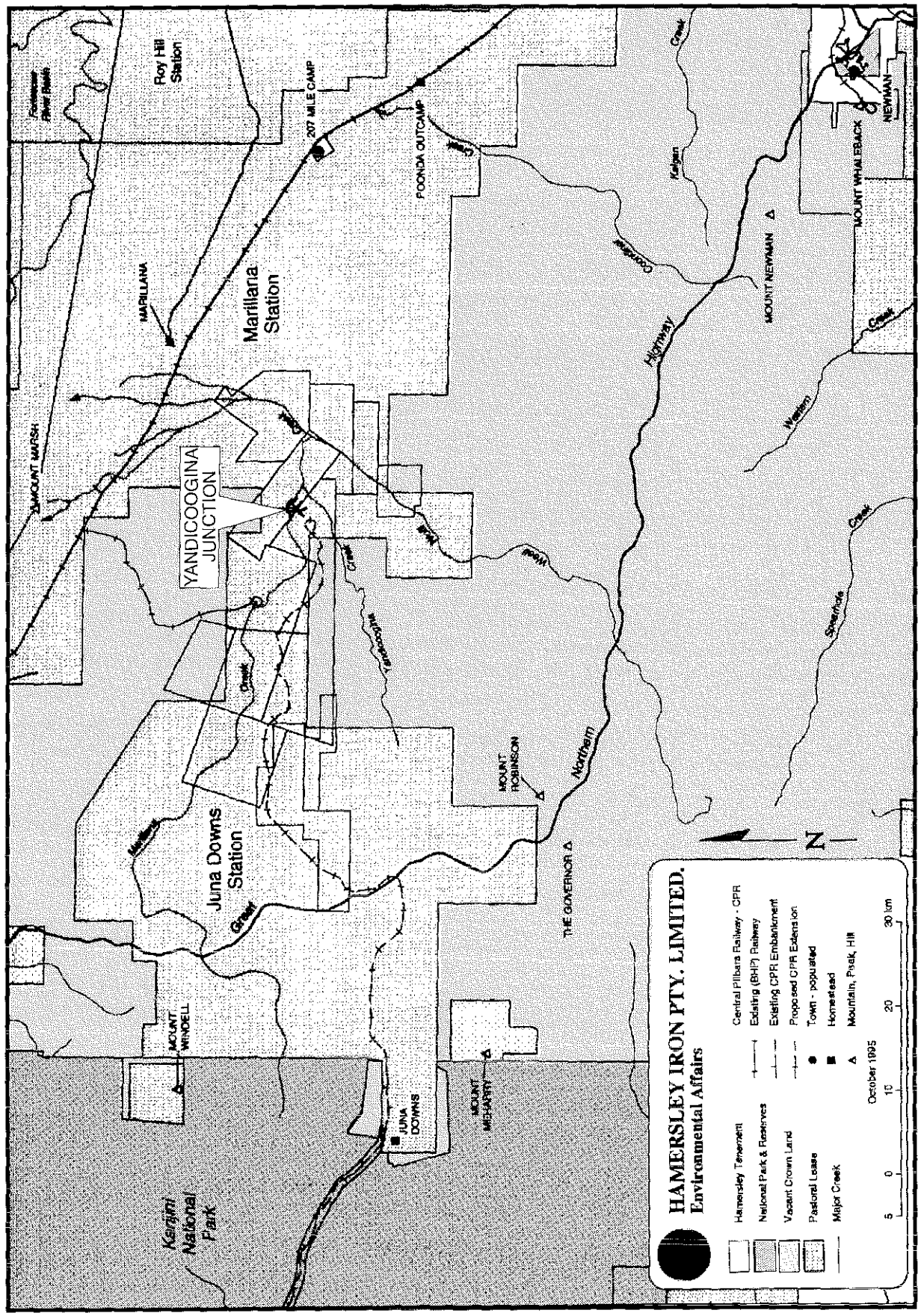


Figure 4. Proposed route of the Central Pilbara railway extension. (Source: Hamersley, 1995)

relevant agencies and interest groups for comment prior to being given to the proponent in a final form.

The proponent then considered these topics during the preparation of the CER through the identification of potential impacts and devising environmental management strategies.

The CER was then reviewed to ensure that each topic had been discussed in sufficient detail prior to its release for public and government agency comment. The proponent's CER was available for public review for four weeks between 20 November 1995 and 18 December 1995, during which five submissions were received.

Following completion of the public review period, the responses received were summarised by the Department of Environmental Protection. This process can raise additional environmental topics to be considered by the proponent.

Hamersley was invited to respond to matters raised in the summary of submissions. Appendix 2 contains the summary of the submissions and the proponent's response to those submissions. The list of submitters is included in Appendix 3.

By this stage in the assessment 13 topics had been identified, of varying environmental significance. The Environmental Protection Authority considered all the topics and identified those that were not environmentally significant or did not require further evaluation by the Environmental Protection Authority. Often these topics can be addressed by other agencies or have been adequately addressed by the proponent's commitments. The remaining topics were considered to be issues of environmental significance that required further evaluation by the Environmental Protection Authority.

For each environmental issue, the environmental impacts of the proposal, and the proponent's environmental management commitments, were evaluated in the context of the Environmental Protection Authority's assessment objective and relevant policy and technical information. The complete list of the proponent's consolidated environmental management commitments is included in Appendix 4 of this report. If the commitments achieve the assessment objectives, there is no need for the Environmental Protection Authority to make recommendations to the Minister for the Environment on that issue. Where the proposal has unacceptable environmental impacts, the Environmental Protection Authority can either advise the Minister for the Environment against the proposal proceeding, or make recommendations to improve the environmental acceptability of the proposal.

Limitation

This evaluation has been undertaken using information currently available. The information has been provided by the proponent in the CER and supplementary documentation, by DEP officers utilising their own expertise and reference material, by utilising expertise and information from other State government agencies, information provided by members of the public and contributions from EPA members.

The Environmental Protection Authority recognises that further studies and research may affect the conclusions. Accordingly, the Environmental Protection Authority considers that if the proposal has not substantially commenced within five years of the date of this report, then such approval should lapse. After that time, further consideration of the proposal should occur only following a new referral to the Environmental Protection Authority.

3.2 Public and agency submissions

Comments were sought on the proposal from the public, interest groups and local and State government agencies. During the public review period five (5) submissions were received. A summary of these submissions was forwarded to the proponent for their response (Appendix 2). Of the five submissions received, 4 were from State government agencies.

The principal topics of concern raised in the submissions were:

Biophysical Impacts

- changes to landform;
- potential impacts on surface water systems;
- impacts on groundwater, including the Fortescue Valley groundwater system;

Pollution Potential

- dust;

Social Surroundings

- impacts on Aboriginal heritage;
- regional issues/cumulative impacts;

Other

- Environmental Management Programme and appropriate monitoring; and
- decommissioning and rehabilitation.

The Environmental Protection Authority has considered the submissions received and the proponent's response as part of the proposal.

3.3 Review of topics

3.3.1 Identification of topics

Thirteen topics were raised during the environmental impact assessment process including those topics identified in the guidelines for the CER, subsequent consultations and the submissions described above. The topics are as follows:

Biophysical Impacts

- changes to landform;
- impacts on local and regional groundwater systems;
- impacts on surface water systems;
- impacts on vegetation;
- impacts on fauna and fauna habitat;

Pollution Potential

- dust;
- noise;
- blasting;
- domestic waste and sewage;

Social Surroundings

- impacts on Aboriginal heritage;
- regional issues and potential cumulative impacts;

Other

- Environmental Management Programme and appropriate monitoring;
- decommissioning and rehabilitation.

The Environmental Protection Authority has evaluated the above topics and considers that a number of them can be managed by the proponent in accordance with their environmental management commitments and in compliance with Department of Environmental Protection regulations and guidelines (see Table 1). The topics which do not require further evaluation by the Environmental Protection Authority are discussed below. The remaining topics become issues requiring Environmental Protection Authority evaluation.

3.3.2 Identification of issues requiring EPA evaluation

Biophysical impacts

Changes to landform

The proposal involves the mining of a pit extending approximately 60 metres below the existing ground level, and approximately 40 metres below the present water table. After two years of mining, the pit would cover an area of approximately 24 hectares, although at the end of the mine life, a total area of approximately 300 hectares would have been affected.

The proposal also involves changes to the surface landform with the establishment of

- topsoil and waste rock dumps - over an area of approximately 16 hectares (after two years) to a height of no more than 20 metres; and
- a railway embankment - 90 kilometres in length, elevated 0.5 to 1.5 metres above the flood plain and requiring 340, 000 m^3 of borrow material.

The main concerns raised in submissions relate to how much overburden is to be backfilled into the pit and the possible need to backfill the pit to a level above the groundwater level.

The significant environmental issue is the effect on regional groundwater rather than the change in landform thus the landform changes do not require separate evaluation by the Environmental Protection Authority.

Similarly the main environmental issues associated with the placement of the railway embankment is the impact on vegetation and the landform change itself does not require separate evaluation by the Environmental Protection Authority.

Impacts on local and regional groundwater systems

Dewatering around the pit would result in a 40 metre reduction in groundwater levels in the aquifer during mining. After mining the groundwater level would be higher than the level of fill in the final void.

The main government agency concerns identified with dewatering were the effects on the alluvial aquifer associated with Marillana Creek, the Channel Iron Deposit (CID) aquifer in the palaeochannel where mining would occur, and the basement aquifer beneath the CID. The CID is recharged during streamflow events by seepage through the alluvium of the creek beds. Due to its position in the central part of the syncline, the CID is also inferred to receive some recharge from the basement Weeli-Wolli formation at those points where the underlying aquifers are crossed by the CID (A J Peck and Associates Pty Ltd, 1995).

There were also public concerns on the effect of the remaining void on regional groundwater quality following decommissioning. The Channel Iron Deposit ultimately recharges the Fortescue Valley groundwater system while Marillana Creek contributes surface flow to the Fortescue Marsh. Submissions expressed concern on the effect on groundwater throughflow and salinity in the aquifer downstream from the decommissioned pit including the impact on the Fortescue Valley deep aquifer system.

This topic has been identified as an issue requiring evaluation by the Environmental Protection Authority.

Impacts on surface water systems

The introduction of landform changes, such as haul roads and bunds and in particular the railway embankment will affect surface drainage characteristics.

The discharge from mine dewatering into Marillana Creek (initially a maximum of 30, 000 m^3 per day reducing to approximately 10, 000 m^3 per day) will change the flow regime in Marillana Creek.

The long term lowering of groundwater through evaporation from the pit may influence streamflow.

Government agency comments indicated there was the potential for changes in the quality and quantity of surface water as a result of the proposal. Public comments sought more information on the likely effects of the dewatering release to Marillana Creek or the regional impacts of the dewatering regime on the Weeli Wolli Creek system and the Fortescue Valley system.

These surface water changes (and their consequential effects on issues such as revegetation) were considered to warrant further evaluation by the Environmental Protection Authority.

Impacts on vegetation

The establishment of the Yandicoogina project would impact on vegetation through:

- direct disturbance as a result of clearing for the mine and construction of infrastructure;
- changes to surface drainage characteristics which would particularly affect areas of mulga woodlands;
- changes to groundwater availability as result of dewatering for mining and the subsequent discharge of mine dewatering to Marillana Creek.

Submissions requested clarification of the extent of riverine vegetation likely to be affected by the proposal, and the possibility of rain shadow effects from the railway construction on mulga communities.

Although no Declared Rare Flora species have been identified within the project area, the vegetation management and monitoring strategies proposed require evaluation.

This topic has been identified as an issue requiring evaluation by the Environmental Protection Authority.

Impacts on fauna and fauna habitat

The development of the mine pit, overburden disposal area and establishment of mine infrastructure would require clearing and disturbance to some 300 hectares of fauna habitat. The construction of the railway would involve disturbance to an additional 900 hectares of habitat. The void remaining at the cessation of mining could lead to the establishment of additional habitat types.

Only one gazetted rare fauna species is likely to be directly affected by the project's development, that being the Pebble-mound mouse. Hamersley has an existing research and translocation programme for this species which would be extended to include the Yandicoogina area in advance of construction and mining.

The general measures proposed by Hamersley to minimise impacts on fauna and fauna habitat require evaluation by the Environmental Protection Authority.

Pollution Potential

Dust

This topic was included in the guidelines for the preparation of the CER, and was also raised in one submission.

The submission requested further detail regarding the proposed management of dust within the processing facilities and during product haulage through Karijini National Park.

The potential for dust lift off during product transport is not expected to be significant due to the low train speeds and relatively high moisture content of the ore. The potential for dust from transport operations to adversely affect vegetation is further discussed in Section 4.1.

Detailed dust management and monitoring measures will be included in the Environmental Management Programme to be prepared by the proponent to the satisfaction of the Minister for the Environment. Dust associated with processing facilities would also be addressed within the Department of Environmental Protection's works approval and licensing provisions under the *Environmental Protection Act* (1986). No further evaluation of this topic is required by the Environmental Protection Authority.

Noise

Adverse noise impacts are potentially associated with the development of any mining proposal. The nearest residents to the mine would be located at the mine accommodation village, 5 kilometres from the mine site.

Noise management has been addressed by the proponent in sections 6.2.5, 6.7 and 6.13 of the Consultative Environmental Review, and compliance with the Noise Abatement (Neighbourhood Annoyance) Regulations is a requirement.

Further evaluation of this topic by the Environmental Protection Authority is not required.

Blasting

During mine development, there will be an on-going requirement for blasting as part of routine mining operations.

The nearest residents to the mine would be located at the mine accommodation village, 5 kilometres from the mine site.

Blasting management has been addressed by the proponent in Section 6.7 of the CER, and the environmental impacts of blasting operations are not expected to be significant.

Further evaluation of this topic by the Environmental Protection Authority is not required.

Domestic waste and sewage

One submission requested additional detail regarding the proposed management of domestic wastes, particularly with regard to their proximity to Marillana Creek. The proponent has clarified this in its response to submissions by indicating that the construction/mining village (which would have the higher nutrient load) would be located 4.5 km from Marillana Creek. The cumulative impact of an additional two sewage treatment systems within the Yandicoogina area is expected to be negligible.

Matters associated with this topic can be addressed through the Department of Environmental Protection's works approval and licensing requirements and the requirements of the Health Department of Western Australia.

Further evaluation of this topic by the Environmental Protection Authority is not required.

Social Surroundings

Impacts on Aboriginal Heritage

The Department of Aboriginal Affairs expressed concern regarding the desirable timing for conducting the assessment for sites along the railway line, and the extent of community consultation to be undertaken by the proponent.

Hamersley has clarified these matters in their response to submissions (questions 4.1 and 6.5). In addition, the proponent must comply with the provisions of the *Aboriginal Heritage Act* (1972).

The Environmental Protection Authority considers that the predicted impacts of the mine and railway on Aboriginal heritage values can be adequately managed through processes outside the *Environmental Protection Act* (1986).

Further evaluation of this topic by the Environmental Protection Authority is not required.

Regional issues and potential cumulative impacts

The proposal by Hamersley Iron represents potentially the third such mining operation along the Channel Iron Deposit. BHP Iron Ore has an existing mining operation on the CID (Yandi E2), and in January 1996 received approval from the Minister for the Environment to duplicate that operation in the area of Central Mesas 1 and 2.

One public submission suggested that the cumulative impact of mining proposals in the region was not being adequately considered, and that the possibilities for the sharing of infrastructure between Hamersley Iron and BHP Iron Ore needed to be addressed.

As the final pit designs for Hamersley's proposal, and for those of BHP's are likely to lead to the creation of a series of open water bodies along the CID, the regional implications of the project's development, particularly on groundwater, require evaluation by the Environmental Protection Authority.

This topic has been identified as an issue requiring evaluation by the Environmental Protection Authority.

Other

Environmental Management Programme and appropriate monitoring

The development of a mining operation of this scale requires the implementation of a comprehensive programme of environmental management and monitoring to ensure that the impacts of the project are appropriately managed during all project phases.

Consideration of an adequate Environmental Management Programme and appropriate monitoring requires Environmental Protection Authority evaluation.

Decommissioning and rehabilitation

The Environmental Protection Authority has in past assessments recognised that rehabilitation management should not impose short or long term costs on the community of Western Australia. This is particularly important when the probable success of rehabilitation cannot be evaluated in the short to medium term.

The proponent has indicated that backfilling of the pit to a level above the water table at the completion of mining would not be feasible. This would result in the formation of an open void, with subsequent implications for the stability of the post-mining landform and effects on the regional groundwater quality.

A number of submissions raised concerns regarding the long term regional implications of a series of open voids which could be allowed to fill with water.

The issue of decommissioning and rehabilitation requires Environmental Protection Authority evaluation.

3.3.3 Summary

Table 1 summarises the process used by the Environmental Protection Authority to evaluate the topics raised during the environmental impact assessment process. The table identifies the topics, the relevant proposal characteristics, and comments received from specialist government agencies and the public. If a topic is considered environmentally significant it becomes an issue and is further evaluated by the Environmental Protection Authority (as summarised in Table 2). Section 4 of this report provides the detail of this evaluation.

Topics	Proposal characteristics	Government Agency Comments	Public Comments	Identification of issues
Biophysical Impacts				
Changes to landform	Mining pit approx. 60 m below ground, approx. 40 m below water table. Overburden disposal areas of 16 hectares. Railway embankment 90 km length, elevated about 1 m above the flood plain.	Quantity of overburden to be placed in the pit and height of backfill to be maximised (DME).	Pit should be backfilled to a level above groundwater level.	Pit backfilling evaluated as part of groundwater impacts. Railway embankment evaluated as part of vegetation impacts. No further evaluation by EPA required.
Impacts on local and regional groundwater systems	Dewatering and the creation of voids will impact upon groundwater quality, levels, and direction of flow during all mining phases. The Channel Iron Deposit (CID) aquifer ultimately recharges the Fortescue Valley groundwater system. Marillana Creek contributes surface flow to the Fortescue Marsh.	Clarification is required of the likely effect of mining on the alluvial, Channel Iron Deposit , and basement aquifers and on the relationships between these aquifers; as well as groundwater drawdown, throughflow and salinity (DME, DEP).	Impact of the remaining void on regional groundwater quality following decommissioning. Effect on groundwater throughflow and salinity in the aquifer downstream from the decommissioned pit, including the impact on the Fortescue Valley deep aquifer system.	EPA evaluation of local and regional groundwater impacts required.
Impacts on surface water systems	The location of haul roads and bunds, will impact upon surface flow characteristics. The railway embankment has the potential for significant impact on surface water flow characteristics. Discharge of mine dewatering to Marillana Creek.	Potential for impacts on the quality and quantity of surface water in these systems (DME). Consideration needs to be given to low level drainage in the area of extensive mulga flats where the railway crosses Great Northern Highway (CALM).	Regional impacts to the Weeli Wolli Creek system and Fortescue Valley system.	Effects on water quantity and quality warrant EPA evaluation. Drainage modification evaluated as part of vegetation impacts.

Table 1. Identification of issues requiring Environmental Protection Authority evaluation

Topics	Proposal characteristics	Government Agency Comments	Public Comments	Identification of issues
Impacts on vegetation	Direct disturbance, dewatering, and discharge of mine dewatering will impact upon vegetation during all phases. In low lying areas to the west, the railway could cause rain shadow effects on vegetation by intersecting sheet flow.	Clarification of the extent of riverine vegetation likely to be affected, and the expected drawdown in these areas is required (DME).	Area has significant remnant vegetation. Mulga stands are biologically unique. Rain shadow on mulga in the western extent of the rail corridor could be significant.	Impacts of the proposal on vegetation requires EPA evaluation.
Impacts on fauna and fauna habitats	Mine pit development, overburden disposal area and mine infrastructure will require clearing and disturbance of habitat (300 ha in total). Some new habitat, (open water) will form in the decommissioned pit. Railway construction involves disturbance to 900 ha.		Rehabilitation should ensure suitable habitat is re-established.	EPA evaluation required.
Pollution Potential				
Dust	Mining and transport activities will generate dust.		Insufficient detail regarding dust suppression measures proposed for the plant and conveyor. Dust impacts on vegetation from product haulage through Karijini National Park.	Dust associated with processing facilities covered by DEP's works approval and licensing. Further EPA evaluation not required.
Noise	Mining activities will increase ambient noise levels. Nearest residents 5 km away at mine village.			Noise limits covered by Regulations. Further EPA evaluation not required.
Blasting	Mining operations will involve blasting. Nearest residents are at the mine village, 5 km from the mine site.			Blasting limits covered by DEP's works approval and licensing requirements. Further evaluation by EPA not required.

Table 1. Identification of issues requiring Environmental Protection Authority evaluation (cont'd)

Topics	Proposal characteristics	Government Agency Comments	Public Comments	Identification of issues
Domestic waste and sewage	Domestic wastes and sewage discharge could pollute the environment.		Insufficient detail provided regarding management of this issue.	Addressed by DEP's works approval and licensing requirements and the requirements of the Health Dept. Further EPA evaluation not required.
Social surroundings				
Impacts on Aboriginal heritage	Activities associated with mining, railway construction and increased human presence, could disturb Aboriginal sites.	The Department of Aboriginal Affairs expressed concern regarding when the assessment for sites would occur, and the extent of community consultation.		Managed in accordance with *Aboriginal Heritage Act* and addressed in proponent responses 4.1 & 6.5. Further EPA evaluation not required.
Regional issues and potential cumulative impacts	This mine would be the third open cut iron ore mine approved on the CID. Other proposals, including from other proponents, will be proposed in the future and may also proceed. A number of existing and proposed mines also exist in other areas of the Pilbara Region of WA.	DRD is currently reviewing infrastructure proposed in the context of overall development in the central Pilbara. The objective of the review is to plan routes for multi-user service corridors to avoid dissection of the area by railways, roads etc serving the individual projects.	The cumulative impact of mining proposals in the region is not being considered. There should be greater consideration of sharing of infrastructure. The regional implications of a series of open voids which could be allowed to fill with water has not been addressed.	EPA evaluation required.
Environmental monitoring				
Environmental Management Programme (EMP) and appropriate monitoring	An EMP is to be developed to include all aspects of environmental management and monitoring for the project.		Details of the EMP should be included within the CER.	EPA evaluation required.
Decommissioning				
Decommissioning and rehabilitation	Residual longer term impacts at the completion of mining operations at Yandicoogina will be mainly associated with the stabilisation of post-mining landforms and hydrological impacts.	The regional implications of a series of open voids which could fill with water should be addressed (CALM).	The regional implications of a series of open voids which could be allowed to fill with water has not been addressed. Rehabilitation along rail line.	EPA evaluation required.

Table 1. Identification of issues requiring Environmental Protection Authority evaluation (cont'd)

The issues identified in Table 1 as requiring further evaluation by the EPA are:

- impacts on local and regional groundwater systems;
- impacts on surface water systems;
- impacts on vegetation;
- impacts on fauna and fauna habitat;
- regional issues and potential cumulative impacts;
- Environmental Management Programme and appropriate monitoring; and
- decommissioning and rehabilitation.

4. Evaluation of key environmental issues

4.1 Impacts on local and regional groundwater systems

Objective

To minimise the short term effects caused by dewatering, and to protect the environment from significant long term impacts resulting from the decommissioning of the mine pit.

Policy information

Past EPA assessment

In its recent assessment of BHPIO's Yandi Central Mesa 1 and 2 proposal, the EPA concluded that although there remained a lack of full scientific certainty regarding the impact of mining on groundwater systems, data collection to date suggests that the potential impacts of mining on local and regional groundwater systems are likely to be manageable in the short term while mining is proceeding. The EPA recognised that the consequences to these systems of decommissioning the mine were less well understood, and that there was a requirement for further data collection and monitoring during the life of mining to verify modelling predictions (EPA, 1995).

Government working group

To date, the Government approach to mining below the water table in the Pilbara has been coordinated through an inter-departmental committee, the Pilbara Iron Ore Environmental Management Committee, which has the objective of co-ordinating and reviewing environmental management of the Pilbara iron ore industry.

The Minister for Resources Development has recently sought agreement from the Ministers for the Environment and Mines, for the establishment of a working group to develop strategy options for mining below the water table in the Pilbara. The working group would consult with industry and interest groups and would make recommendations to Government on how to manage the issue.

Pilbara Regional Water Resources Review

The Pilbara Regional Water Resources Review Interim Report (Water Authority of Western Australia, 1995), indicates that there does not appear to be a lack of water resources in the region that is likely to impede the development of new industries in the Pilbara. However, the final report will address the issue of groundwater and surface water resources further and no definitive conclusions can be drawn from the interim report.

Technical information

The requirement for dewatering in advance of mining and the creation of a void which will remain at the completion of mining, will impact upon groundwater quality, levels, and direction of flow during all mining phases.

A comprehensive description of the hydrology and hydrogeology of the area has been provided in Section 4.1.4 of the proponent's CER (Hamersley, 1995). The Channel Iron Deposit ultimately recharges the Fortescue Valley groundwater system, and Marillana Creek contributes surface flow to the Fortescue Marsh.

During Mining

The dewatering operation would result in a drop in groundwater levels by 40 metres along a 2 kilometre section of the CID. Mining is proposed in a hairpin section of the CID where it is not overlain by the alluvial aquifer system associated with Marillana Creek. Groundwater levels would be lowered not only in the CID aquifer, but also in the stream bed alluvial deposits and adjacent Weeli Wolli formation.

The magnitude of the decline at any point will decrease from the pit upstream towards Phil's Creek, and downstream towards Marillana Creek (see Figure 3). It is expected that there would be no significant change of groundwater level beyond each of these creek crossings (Hamersley, 1995).

Post mining

Dewatering and wastewater discharge will cease after the completion of mining. Groundwater within the CID will continue to flow towards the mine void forming areas of wet soil or lakes within the void. Water in these lakes would be supplied by direct rainfall and seepage from the remaining CID and basement rocks. Water levels in the final void would vary seasonally and from year to year depending on the balance between inflows (from the CID and basement rocks) and outputs (from evaporation).

After mine dewatering operations and subsequent discharge to the creek alluvium ceases, groundwater levels in this aquifer will fall due to a combination of transpiration, drainage to the underlying CID, and possible drainage to basement rock.

The salinity of water in the void will be greater than that in the CID prior to mining due to evaporation from the water surface. Salinity will also vary depending on the balance of water inflows and evaporation. In the worst case, if there is no groundwater flow from the void, salinity will increase until dense saline water flows into the CID. An important factor affecting water salinity is the amount of seepage which it will receive from basement rocks. The rate of seepage will be included in models to estimate future salinity (Hamersley 1995).

Any escape of saline waters from the decommissioned mine pit would occur through density driven processes, where the more dense and saline water would migrate at depth through the groundwater system. Studies undertaken by BHPIO, and reported on in EPA Bulletin 802 (EPA 1995), have demonstrated that the Marillana/Weeli Wolli Creek groundwater system discharges to the deeper saline Fortescue Plain aquifer sub-system of the Fortescue Valley. As a result of this, the addition of potentially salinised water from the Marillana/Weeli Wolli Creek system is unlikely to impact on the water quality of this regional system.

Comments from key agencies / interest groups

Clarification was requested on the likely effect of mining on the alluvial, Channel Iron Deposit, and basement aquifers, as well as groundwater drawdown, throughflow and salinity. A number of submissions raised concerns regarding the potential long term impact of the void on groundwater quality following mine decommissioning.

Salinisation of aquifers, reduced flow in aquifers, and potential cumulative impacts arising from the development of exposed water bodies in the mined out pits were raised in submissions. Protecting the water resource for the long term sustainability of interests other than mining,

such as pastoralism, horticulture and tourism as well as the long term responsibilities of mining companies, were also concerns.

Response from the proponent

The final salinity of the void will be affected by the filling strategy used. Assuming a uniform filling approach, and the best current knowledge of the hydrogeology, the salinity within the void is predicted to be about 13, 000 mg/L (Hamersley 1996).

Hamersley will continue to evaluate the effects of decommissioning the mined pit on Marillana Creek and the CID to further understand the hydrogeological system in order to develop long term management strategies. The hydrogeological model being developed will assist in the appropriate design of the final void to minimise long term impacts on the local and regional groundwater resources.

Hamersley has made a number of commitments regarding this issue including:

- continuing evaluation of the impact of mining on the hydrogeology in order to develop and evaluate options for long term management that are compatible with BHPIO (Commitment 3);
- establishing groundwater monitoring bores (Commitment 4);
- further data collection and development of a model for the final void to minimise the long term impacts of mining on local and regional groundwater resources (Commitment 5); and
- groundwater management during and post mining within the EMP (Commitment 8).

Environmental Protection Authority Evaluation

The Environmental Protection Authority recognises that there remains a lack of full scientific certainty regarding the impacts to local and regional groundwaters from mining the Yandicoogina iron ore deposit.

Data collection during the life of the BHPIO Yandi E2 mine has indicated that mining has not appeared to have an adverse impact on the quality of groundwater during the operational phase (EPA 1995). The likely consequences on groundwater quality as a result of decommissioning a mining operation of this type, and the retention of an open void are less well understood. The proponent has, however, put forward some predictions based upon regional groundwater modelling.

Further data collection and refinement of groundwater modelling predictions is required before the consequences of the operation in the long term, and appropriate management measures, can be predicted with adequate certainty. The proponent has committed to undertake this work, and to report on these results to both the Pilbara Iron Ore Environmental Management Committee and the State.

The Environmental Protection Authority considers that the proponent's commitments and management details contained in the CER are adequate to minimise the short term effects caused by dewatering, and to protect the environment from significant long term impacts resulting from the decommissioning of the mine. Other aspects of decommissioning the project area are discussed in Section 4.7.

4.2 Impacts on surface water systems

Objective

Minimise adverse impacts on the quality and quantity of surface water.

Technical information

Physical changes to the land surface as a result of the construction of haul roads, bunding around the pit, and construction of the railway embankment, have the potential for significant changes to surface water flow characteristics.

The discharge of minesite dewatering during mine preparation and the mining operation would lead to the creation of a permanent pool of water within Marillana Creek. Much of the discharge water would be lost through seepage to the underlying strata, primarily the CID at those points where it underlies Marillana Creek, during normal mine operating conditions (ie, maintenance dewatering rates). Surface water may be present for several kilometres downstream of the discharge point.

The discharge would sustain normal flow, or greater, in the creek alluvium and the Channel Iron Deposit, below the area where Marillana Creek overlies the CID (see Figure 2). The presence of permanent water within Marillana Creek as a result of dewatering discharge would lead to the establishment of an ecosystem dominated by regional species tolerant of permanent water. After discharge ceases, the species that would have established during dewatering would become stressed and die. Following the completion of mining, the vegetation along the water course would eventually revert to the seasonally wet ecosystems, currently found in this area of Marillana Creek.

For the life of BHPIO's dewatering operation (40 years, compared with 20 years for Hamersley's) it is expected that water levels in Marillana Creek upstream of Hamersley's dewatering point would be maintained by discharges from BHPIO (Hamersley, 1995).

Comments from key agencies / interest groups

One submitter requested more detail from Hamersley in relation to the impacts that the release of water from dewatering might have in creating unseasonal water flow, containing higher dissolved oxygen content, changing the pH and salinity levels, thereby affecting the seasonal fluctuations within the lower reach pools rich with macrobiotic organisms.

A number of submissions requested clarification of the potential impact of the dewatering discharge regime on the quality and quantity of surface water within the regional Weeli Wolli Creek system and the Fortescue Valley system.

Response from the proponent

The proponent has pointed out that there is no significant wetland or pool downstream along either Marillana Creek or Weeli Wolli Creek between the mine area and the top end of the Fortescue Marshes. Consequently it is not expected that there is a potential for the project to impact on water quality within 'lower reach pools'.

The most significant area of the Weeli Wolli Creek system is Weeli Wolli Springs, which is located approximately 11 kilometres upstream of the intersection of the CID and Weeli Wolli Creek and 17 kilometres upstream of the junction of Yandicoogina Creek and Weeli Wolli Creek. Detailed hydrogeological investigations commissioned by the proponent have indicated that the potential for the project to adversely impact on Weeli Wolli Creek or Weeli Wolli Springs would be negligible.

The proponent has made a number of commitments regarding the management of potential impacts on the quality and quantity of surface water systems. These include:

- monitoring of the alluvium to record surface water levels from the pre-construction phase onwards (Commitment 4);
- management and monitoring of surface water as a result of changes to the land surface during and post mining, and sheet and gully drainage management along the railway (Commitment 8); and
- management of contaminated surface runoff (Commitment 13).

Environmental Protection Authority Evaluation

Potential impacts on surface water systems during the mining operation will result from the discharge of mine dewatering and changes in surface water runoff as a result of changing landforms. As discussed above, the proponent has made a number of commitments in order to achieve the Environmental Protection Authority's objective relating to this issue.

The Environmental Protection Authority has concluded that the commitments made by the proponent, and the measures outlined in the CER, meet the Environmental Protection Authority's objectives in relation to the management of potential impacts on surface water systems. The issue of potential dewatering impacts on vegetation is discussed in the next section.

4.3 Impacts on vegetation

Objective

Rare flora, priority flora, and regionally significant vegetation associations should be protected. The loss of locally significant vegetation associations should be minimised.

Technical information

This proposal has the potential to adversely affect vegetation through:

- direct disturbance to vegetation as a result of clearing for the mine, and the construction of infrastructure, particularly the railway;
- changes to surface drainage characteristics, and water availability to vegetation, as a result of the bunding of the pit and construction of the railway; and
- affects of minesite dewatering on the phreatophytic vegetation associated with Marillana Creek, particularly following decommissioning of the mine, and as a result of dewatering discharge.

The proponent has conducted extensive flora and vegetation surveys of the project area as reported in the CER (Hamersley, 1995). No declared rare flora species have been identified within the Yandicoogina project area. Priority 2 species *Triumfetta maconochieana* and *Goodenia stellata* were identified along the proposed railway corridor.

Of the vegetation associations occurring within the project area, the majority are widespread throughout the Pilbara (Hamersley, 1995). The riverine associations occurring along the major creeklines are locally significant given the relatively smaller extent of drainage channels compared with other landform types. The vegetation survey results indicate that there is no direct correlation between the occurrence of a particular flora species or vegetation association and the presence of the Channel Iron Deposit (Hamersley, 1995).

Mulga (*Acacia aneura*) woodlands within the project area are restricted to the western portion of the proposed railway extension. The root systems of mulga are adapted to obtaining water from surface soil, and the distribution and abundance of mulga is, therefore, determined by soil moisture and the pattern of surface drainage. Mulga depends upon overland sheet flow of water for survival and impediment to this flow can have a significant impact. Particular attention in the design and construction of the railway and service road needs to be given to the maintenance of sheet flow regimes.

Prediction of the likely impact of the proposal on phreatophytic vegetation is intrinsically related to the proponent's groundwater modelling and their long term scenarios for rehabilitation and decommissioning of the mine, and needs to be evaluated in that context.

Impacts on riverine vegetation as a result of dewatering during the operating life of the mine could be managed via irrigation.

After mine dewatering operations and subsequent discharge to the creek alluvium ceases, groundwater levels in the alluvial aquifer would fall due to a combination of transpiration, drainage to the underlying CID, and possible drainage to the basement rock. The riverine vegetation would be stressed until the next Marillana Creek flood when the alluvium would be recharged. Vegetation in and near areas where the creek alluvium overlies the CID would be affected most severely during the drying phase. Trees likely to be dependent on this association are the Melaleucas and to a lesser extent the River Gums (Hamersley, 1995).

Based on the model developed by Hamersley for the aquifer systems the best and worst case scenarios for impacts on phreatophytic vegetation following mining are:

Best case scenario - no eventual loss of riverine tree stands as annual recharge of the alluvial aquifer through rainfall and surface flow provide sufficient water for trees.

Worst case scenario - trees dependent on water in the CID for their survival die within the area of vegetation situated in the Marillana Creek - CID association either side of the hairpin. The proponent has estimated that this could affect 4 % of the vegetated creekline, or patches of vegetation within a maximum area of 100 hectares. Additional work by Hamersley on the vegetation likely to be found in these areas has determined that the worst case scenario is only likely to affect 10 mature individuals of *Melaleuca argentea* which is the one species present known to be critically dependent on this water (Hamersley 1996).

Policy information

The precedent of past assessments provides a policy framework for consideration of this issue.

The Environmental Protection Authority's assessment of BHPIO's proposal to develop Yandi Central Mesas 1 and 2 identified that the most significant of the potential impacts on vegetation were those on phreatophytic vegetation, particularly *Melaleuca argentea* (EPA, 1995).

The Environmental Protection Authority's assessment of the Marandoo Iron Ore Mine and Central Pilbara Railway recognised the significance of Mulga woodland (EPA, 1992). A recommendation was made during that assessment for a drainage management programme to manage and monitor surface water drainage impacts on mulga vegetation. This requirement was subsequently applied as an environmental condition by the Minister for the Environment.

Comments from key agencies / interest groups

The Department of Conservation and Land Management (CALM) has indicated that detailed consideration needs to be given to low level drainage in the area of extensive high quality mulga flats where the railway crosses the Great Northern Highway. Sheet CPR6 (included in Appendix C of the CER (Hamersley, 1995)) shows that the rail corridor will cut drainage to the mulga from the hills, and CALM has advised that there should be a requirement for appropriate drainage control.

One submission identified the potential for dust liftoff during product transport to adversely affect adjacent vegetation, particularly within Karijini National Park. The submission referred to vegetation on the Yarrie station adjacent to the BHP Goldsworthy rail line and claimed that up to 400 metres of vegetation either side of that line has been retarded as a result of dust smothering.

Response from the proponent

The proponent's response to the issues raised in submissions and discussed above is included in Appendix 2 (Questions 4.2 and 5.2).

Final railway plans will be submitted to the DEP and CALM for their approval. Drainage management planning and appropriate drainage structures to minimise potential impacts will be

applied during final engineering design work. Details of the location and types of drainage controls will also be submitted to the DEP and CALM for approval.

Vegetation monitoring will be undertaken on either side of the railway to evaluate the potential impacts of drainage shadowing or drainage alteration. Management measures, monitoring results and any remediation works would be reported within the Environmental Management Programme (Commitment 8).

The high moisture content of the ore to be transported from the Yandicoogina site should minimise the potential for dust generation. The ore from the project area has a moisture content of approximately 8%, compared with an average moisture content of 2.5% and 4.5% for lump and fines ore respectively.

The proponent's commitment to prepare an Environmental Management Programme includes proposed management and monitoring measures for flora protection, and fire and weed management.

Environmental Protection Authority Evaluation

The biological survey undertaken by the proponent and commitments made by the proponent achieve the objective of the Environmental Protection Authority in relation to minimising direct disturbance to significant vegetation, and the potential for the railway to detrimentally affect mulga woodlands.

The project is unlikely to have unacceptable impacts on vegetation identified as having high conservation value. This issue will be further addressed in the Environmental Management Programme.

The Environmental Protection Authority recognises that the discharge of mine dewatering will have a significant effect on the occurrence of species along Marillana Creek downstream from the discharge point. This would involve a two stage change, both after the commencement of dewatering when permanent water is first present, and following the cessation of dewatering, when the water regime reverts to being seasonally wet.

4.4 Impacts on fauna and fauna habitat

Objective

Rare and endangered species and their habitat should be protected.

Technical information

A number of species listed as gazetted rare fauna have been identified as likely to occur within the project area. The known distribution of all of these species extends beyond the project area boundary. The species most likely to experience direct impact from the proposal (particularly the construction of the railway) is the Pebble mound mouse (*Pseudomys chapmani*), which is listed as Threatened under the *Wildlife Conservation Act* (1950).

Hamersley has an existing research and translocation programme for the Pebble mound mouse related to the Marandoo project, which would be extended to the Yandicoogina project area in advance of construction and mining.

The habitat types found in the project area are representative of habitat types found throughout the Central Pilbara region.

Comments from key agencies / interest groups

One submission requested clarification regarding the availability of firearms on any part of the project area, and the presence of domestic pets or animals.

Submissions also stated that rehabilitation measures should ensure that suitable habitat is re-established following mining.

Response from the proponent

Regulations for the banning of firearms and pets have been in place at all Hamersley mine sites and exploration areas for many years.

The general measures to be implemented by Hamersley to minimise impacts on fauna and fauna habitat include:

- implementation of appropriate drainage management to minimise drainage shadow, flooding, erosion and siltation of fauna habitats;
- siting of infrastructure to avoid or minimise habitat partitioning for small birds, mammals, amphibians and reptiles;
- induction programme for employees containing aspects of fauna protection, including regulations for banning of firearms and pets, and safe driving speeds to avoid roadkills;
- minimising clearing and progressively rehabilitating cleared areas; and
- implementation of a translocation programme for the Pebble-mound mouse within the project area.

(Hamersley, 1995).

Hamersley has committed to progressive rehabilitation of the site, with the broad objective of establishing a safe and stable landform to allow development of land use and ecological values in similar conditions to those which existed prior to mining, that is, pastoral land uses.

Environmental Protection Authority Evaluation

The proponent has made a number of commitments to minimise the potentially adverse impacts of the project on fauna. These include the management and monitoring of the fauna protection measures outlined above within the framework of the Environmental Management Programme (Commitment 8) and the progressive rehabilitation of disturbed areas (Commitment 18).

The management measures outlined in the CER, and the commitments made by the proponent achieve the Environmental Protection Authority's objective in relation to impacts on fauna and fauna habitat.

4.5 Regional issues and potential cumulative impacts

Objective

To consider the regional cumulative impact of the project's development on the environment (EPA, 1995 p.10).

Policy information

Previous EPA assessment

In its recent assessment of BHPIO's Yandi Central Mesa 1 and 2 proposal, the EPA noted the potential for future development of the CID orebody and considered that a coordinated approach to hydrological research across mining tenements would contribute more effectively to the long

term management of this area. It was the EPA's view that the Pilbara Iron Ore Environmental Management Committee should undertake this coordinating role (EPA, 1995).

Technical information

If this proposal is approved, Hamersley's mine would be the third open cut mine approved on the CID. In addition to operations along this deposit, the Central Pilbara region supports a number of existing and proposed iron ore mines, as illustrated by Figure 1.

As this proposal represents Hamersley's first venture in the region there is a significant infrastructure requirement to link the operation with Hamersley's existing rail network.

Comments from key agencies / interest groups

A number of submissions raised concerns regarding the regional implications of a series of open voids which could be allowed to fill with water. The expected future development along the CID could result in many exposed water bodies, and one submission considered that the cumulative impacts and long term impacts had not been addressed by the proponent.

Submissions also requested greater consideration of the possible sharing of infrastructure between Hamersley Iron and BHPIO.

The Department of Resources Development (DRD) commented that it is currently reviewing the infrastructure proposed by Hamersley in the context in the overall development in the Central Pilbara. The objective of DRD's review is to plan routes for multi-user service corridors to avoid dissection of the area by railways and roads serving individual projects.

Response from the proponent

The impact of the ultimate development of numerous pits along the CID is uncertain. Hamersley has only sought environmental approval for a single pit as described in the CER. Other than BHPIO's recent proposal to duplicate its current Yandi mine, there are no other mining proposals for the CID. Until such time that firm proposals are put forward to extend existing or approved mines, there are no specific details upon which to assess the cumulative environmental impacts of mining along the CID. Any future proposal to mine areas along the CID will need to take into account existing and approved mines when environmental approvals are sought.

The best hydrogeological advice on the long term impacts of the proposal on land and water resources is that the impacts will be confined to within several kilometres of the mine site and would have negligible impacts elsewhere.

State Agreements covering Hamersley operations contain provisions for sharing infrastructure, where it is practical to do so. Connection to the BHPIO existing railway network is not practical, as BHPIO's port facilities are located at Port Hedland, and Hamersley's at Dampier. There is insufficient capacity and space for Hamersley to establish facilities at Port Hedland, in addition to this not being economically feasible. Most other potential iron ore mines shown in the Pilbara 21 Study occur well to the south of Hamersley's nominated route, and are separated from the proposed railway corridor by rugged terrain which would preclude building of shared rail lines (Hamersley 1996).

Environmental Protection Authority Evaluation

In describing the expected cumulative impact of the proposal on Marillana Creek and the CID, the modelling work undertaken by Hamersley has included the effect of BHPIO's existing mine and proposed duplication. The cumulative impacts and long term management will be the subject of future research to be undertaken by Hamersley (Commitments 3, 5, 8 and 19), and

the final void would be designed to minimise the long term impacts of mining on local and regional groundwater resources (Commitment 5).

The Environmental Protection Authority recognises that the Channel Iron Deposit represents a significant iron resource that is likely to be further developed in the future. The regional cumulative impacts associated with development in the Central Pilbara Region need to be considered at a strategic level with other regional planning issues, as well as at the level of the individual proposal. This could be achieved through the comprehensive land use strategy for the Pilbara which is currently being undertaken by the Pilbara Land Use Planning Group.

The Environmental Protection Authority notes that the modelling predictions developed by Hamersley have indicated likely effects of the existing and approved mine along the CID. Accordingly, the proponent's commitments as summarised above are considered sufficient to achieve the EPA's objective for this issue.

4.6 Environmental Management Programme and appropriate monitoring

Objective

To ensure the project is managed during construction, operational and decommissioning phases, to avoid unnecessary impacts and to properly manage unavoidable impacts to an acceptable level.

Technical information

An EMP is to be developed to include all aspects of environmental management and monitoring of the project.

The EMP would specifically address the detailed management of:

- groundwater and surface water management during mining and post mining;
- sheet and gully drainage management along the railway;
- dust and noise emissions;
- waste management;
- flora and fauna protection;
- fire and weed management;
- environmental inductions for construction and operation personnel;
- rehabilitation of disturbed areas; and
- monitoring programmes.

Comments from key agencies / interest groups

One submission expressed concern that the CER did not include the details of an EMP and that therefore no comprehensive evaluation of the project could be conducted. The submitter considered that the development of EMPs after assessment of the CER is not satisfactory and does not allow the public to participate in the process.

Response from the proponent

The EPA guidelines for the CER did not require an EMP to be prepared, but indicate that the purpose of the CER is to, in part, "provide the basis of the proponent's environmental

management programme, which shows that the environmental issues resulting from the proposal can be acceptably managed." It is normal practice for an EMP to be prepared following the release and assessment of the CER. This approach ensures that any relevant issues that are raised during the review process can be addressed in the EMP.

Environmental Protection Authority Evaluation

The Environmental Protection Authority considers it imperative that there be a management mechanism in place for the potential environmental impacts associated with the ongoing development of the project This should also include appropriate monitoring frameworks, so that over time, management measures can be further refined as required.

The CER has demonstrated that the environmental issues arising from this proposal could be adequately addressed through appropriate management and monitoring. The proponent has made a number of commitments to ensure appropriate management and monitoring of the proposal (Commitments 4, 7, 8, 9, 13, and 14).

The Environmental Protection Authority considers, however, that the programme for monitoring and managing potential environmental impacts requires flexibility to ensure that those procedures remain appropriate during the development of the project. The implementation of the EMP should also be subject to review to ensure that the management measures proposed achieve the environmental objectives upon which the Environmental Protection Authority's assessment is based (Recommendation 2, Section 5).

It is recognised that the proponent has committed to environmental reporting on an annual and triennial basis (Commitment 7), and to report on groundwater monitoring results annually (Commitment 4). It is expected that some of the reporting requirements for this proposal could be combined to avoid unnecessary duplication.

4.7 Decommissioning and rehabilitation

Objective

To ensure an acceptable rehabilitation and decommissioning programme is put in place which incorporates a "closure strategy" agreed to by the Western Australian Government.

Policy information

Past assessments by the Environmental Protection Authority of similar mining proposals provide a policy framework for consideration of the rehabilitation and decommissioning scenarios proposed, and the expectations of the Environmental Protection Authority.

The Environmental Protection Authority has recognised that for rehabilitation to be most effective it must be integrated into the mining plans early on in the project's development, and not left to the conclusion of mining (EPA, 1991 Bulletin 547).

It is of paramount importance to the State that rehabilitation management does not impose short or long term costs on the community of Western Australia. This is particularly relevant when the success of rehabilitation cannot be evaluated in the short to medium term (EPA, 1994, Bulletin 766).

In approving the proposal by BHPIO for the development of the Yandi Central Mesas 1 and 2 areas, the Minister for the Environment has required that there be a specific mechanism put in place for the development of the final decommissioning scenario for the site.

Technical information

The longer term impacts arising from the completion of mining operations at Yandicoogina will be mainly associated with the stabilisation of post-mining landforms and hydrological impacts.

Although the majority of overburden material (85 %) will be returned to the pit for backfilling, because the ratio of overburden to ore is so low (0.6:1), there would be insufficient material available to fill the pit above the existing water level. The proponent estimates that, at the completion of mining, 40 - 50 % of the pit volume would be filled. The strategy for filling (whether asymmetrical or symmetrical) the pit has not yet been finalised, and this could potentially affect the surface area of water remaining in the void at the completion of mining.

Groundwater will flow into the pits and form open water bodies, although it is unknown to what level 'groundwater' will recover in a backfilled pit. Due to the high evaporation rates in the Pilbara and the open water surface area, pit water levels will not recover to pre-mining groundwater levels. Salinity levels will build up in decommissioned pits. Worst case modelling has indicated that pit water salinity would approach 13,000 mg/L following the cessation of mining (Hamersley, 1995). Groundwater samples taken from the CID have had salinities recorded in the range from 150 to 600 mg/L, with most results averaging 500 mg/L (Hamersley, 1995).

The modelling and monitoring work that Hamersley has conducted to date to gain a better understanding of the hydrogeological systems in the area will be continued to further refine the model. This would be on-going during the life of the mining operation to test the predictions and refine the model so that the longer term management options can be optimised.

Given that approval for this proposal would result in a second operator along the CID, and a third open pit, there is a need for cooperation between BHP Iron Ore and Hamersley to ensure that the rehabilitation and decommissioning scenarios developed are compatible over the longer term.

Comments from key agencies / interest groups

Submissions generally recognised that the regional implications of a series of open voids which could fill with water needed to be addressed, and that impacts associated with decommissioning the project required further definition.

The point was made that the full impact on water tables around the mines will only be seen when the mining companies are long gone. The salinisation of the Goldsworthy pit and reference to other mines where mining occurs or will occur below the water table was also mentioned. Submitters consider that the mining companies must be willing to cover exposed water tables as part of the normal costs of developing a deposit.

One submission also queried what would be the final rehabilitation strategy for the railway line.

Response from the proponent

The main objective of the rehabilitation/decommissioning strategy to be adopted by Hamersley would involve maximising the amount of material returned to the mined pit to cover as much of the likely final water table as practical. Hamersley has made a commitment to prepare a decommissioning plan in consultation with the relevant government authorities and to submit the plan for approval two years prior to decommissioning (Commitment 19). This plan would specifically address the issue of post mining water management in controlling long term salinity levels in the final void.

Continuing hydrogeological investigations to be undertaken by Hamersley would provide a better understanding of the system. This information would assist in the management of salinity through selection of the most appropriate backfilling strategy.

Planning for the final void has already commenced with hydrogeological studies being commissioned for the most effective 'walk away' solution to decommissioning. Final void

planning is also being undertaken at the same time as detailed mine planning, as both aspects are inherently linked. Information developed through modelling for the final void and from other ongoing hydrogeological studies will be provided to Government through specific consultative reporting channels.

The removal and rehabilitation of the Central Pilbara Railway extension between Juna Downs and Junction will be addressed in the decommissioning plan to be prepared by Hamersley.

Hamersley has committed to continue to evaluate the impacts of mining and decommissioning on Marillana Creek and the CID jointly with BHPIO to further understand the hydrogeological system to facilitate the development and evaluation options for compatible long term management strategies (Commitment 3).

Environmental Protection Authority Evaluation

In considering the assessment of the proposal, the DEP asked the proponent to estimate the surface disturbance involved if material was to be brought in from elsewhere to fill the remaining void.

If Hamersley's internal recommendations for borrow establishment of a maximum of 1 metre is used, an area of approximately 20 - 30 km^2 would be disturbed to extract sufficient material to fill the pit above the existing water table. To fill the pit to the existing land surface could involve a disturbance as large as 50 km^2. These figures are approximations only and are based on the assumptions that all of the material is extracted from borrow pits, rather than a more

significant change to the existing land surface, and also ignores the fact that the locations of suitable borrow pits would have to consider rare and endangered flora, translocation of affected fauna, suitable landform types, construction of roads to access borrow areas and possible additional dissection of habitat and direct disturbance from topsoil dumps.

The EPA recognises that it may be impractical to infill the mined-out pit to a level which would cover the exposed water table. The amount of material required would greatly exceed available overburden and would need to be sourced from areas that might otherwise remain undisturbed. In retaining an open water body, the EPA appreciates that it is highly likely that over a significant time frame the water body would become salty. The current understanding of the regional groundwater system is that water is discharged at depth in the Fortescue valley, and the water quality of Fortescue Marsh is already poor.

On this basis, the EPA concludes that the consequences of an open void potentially becoming saline are insufficient to justify significant disturbance to areas that would otherwise remain undisturbed to backfill the pit.

Although the proponent has made a number of commitments regarding rehabilitation and decommissioning of the site (Commitment 5 - design of the final void; Commitment 8 - EMP; Commitment 18 - progressive rehabilitation; and Commitments 19 - preparation of a decommissioning plan at least 2 years prior to decommissioning), the EPA considers that the process of planning for decommissioning, and the development of a 'walk away' solution, should be formally instigated earlier within the mine life. Accordingly, a plan describing the process of decommissioning should be developed within 5 years of commissioning the mine (Recommendation 3, Section 5).

Issues	Objective	Evaluation Framework	Proponent's Commitments	EPA Recommendations
Biophysical Impacts				
Impacts on local and regional groundwater systems	Minimise short term effects caused by dewatering and to protect the environment from significant impacts resulting from decommissioning the mine pit.		The regional groundwater model being developed will allow longer term management options (during mining and post- mining) to be developed (Commitments 3, 4, 5). Groundwater monitoring and management addressed by proponent in commitments 4 & 8.	Predicted impacts based on modelling to date. Further data collection and modelling required to refine the prediction of long term impacts and management. The proponent's commitments are considered adequate.
Impacts on surface water systems	Minimise impacts on the quality and quantity of surface water.		Monitoring and management addressed by proponent in commitments 4 (monitoring alluvium), 8 (EMP) and 13 (management of contaminated surface runoff).	The proponent's commitments are considered adequate.
Impacts on vegetation	Rare, priority flora, and regionally significant vegetation associations should be protected. The loss of locally significant vegetation associations should be minimised.	Yandicoogina project area contains no declared rare flora. Mine site has no priority species. 2 priority species identified along railway corridor. Affected plant communities widespread throughout the Pilbara.	EMP to address flora protection, weed management, drainage management planning and appropriate drainage structures (Commitment 8). Impacts of dewatering on riverine vegetation to be monitored and ameliorated (Commitment 9). Water supply to species adversely affected by dewatering will be ameliorated by irrigation.	The proponent's commitments are considered adequate.
Impacts on fauna and fauna habitats	Rare and endangered species should be protected.	One rare species identified, the Pebble mound-mouse.	Proponent's current translocation and monitoring programme for this species to be extended in advance of construction and mining. EMP to address fauna protection and progressive rehabilitation (Commitment 8).	The proponent's commitments are considered adequate.

Table 2. Summary of Environmental Protection Authority recommendations

Issues	Objective	Evaluation Framework	Proponent's Commitments	EPA Recommendations
Social surroundings				
Regional issues and potential cumulative impacts	To consider the regional cumulative impact of the development on the environment.	Regional cumulative impacts should be considered at a strategic level with other regional planning issues, and not at the level of the individual proposal. The Pilbara Land Use Planning Group established through the Pilbara 21 Study is undertaking a comprehensive land use strategy for the Pilbara.	Final void to be designed to minimise the long term impacts of mining on local and regional groundwater resources (Commitment 5).	The proponent's commitments are considered adequate.
Environmental monitoring				
Environmental Management Programme (EMP) and appropriate monitoring	To ensure the project is managed, during construction, operational and decommissioning phases, to avoid unnecessary impacts and to properly manage unavoidable impacts to an acceptable level.		CER has provided general information regarding the management of the potential impacts of the proposal. The proponent has committed to prepare an EMP detailing the management and monitoring of these issues, to the satisfaction of the Minister (Commitment 8).	Recommendation for an EMP to the satisfaction of the EPA. The management and monitoring programme should also include provision for review of the EMP's implementation, and effectiveness in achieving the objectives of the EPA's assessment.
Decommissioning				
Decommissioning and rehabilitation	To ensure an acceptable rehabilitation and decommissioning programme is put in place which incorporates a "closure strategy" agreed to by the WA Government.	Precedent of past projects in this area, which require that long term rehabilitation & decommissioning scenarios are considered early on in the projects development, to best integrate rehabilitation options with the mine plan.	Addressed in proponent commitments 5 (design of the final void), 8 (EMP), 18 (progressive rehabilitation) and 19 (decommissioning plan to be prepared two years prior to decommissioning).	The process of planning for decommissioning and the development of a 'walk away' solution, should be instigated earlier in the life of the mine. Recommendation for a plan, describing the process of decommissioning, within 5 years of commissioning the mine.

Table 2. Summary of Environmental Protection Authority recommendations (cont)

5. Conclusions and recommendations

Following review of the proponent's Consultative Environmental Review, the issues raised in the public submissions, advice received from government departments, relevant literature and the proponent's revised environmental management commitments, the Environmental Protection Authority concludes that the proposal by Hamersley Iron Pty Limited for the development of the Yandicoogina iron ore mine and railway is environmentally acceptable.

The Environmental Protection Authority is satisfied that, using information currently available, the following recommendations may be made to the Minister for the Environment.

Recommendation 1

The proposal is environmentally acceptable subject to the proponent's revised environmental management commitments and the EPA's recommendations in this report.

Recommendation 2

Prior to the construction and operation of the project the proponent shall prepare and subsequently implement an Environmental Management Programme to the satisfaction of the Environmental Protection Authority on the advice of the Department of Environmental Protection. The EMP should detail the procedures and practices for the protection of the environment during all phases of mining and shall include but not be limited to the following:

- **groundwater monitoring and management;**
- **surface water monitoring and management including measures for the protection of the integrity of Marillana Creek;**
- **sheet and gully drainage management along the railway;**
- **pollution prevention measures including noise and dust;**
- **waste management including overburden, liquid, solid and gaseous wastes;**
- **protection of flora and fauna including fire and weed management;**
- **rehabilitation of disturbed areas; and**
- **development of a comprehensive monitoring, management and reporting programme for the above.**

The reporting programme should provide for:

- **annual reports outlining implementation of the EMP;**
- **triennial reports reviewing the implementation of the EMP; and**
- **six yearly reports reviewing the environmental objectives and implementation of the EMP and its effectiveness in achieving those objectives,**

to the requirements of the Environmental Protection Authority.

Recommendation 3

Within five years of commissioning the Yandicoogina mine, or at such later time considered appropriate by the Minister for the Environment, the proponent should prepare and subsequently implement a plan which:

- **describes the process for the decommissioning and rehabilitation of the project area;**
- **provides for the long term management of salinity in the mined-out pit;**
- **provides for the long term management of any regional effects arising from mining the CID;**
- **has the objective of protecting the water resources and phreatophytic vegetation of the area; and**
- **provides for the development of a 'walk away' solution for the decommissioned mine,**

to the requirements of the Environmental Protection Authority, on the advice of the Department of Minerals and Energy and the Water and Rivers Commission.

Note: A 'walk away' solution means that the site shall either no longer require management at the time the proponent ceases mining operations, or if further management is deemed necessary, the proponent shall make adequate provision so that the required management is undertaken with no liability to the State.

6. Recommended environmental conditions

Based on its assessment of this proposal and the recommendations in this report, the Environmental Protection Authority considers that the following Recommended Environmental Conditions are appropriate.

PROPOSAL: YANDICOOGINA IRON ORE MINE & RAILWAY, 90 KILOMETRES NORTH WEST OF NEWMAN (979)

CURRENT PROPONENT: HAMERSLEY IRON PTY. LIMITED

This proposal may be implemented subject to the following conditions:

1 Proponent Commitments

The proponent has made a number of environmental management commitments in order to protect the environment.

1-1 In implementing the proposal, the proponent shall fulfil the commitments made in the Consultative Environmental Review and in response to issues raised following public submissions; provided that the commitments are not inconsistent with the conditions or procedures contained in this statement.

The environmental management commitments (February 1996), including those which will be audited by the Department of Environmental Protection, were published in Environmental Protection Authority Bulletin 809 (Appendix 4) and a copy is attached.

2 Implementation

Changes to the proposal which are not substantial may be carried out with the approval of the Minister for the Environment.

2-1 Subject to these conditions, the manner of detailed implementation of the proposal shall conform in substance with that set out in any designs, specifications, plans or other technical material submitted by the proponent to the Environmental Protection Authority with the proposal.

2-2 Where, in the course of the detailed implementation referred to in condition 2-1, the proponent seeks to change the designs, specifications, plans or other technical material submitted to the Environmental Protection Authority in any way that the Minister for the Environment determines, on the advice of the Environmental Protection Authority, is not substantial, those changes may be effected.

3 Proponent

These conditions legally apply to the nominated proponent.

3-1 No transfer of ownership, control or management of the project which would give rise to a need for the replacement of the proponent shall take place until the Minister for the Environment has advised the proponent that approval has been given for the nomination of a replacement proponent. Any request for the exercise of that power of the Minister shall be accompanied by a copy of this statement endorsed with an undertaking by the proposed replacement proponent to carry out the project in accordance with the conditions and procedures set out in the statement.

4 Environmental Management Programme

A detailed Environmental Management Programme should contribute to the development of long term management options through comprehensive monitoring and management practices.

4-1 Prior to the construction and operation of the project, the proponent shall prepare an Environmental Management Programme to the requirements of the Environmental Protection Authority on the advice of the Department of Environmental Protection. The EMP shall detail the procedures and practices for protection of the environment during all phases of mining and include but not be limited to the following:

(1) groundwater monitoring and management;

(2) surface water monitoring and management including measures for the protection of the integrity of Mariliana Creek;

(3) sheet and gully drainage management along the railway;

(4) pollution prevention measures, including noise and dust;

(5) waste management, including overburden, liquid, solid and gaseous wastes;

(6) protection of flora and fauna including fire and weed management;

(7) rehabilitation of disturbed areas; and

(6) development of a comprehensive monitoring, management and reporting programme for the above.

The reporting programme should provide for:

- annual reports outlining implementation of the EMP;
- triennial reports reviewing the implementation of the EMP; and

- six yearly reports reviewing the environmental objectives and implementation of the EMP and its effectiveness in achieving those objectives,

to the requirements of the Environmental Protection Authority.

4-2 The proponent shall implement the Environmental Management Programme required by condition 4-1 to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection, Department of Minerals and Energy, the Water and Rivers Commission and the Department of Resources Development.

5 Decommissioning

The satisfactory decommissioning of the project, removal of the plant and installations and rehabilitation of the site and its environs to a sustainable condition in the long term, is the responsibility of the proponent.

5-1 Within 5 years of commissioning the Yandicoogina mine, or at such later time considered appropriate by the Minister for the Environment acting on the advice of the Department of Environmental Protection, the proponent shall prepare a plan which:

1. describes the process for decommissioning and rehabilitation of the project area;
2. provides for the long term management of salinity in the mined-out pit;
3. provides for the long term management of any regional effects arising from mining the Channel Iron Deposit;
4. has the objective of protecting the water resources and phreatophytic vegetation of the area; and
5. provides for the development of a 'walk away' solution for the decommissioned mine,

to the requirements of the Environmental Protection Authority, on the advice of the Department of Minerals and Energy and the Water and Rivers Commission.

Note: A "walk away" solution means that the site shall either no longer require management at the time the proponent ceases mining operations, or if further management is deemed necessary, the proponent shall make adequate provision so that the required management is undertaken with no liability to the State.

5-2 The proponent shall implement the plan required by condition 5-1 to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection, Department of Minerals and Energy, the Water and Rivers Commission, and the Department of Resources Development.

6 Time Limit on Approval

The environmental approval for the proposal is limited.

6-1 If the proponent has not substantially commenced the project within five years of the date of this statement, then the approval to implement the proposal as granted in this statement shall lapse and be void. The Minister for the Environment shall determine any question as to whether the project has been substantially commenced.

Any application to extend the period of five years referred to in this condition shall be made before the expiration of that period to the Minister for the Environment.

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

7 Compliance Auditing

To help determine environmental performance, periodic reports on progress in implementation of the proposal are required.

7-1 The proponent shall submit periodic Progress and Compliance Reports, in accordance with an audit programme prepared by the Department of Environmental Protection in consultation with the proponent.

Procedure

1 Unless otherwise specified, the Department of Environmental Protection is responsible for assessing compliance with the conditions contained in this statement and for issuing formal clearance of conditions.

2 Where compliance with any condition is in dispute, the matter will be determined by the Minister for the Environment.

Note

The proponent is required to apply for a Works Approval and Licence for aspects of this project under the provisions of Part V of the Environmental Protection Act.

7. References

A J Peck and Associates Pty Ltd (1995) *Junction deposit at Marillana Creek, long term impacts on groundwater* Report to Hamersley Iron Pty Ltd.

Environmental Protection Authority (1991) *Application for exploration licences 63/280 & 63/281 Dalyup area, Esperance*: Report and recommendations of the Environmental Protection Authority. Bulletin 547. Environmental Protection Authority, Perth.

Environmental Protection Authority (1992) *Marandoo Iron Ore Mine and Central Pilbara Railway* : Report and recommendations of the Environmental Protection Authority. Bulletin 643. Environmental Protection Authority, Perth.

Environmental Protection Authority (1994) *Boddington Gold Mine: Rehabilitation Strategy*: Report and recommendations of the Environmental Protection Authority. Bulletin 766. Environmental Protection Authority, Perth.

Environmental Protection Authority (1995) *Duplication of iron ore mining operation, Yandi mine ML 270SA, Hamersley Range, 90 km north-west of Newman:* Report and recommendations of the Environmental Protection Authority. Bulletin 802. Environmental Protection Authority, Perth.

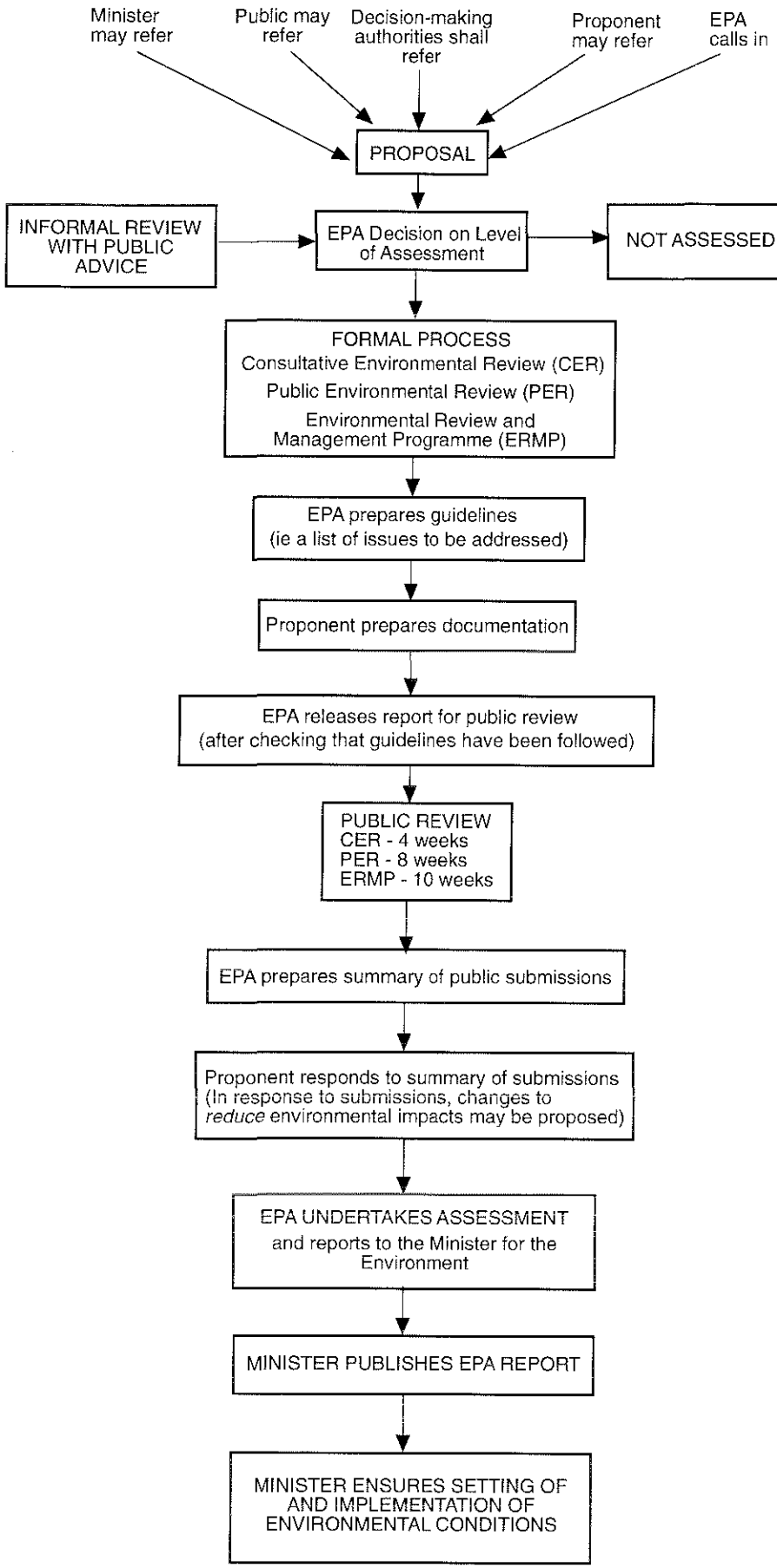
Hamersley Iron Pty Limited (1995) Yandicoogina Iron Ore Mine and Railway Project, Consultative Environmental Review, Hamersley Iron Pty Limited, Perth.

Hamersley Iron Pty Limited (1996) Responses to issues raised in public submissions on the CER (See Appendix 2 of this report).

Water Authority of Western Australia (1995) Pilbara Regional Water Resources Review Interim Report.

Appendix 1

Environmental Impact Assessment flow chart


Minister may refer
Public may refer
Decision-making authorities shall refer
Proponent may refer
EPA calls in
PROPOSAL
INFORMAL REVIEW WITH PUBLIC ADVICE
EPA Decision on Level of Assessment
NOT ASSESSED
EPA decides within 28 days. Anybody may appeal to the Minister within 14 days on level set; Minister may direct higher level but not vice versa
FORMAL PROCESS
Consultative Environmental Review (CER)
Public Environmental Review (PER)
Environmental Review and Management Programme (ERMP)
DMA cannot allow implementation unless either no formal assessment or the Minister Authorises. Process not suspended
EPA prepares guidelines (ie a list of issues to be addressed)
Draft guidelines usually issued within 14 days of first meeting of proponent
Proponent prepares documentation
EPA releases report for public review (after checking that guidelines have been followed)
PUBLIC REVIEW
CER - 4 weeks
PER - 8 weeks
ERMP - 10 weeks
EPA prepares summary of public submissions
EPA usually completes summary in 2-3 weeks
Proponent responds to summary of submissions (In response to submissions, changes to *reduce* environmental impacts may be proposed)
EPA UNDERTAKES ASSESSMENT and reports to the Minister for the Environment
Report release often 3-5 weeks after receipt of response to submissions
MINISTER PUBLISHES EPA REPORT
Any body may appeal on EPA report to Minister within 14 days. Minister may remit to EPA or take appeal into consideration when setting conditions
MINISTER ENSURES SETTING OF AND IMPLEMENTATION OF ENVIRONMENTAL CONDITIONS
Proponent may appeal on conditions within 14 days of issue

Appendix 2

Summary of submissions and proponent's response

Hamersley Iron Pty. Limited

YANDICOOGINA IRON ORE MINE AND RAILWAY PROJECT

RESPONSES TO ISSUES RAISED IN PUBLIC SUBMISSIONS ON THE CER

1. GROUND AND SURFACE WATERS

Dewatering discharge

Q1.1 Can Hamersley estimate the length of surface flow from downstream of the proposed dewatering point?

The length of the surface flow downstream of the discharge point will respond to a number of factors, including the rate of discharge, the amount of vegetation that establishes along the sides of the pond (evapo-transpiration), and the past and current meteorological conditions (rainfall, temperature, wind). Much of the discharge water will be lost through seepage to the underlying strata , primarily the CID where it underlies Marillana Creek and evaporation. During normal mine operating conditions (maintenance dewatering rates), surface water may be present for several kilometres downstream of the discharge point.

Q1.2 Does BHPIO's current dewatering discharge or the proposed changes to this activity have a surface flow to either the start of Hamersley's lease, or the proposed Hamersley discharge point?

It is understood that the length of surface flow from the current BHPIO pond is variable. The factors mentioned in the response to Question 1.1 would also influence the length of surface flow from BHPIO's discharge point.

The pond that has developed below BHPIO's current water discharge point is believed to extend at times beyond the boundaries of lease ML270SA. The discharge point is now proposed to be relocated 2.5 km downstream from its current position and the rate of discharge expected to increase as part of BHPIO's duplication project. The resulting pond below the relocated discharge point is expected to extend to about the Phil's Creek junction (situated inside Hamersley's E47/6). The pond could extend beyond Phil's Creek junction during the initial dewatering for the duplication project, particularly if this occurs before Hamersley commence dewatering operations.

During maintenance dewatering at the BHPIO mines and the Hamersley Junction mine, there is likely to be a gap of several kilometres between the lower limit of the BHPIO discharge pond and the upper end of Hamersley's discharge pond.

Q1.3 Do any significant permanent wetlands occur along the proposed discharge line?

The area of the nominated discharge point and elsewhere along the route of the above ground pipework leading from the dewatering borefields does not contain any permanent wetland.

Neither is any significant permanent wetland known to exist along Marillana Creek between the Junction Deposit and its intersection with either Yandicoogina Creek or Weeli Wolli Creek or downstream of the Marillana-Weeli Wolli creek intersection and the top end of the Fortescue Marshes.

Q1.4 On Page 6.4, the proponent states that "there will be no significant effect of mining operations on flood flows in Marillana Creek. Water levels in Marillana Creek upstream of Hamersley's dewatering point will be maintained by discharges from BHPIO".

Can Hamersley guarantee that BHPIO will maintain its water discharges and that these will maintain water levels in Marillana Creek upstream of Hamersley's proposed operations?

The statement in the CER was made in the context of potential environmental impacts during mining operations involving dewatering activities and the ability of the BHPIO discharge to sustain water to trees upstream of Hamersley's proposed discharge point. Should BHPIO cease discharging while Hamersley is still operating in the Junction area and should this lead to impacts on riverine vegetation from Hamersley operations, vegetation monitoring to be undertaken by Hamersley (refer response provided to Question 2.1) will enable early detection and management measures to be implemented.

Hamersley cannot provide any guarantee as to BHPIO's future operations.

Q1.5 The proponent does not provide any information or design criteria as to the method or engineering practices proposed for the discharge of mine water.

There is a range of available engineering options for the discharge of mine water. As indicated in Section 6.3.1 of the CER, in selecting the discharge point for mine water, the principal objective will be to avoid erosion and to maintain phreatophytic vegetation in downstream areas. The key aspect of the design criteria will be to create a stable discharge pool. These criteria will be considered in the selection of the exact discharge point and in the adoption of the engineering option selected for the discharge of mine water.

Prior to the commencement of construction activities, the design criteria for the mine water discharge structure will be submitted to the DEP for approval as part of obtaining Works Approval. Details on the operation of the mine water discharge structure and its monitoring will be provided in the EMP to be prepared by Hamersley, in consultation with, and to the satisfaction of, the DEP.

Q1.6 The proponent fails to address the impacts that the release of water from the dewatering regime may have by creating unseasonal water flow, containing higher dissolved oxygen content, changing the pH and salinity levels, thereby affecting the seasonal fluctuations within the lower reach pools rich with macrobiotic organisms.

Exposed water bodies will change the fragile ecosystems as mining in the region increases. Mines generated exposed water bodies where they exist, are already creating macro ecological changes in terms of avifauna and laterally, flora by the deposition of avifauna transported seed.

As noted in the response to Question 1.3, there is no significant wetland or pool downstream along either Marillana Creek or Weeli Wolli Creek between the Junction area and the top end of the Fortescue Marshes. Therefore there will be no potential to impact on water quality within 'lower reach pools'.

The decommissioned final void is not expected to cause significant alterations to ecosystems of the region. Permanent surface water is already available in the region at Flat Rocks (25 km to the west of the Junction Deposit) and at Weeli Wolli Springs and would be expected to be subject to avifauna activity. Ecological changes through the deposition of avifauna transported seed will not be significant because flora species which have been previously introduced by other means (eg pastoral activities, use of recreational vehicles, natural creek flows) have a greater potential to alter the regional ecology.

Regional surface water systems

Q1.7 The CID continues on to the south beyond the area shown on Figure 3.1, and includes part of the Weeli Wolli Creek System ("Billiard Deposit" is on Weeli Wolli). Weeli Wolli is an extremely important wetland system which will come under increasing pressure as mining rates increase. The proponent should quantify the potential impacts of the project on Weeli Wolli. Can Hamersley qualify the environmental and conservation significance of the Weeli Wolli system, particularly on a regional scale?

The most significant area of the Weeli Wolli Creek system is Weeli Wolli Springs, located about 11 km upstream of the intersection of the CID and Weeli Wolli Creek and 17 km upstream of the junction of Yandicoogina Creek and Weeli Wolli Creek. Detailed hydrogeological investigations commissioned by Hamersley as part of project feasibility studies have indicated that the potential for this project to have any impact on Weeli Wolli Creek or Weeli Wolli Springs will be negligible. This has been stated clearly in the CER. Therefore, a detailed analysis of the environmental and conservation significance of the Weeli Wolli Creek system, or Weeli Wolli Springs, is not warranted.

Q1.8 At no stage have the implications of salinity, water drawdown, or proximity to riverine systems been addressed in terms of the regional impact on the Weeli Wolli creek system, one of the most significant water systems in the region.

Refer to the response provided to Question 1.7.

Q1.9 The CER fails to evaluate acidity and pH changes in the regional water bodies.

Section 3.2.3 of the CER states that due to the nature of the waste and low grade material being mined and stockpiled, the potential for acid mine drainage is negligible. Acid drainage from the type of ore to be mined from the CID is not an issue because the material has already been oxidised and does not contain sufficient sulphides to result in acid generation that could cause changes in the pH (acidity) of groundwater or surface water.

Q1.10 The proponent takes no heed of the industry's knowledge of the impacts of the Goldsworthy pit salinisation, the groundwater drawdown impacts on the Tom Price southern Fortescue bore fields, the impacts of groundwater drawdown at Whaleback

and the associated problems of the Ophthalmia Dam, and the demise of the Robe River semi-permanent water bodies associated with the drawdown of the various mines near Pannawonica.

The guidelines set down by the DEP for the assessment quite clearly require the proponent to evaluate acidity and pH changes in the regional water bodies and yet the document fails to provide any information on the implication of such changes.

No two mining operations in the Pilbara have exactly the same hydrogeological characteristics. Each of the developments cited has its own particular hydrogeological uniqueness, with the Yandicoogina Project having a vastly different set of hydrogeological characteristics to any of the developments cited. Hamersley has employed best available industry knowledge that relates to the particular situation at Marillana Creek in order to plan the project such that it will minimise the impact on the environment.

In regard to acidity, refer to the response provided to Question 1.9.

Interactions with the final void

Q1.11 Can Hamersley quantify the following impacts:

- **the final water level range in the pit (void);**
- **the final salinity in the pit (void);**
- **the effect of backfill on groundwater flow through the mined out aquifer.**

The effects of both BHPIO voids (Yandi E2 and the proposed Yandi C1/C2) have been considered in the current modelling of the water and salt balance of the Hamersley final void; however, it is not possible to incorporate details or predict impacts of other voids along the CID until details of these voids are known.

The model of the water and salt balance of Hamersley's final void indicates that critical parameters are:

- the level of fill returned to the void
- the conditions for drainage from the void down the CID
- recharge to the CID from Marillana Creek when it flows

The height of backfill will be dependent on the strategy employed by Hamersley. The main options for backfill are uniform filling (even fill across the CID) and asymmetrical filling (filling from two sides of the mined pit). Both options will result in insufficient available backfill material to maintain the water table level at its pre-mining level.

Assuming a uniform filling approach, the final watertable level is predicted to be about 0.5 m below the surface of the fill. Under this decommissioning scenario and using the best current knowledge of the hydrogeology, the final salinity within the void is predicted to be about 13,000 mg/L. Similar salinity levels could result from the asymmetrical filling approach, which could have an exposed water surface of about 26 ha.

The reduced cross-section of CID material left below the void will result in reduced through-flow even if there is no change in the hydraulic gradient. The fill itself will be an aquifer with a potentially high transmissivity. Through-flow in the filled void will decrease from upstream to downstream, due to losses of water by evaporation, with at most small discharge to the CID downstream of the mine.

Q1.12 The Yandicoogina iron ore project in Marillana Creek involves mining below the water table. Anywhere a water table is left exposed, the water in the mined out pit will become more saline through evaporation. The salt content of the water in the Goldsworthy pit had risen from 2000 ppm in 1981 to 5000 ppm in 1990.

The proponent has given no idea as to how this problem will be addressed.

Section 3.2.4 of the CER states that during mining operations, as much waste material and low grade ore as practical will be dumped in previously mined areas. Due to the low stripping ratio of waste material to ore, there will be insufficient backfill material to ensure that the existing water table level in the final void will be covered. Because iron ore is a bulk commodity, mining it will always result in a significant shortfall of material to place back into a mined pit. Obtaining additional fill from another source (ie borrow) is not practical as it will result in disturbance to a much larger area that would otherwise have remained undisturbed.

At the completion of mining, groundwater will continue to flow toward the final void, forming an area of wet soil or a lake. Water levels in the final void will vary both seasonally and from year to year depending on the balance between inflows from the CID and basement rocks and outputs from evaporation.

The main objective of the rehabilitation/decommissioning strategy to be adopted by Hamersley will involve maximising the amount of material returned to the mined pit to cover as much of the likely final water table level as is practical (refer Question 3.2). Hamersley will prepare a decommissioning plan in consultation with relevant Government authorities and will submit the plan for approval two years prior to decommissioning (Commitment 19). This plan will specifically address the issue of post mining water management in controlling long term salinity levels in the final void.

Continuing hydrogeological investigations to be undertaken by Hamersley will provide a better understanding of the system. This information will assist in the management of salinity through selection of the most appropriate backfilling strategy.

Q1.13 No assurance has been given that the aquifer can be restored following mining. It may drain to lower levels affecting dependent riverine vegetation.

Section 6.3.2 of the CER acknowledges that after mine dewatering ceases, groundwater levels in the creek alluvial aquifer will fall, due to transpiration, drainage to underlying CID and possibly drainage to underlying basement rock, and riverine vegetation will be stressed. Present estimates are that these stresses will not be significant at the ecosystem level (refer to the response provided to Question 2.2)

As stated in the CER, Hamersley will continue to evaluate the effects of decommissioning the mined pit on Marillana Creek and the CID to further understand the hydrogeological system in

order to develop options for long term management strategies. The hydrogeological model being developed will assist in the appropriate design of the final void to minimise long term impacts on the local and regional groundwater resources.

2. VEGETATION

Q2.1 It is important for Hamersley to develop a vegetation monitoring programme to determine the dewatering effects on riverine vegetation.

Hamersley will develop a comprehensive monitoring plan as part of the EMP to be finalised after the EPA's recommendations on project approval. The EMP is to be approved by Government prior to the commencement of construction. Hamersley carried out preliminary data collection on tree health in several transects in the area in 1994 to commence estimation of a seasonal baseline for future monitoring.

Hamersley has already committed (Commitment 9, refer Table 7.1 of the CER) to undertake monitoring to assess the impacts of dewatering on riverine vegetation, and that if unacceptable impacts are detected, strategies for the management of riverine vegetation will be implemented.

Q2.2 On Page 6-5, the proponent acknowledges that groundwater levels in the CID will fall (post-mining) and that riverine vegetation will be stressed until the next flood.

Can Hamersley identify these areas in size (ha) and the expected drawdown in these areas?

The mechanism by which riverine vegetation may depend on water levels in the CID was described in Section 4.1.4 of the CER. In essence, where the CID and Marillana Creek abut and water levels in the CID are above the bottom of the creek alluvium, there may be a contribution from the CID to sustain water levels in the lower alluvium during long dry periods. Studies conducted for BHPIO (refer EPA Bulletin No. 802) suggest that only one of the three major tree species growing in Marillana Creek, *Melaleuca argentea*, may be critically dependent on this water.

River gums, *Eucalyptus camaldulensis*, currently growing in areas of Marillana Creek where dry season water levels in the alluvium are sustained by the CID, may be adapted to these water levels and may suffer and die if levels are lowered for long periods. Clearly, river gums also grow in areas where the creek is distant from the CID and can survive without a CID contribution if they have grown under the influence of a deeper (at least seasonally) water table. If present day river gums die, they are likely to be replaced by new trees of this species.

At present, neither the size of the CID contribution to water in the alluvium, nor the degree to which trees might be impacted by lowering alluvium water level can be specified with confidence. Thus in assessing the impacts of lowered CID water levels, Hamersley has adopted a conservative (worst-case) approach - that is, we assume the CID has a major role in sustaining water in the alluvium and that all affected *M. argentea* will die.

In determining which areas of riverine vegetation might be affected by a post-mining decrease in CID water level we need only consider areas where the CID and Marillana Creek are in direct connection, plus some small distance either side. Figure 6.1 of the CER shows the entire length of these areas adjacent to the proposed pit; in total, they stretch over about 6 km and amount to about 100 ha. These areas contain less than 10 mature individuals of the sensitive Melaleuca trees.

Q2.3 The proponent has identified that significant impacts may be likely concerning the surface and groundwater regimes. On Page 3-2, the proponent states that dewatering will cause the watertable to be lowered by about 40 metres over a 2 kilometre length of the ore body and that this may cause trees dependent on water in the CID to die (Page 6-5). The worst case scenario for tree stress is identified in Figure 6.1.

At what distance along Marillana Creek, on either side of the CID, will trees be stressed?

Hydrogeologists from the Department of Minerals and Energy suggest that trees may be stressed further along Marillana Creek than indicated on Figure 6.1. The proponent needs to justify why trees would not be stressed outside the zones indicated in Figure 6.1.

Refer to the response provided to Question 2.2

Q2.4 What proportion of the different vegetation units will be affected by the proposal, and what is the local and regional significance of the vegetation affected?

The local and regional significance of vegetation impacted has been covered in the CER in Executive Summary page vi and Sections 4.2.1, 6.2.1 and 6.4. The proportion of sensitive riverine vegetation impacted within the region was estimated at less than 4% (p.6-5). Other vegetation communities to be impacted by project clearing occur more or less continuously throughout the Pilbara and the exact proportion impacted would depend merely on how extensive a definition of "local" or "regional" was used.

3. REHABILITATION AND DECOMMISSIONING - OPTIONS AND SCENARIOS FOR THE FINAL VOID

Overburden management/backfilling strategy

Q3.1 What percentage of overburden will be placed outside the pit compared with in the pit?

Much of the initial waste material will be used to construct flood control bunds, haul roads, ramps, mine equipment hardstands and for general plant earthworks (refer Section 3.2.3 of the CER). The initial mine development and stockpiling of waste material (overburden) will result in a 5 Mt out-of-pit waste stockpile. This stockpile will have a maximum capacity of 10 Mt over the following five years; however, some of the low grade ore material stockpiled on top

of the waste stockpile may ultimately be used as product if suitable markets can be secured. The percentage of overburden to be stockpiled outside the pit compared with in the pit over the life of the mine will not exceed 15 %.

Q3.2 This particular proposal gives no indication of how much the water table will be covered at the cessation of mining.

The waste:ore ratio is about 0.6:1. It is expected that sufficient waste material is to be returned to the pit to result in the pit being filled to about 40-50% of its pre-mine volume. This estimate takes into account the expected swell factor.

Refer to the response provided to Question 1.11.

Q3.3 How many years following commissioning will mining be sufficiently advanced to allow direct infilling of the mined out pit?

The timing for direct backfilling into the pit will be dependent on the capacity to dewater to reduce the water table level to below the base of the proposed mining depth. If this can be achieved, direct backfilling will commence within two years of commissioning.

Q3.4 Hamersley should investigate the possibility of partial backfilling of the pit below the water table upon completion of mining. If it is not feasible to do this, then that should be stated by the proponent.

The CER states that as mining proceeds, backfilling of the mined pit using overburden will be undertaken (see responses to other questions in this section)

Q3.5 What quantity of backfill would be placed in the Junction void, and what will be the height of backfill?

Refer to the response provided to Questions 1.11 and 3.1.

Q3.6 Although there is passing comment about backfill of the pit in relation to mine development, no discussion is had into the infill of pits to a level above the water table to mitigate salinity and associated saline plumes.

Refer to the response provided to Questions 1.11 and 1.12.

Rehabilitation

Q 3.7 Will seed collected from the local provenance be used in revegetation operations?

The standard procedures for rehabilitation outlined in Section 6.12 of the CER involve the use of topsoil return (which contains viable native seed and rootstock), rather than the use of seeding. If, and when, seed collection is required, seed will be collected from local native plant species. Some seed may be sourced from outside the local provenance if its availability is limited.

Q3.8 The document fails to address rehabilitation, it merely refers to other documents (Topsoil, No.2 Detritals Mine, Hamersley 1995).

Section 6.12 of the CER specifically addresses rehabilitation and decommissioning during the life of the project. This section summarises the standard procedures for rehabilitation that have been practised by Hamersley over many years at other operating mine sites. These procedures are to be applied to the rehabilitation of most disturbed areas, both during construction and mining operations. The EMP will provide further details of rehabilitation, including rehabilitation performance criteria for final land use.

The Rehabilitation Plan referred to in the CER is a document that provides a detailed description of standard rehabilitation procedures and rehabilitation performance criteria adopted by Hamersley. The plan was prepared with input from the DRD, DEP and DOME. The plan has been approved by Government as meeting the requirement of a condition set in relation to the Brockman project.

Q3.9 No information is supplied as to the removal and rehabilitation of rail structures, or infill of old borrow pits with rail embankment ballast.

The removal and rehabilitation of the Central Pilbara Railway extension between Juna Downs and Junction will be addressed in the decommissioning plan to be prepared by Hamersley.

Q3.10 The CER states that the broad objective is to rehabilitate to safe and stable land forms to allow the development of land use and ecological values in similar conditions to those which existed prior to mining (Section 6.1.2). A large void containing water resulting from exposing the water table is not consistent with the pre-existing land use and ecological values (grazing and hummock grassland communities).

The statement refers only to the broad objective of rehabilitation; it is acknowledged that not every part of the project area can be returned to the same state that exists prior to mining. For this reason, although most of the area will be consistent with the broad objective of rehabilitation, some small areas (such as any lake area to be formed) may not be consistent with that objective. The values of the ecological system will not be altered, only a very small part of that system will be altered in some way. Much of the void will not contain water and will be useable for the same pastoral land use as currently exists.

Q3.11 Section 6.12 of the CER states that rehabilitation will be undertaken progressively and a decommissioning plan is proposed to be submitted at least two years prior to decommissioning.

It is not entirely clear what the extent of void planning prior to mining will be. Consideration needs to be given to modelling for the void and options developed for Government consideration prior to mining commencing. If planning is deferred then cost may prohibit the use of techniques that could have been incorporated at an early stage.

Planning for the final void has already commenced with hydrogeological studies being commissioned on the most effective 'walk away' solution to decommissioning. Final void planning is also being undertaken at the same time as detailed mine planning, as both aspects

are inherently linked. Information developed through modelling for the final void and from other ongoing hydrogeological studies will be provided to Government through specific consultative and reporting channels.

Decommissioning

Q3.12 How long after decommissioning will the progress of revegetated areas be assessed?

This issue will be specifically addressed in the EMP and the decommissioning plan to be prepared by Hamersley. Monitoring of rehabilitation and decommissioning will enable the performance of these activities to be measured, allowing the timing for a 'walk-away' decision to be agreed on quantitative data.

Q3.13 With respect to decommissioning, we note the proponent commits "to develop and evaluate options for possible viable and compatible long term integrated management strategies" (Executive Summary Page-vi).

Given that the proponent cannot be clear on the impacts of the pit on areas like Weeli Wolli Springs, more positive commitments to its protection should be given.

Leaving plans for visual impact management and water management to the effective end of the mine life is not considered to be appropriate or adequate. Issues that need consideration are:

- **beach and sub surface profiles (morphometry) and safety;**
- **hypersalinisation of the water body, ie. need for design to incorporate flushing and purging by storm events if turnover is low (see Q3.14 below); and**
- **potential beneficial uses of the water body and planning to enhance/accommodate those uses.**

Given the location of Weeli Wolli Springs in relation to the Junction Deposit and the flow direction of Weeli Wolli Creek, the potential for impact on Weeli Wolli Springs is negligible (refer response provided to Question 1.7).

Hamersley will not leave environmental management planning for mine decommissioning to the end of the project life. Planning for the final decommissioning strategy has commenced already (refer response provided for Question 3.11 and the CER). Past EPA assessments of mining projects have shown a preference to defer final approval of decommissioning plans to a date nearer to the time of eventual mine closure.

Long term drainage management

Q3.14 The Pilbara now supports a number of projects which have previously, propose to, or are currently engaged in mining below local water tables. A number of these are located in areas where groundwater quality is significant in the maintenance of local ecosystems, including permanent wetlands of major regional significance.

Because of high evaporation rates, salinity will increase in the exposed water body. This may not be significant where groundwater flows are high enough to provide continual water turnover within the pit. However, if turnover is low, water within the pit will become hypersaline. This may be a significant threat to wetland and groundwater environments in the vicinity of the pit.

How will Hamersley manage the potential for groundwater contamination and impacts on vegetation both during the life of the mine and at decommissioning?

Refer to the responses provided to questions 3.1 - 3.6.

4. INFRASTRUCTURE

Q4.1 A review of the relevant sections of the document indicates that not all of the proposed route has been surveyed for ethnographic and archaeological sites. The indication is that this will be completed when the railway route has been finalised and vehicle access provided. There is some concern regarding this course of action as the implication is that ground disturbing activities will be undertaken prior to ethnographic and archaeological survey work over the chosen route.

An archaeological survey is to be undertaken along the railway corridor and in those areas where borrow pits, access tracks, water bores and cuttings are proposed, during geotechnical work to be undertaken before construction commences. As soon as appropriate access is established, Aboriginal people will be consulted and the necessary archaeological clearance work completed prior to any new track work. Should any site be identified, it will be marked so that the site can be avoided during construction work or until its significance can be evaluated and the necessary approvals obtained.

In addition, all geotechnical evaluation and other evaluation works with the potential for causing some ground disturbance in the railway corridor are being closely supervised and monitored by on-site environmental personnel.

Rail and access road construction - drainage management

Q4.2 Detailed consideration needs to be given to low level drainage in the area of extensive high quality mulga flats where the railway crosses the Great Northern Highway. Sheet CPR6 shows that the rail corridor will cut drainage to the mulga from the hills to the north. In the absence of appropriate drainage control, severe damage may be inflicted on this area. Plans for the drainage management should be reviewed and approved by DEP and CALM.

Final railway plans will be submitted to the DEP and CALM for approval. These plans will show the drainage controls proposed along the length of the railway alignment.

As stated in Section 3.3.3 of the CER, drainage management planning and appropriate drainage structures for the railway will be applied during final engineering design work to

minimise potential impacts. Details of the location and type of drainage controls in the final design will be provided to the DEP and CALM for approval (refer response provided to Question 4.2). The principal drainage controls to be implemented will be the use of culverts. The drainage structures along the railway will be designed to a 1 in 50 year recurrence interval. Wherever practicable, existing natural drainage flows will be maintained along the length of the railway.

Vegetation monitoring will be undertaken on either side of the railway for the purpose of evaluating the potential impacts of drainage shadowing or drainage alteration. Should monitoring indicate unacceptable impacts, remediation works will be undertaken to improve drainage management. The details of this monitoring will be provided in the EMP.

Q4.3 The CER contains no description of culvert/bridge design or their location. There is also no indication of how sheet flood will be managed in the Juna Downs section as it tries to move southwards into the upper reaches of the Yandicoogina creek or how the bridge is going to be built over that same river, but relies on the statement that rail construction will be of the same high standard as that of the construction of the Central Pilbara Railway. This is not satisfactory.

There is no bridge proposed to be constructed over Yandicoogina Creek. The railway alignment is separated from Yandicoogina Creek by high terrain and therefore never crosses it, or extensive sections of its catchment (refer Figure 3.2 of the CER). The nearest structure associated with the project that is located on or near Yandicoogina Creek is the mine water discharge point; the nearest other structure is the load-out conveyor, located about 2 km from Yandicoogina Creek (refer Figure 3.1 of the CER). The conveyor will be elevated well above known flood levels where it crosses Marillana Creek.

Q4.4 How will the adjacent service road be constructed and culverted or bridged?

The adjacent railway service road will be a formed, unsealed gravel road using local materials, similar to that established for the remainder of Hamersley's existing railway network. The service road will be available only to Hamersley personnel. As for similar service roads, most drainage crossings will be floodways, rather than being culverted.

Q4.5 The direct physical impact of the railway line is three times the area of that affected by the mine itself. How does Hamersley propose to manage the wider impact of the railway through the alteration of surface drainage?

Refer to the response provided to Question 4.2.

Provisions for sharing of infrastructure

Q4.6 The holistic issue of third party rail sharing provisions proposed by Pilbara 21, both as an environmental and economic issue, has not been addressed by the proponent.

State Agreements covering Hamersley operations contain provisions for sharing infrastructure, where it is practical to do so. This issue was addressed by Hamersley in the CER.

Section 2.3.2 of the CER states that "connection to BHPIO current railway network is not practical. That rail system does not connect to Hamersley's port at Dampier and it would not be practical to establish a spur to Hamersley's main line. Sharing of port facilities at Port Hedland is not practical due to insufficient capacity/space and the high cost of port extensions."

In addition, Section 6.11.2 of the CER states that "Hamersley's rail corridor developed for the present project provides the most cost-effective route possible from its existing rail infrastructure to the proposed mine site. Most other potential iron ore mines shown in Pilbara 21 occur well to the south of (the nominated) route and are separated from the proposed corridor by rugged terrain which would preclude building of shared rail lines."

Q4.7 The transport infrastructure options for this project need to be thoroughly explored and should include the possible sharing of rail lines and port facilities. The wording of Agreement Acts has been designed to facilitate the sharing of infrastructure. The potential use of longer conveyor systems should also be considered and discussed.

Refer to Hamersley's response to Question 4.6. The use of longer conveyor systems is not practical on the basis of economics and the need to link into Hamersley's existing rail network.

5. DUST

Q5.1 The CER has failed to include the design of materials handling facilities, any description of dust monitoring process (ie High Volume Dust Monitors - establishment - location), or any description of dust filtration systems or ore transport systems.

What type of water sprays and water quantities are to be used on conveyor belts at transfer points?

What type of water sprays and water quantities are to be used on slewing/luffer ore stacker?

What type of water cannon and water quantities are to be used on the stockpiles?

What dust extraction methods are proposed to be used at transfer points?

What type of medium is to be used to ameliorate dust plumes rising from transfer points and conveyors? Will all conveyors be covered/enclosed, especially the 3 km conveyor that traverses Marillana Creek ?

What type of butterfly sprays, water/chemical suppression will be used on material handling facilities?

What type of water cart systems are to be used to suppress roadway and trafficable area dust?

What type and size of concrete aprons are to be established around stockpile, transfer areas?

Section 6.1 and Section 6.13 of the CER and Hamersley's commitment (Commitment 8) indicate that Hamersley will address dust management and dust monitoring in the EMP to be prepared prior to the commencement of construction. This EMP will state the type of dust monitoring equipment and the monitoring schedule to be adopted. Due to the high moisture content of this ore, dust management is likely to be easier than at other operating mines.

Dust lift-off from rail transport

Q5.2 A prime example of the damage sustained to flora can be viewed on the Yarrie station in the Pilbara, where vegetation up to 400 metres either side of the BHP Goldsworthy rail line has been retarded. The rail cars in this case will be travelling through the Karijini National Park. No discussion has taken place as to how dust impacts will be managed on the Karijini National Park, the denuding of vegetation or the problems posed to vertebrates trying to seek cover whilst crossing the rail corridor.

The high moisture content of the ore to be transported from Yandicoogina to Dampier will minimise dust generation from rail wagons. The ore from Yandicoogina will have a moisture content in the order of about 8%. This compares with an average moisture content of lump ore (about 2.5%) and fines ore (about 4.5%). The high moisture of Yandicoogina ore will minimise the potential for dust. It is understood that there is no problem of dusting from BHPIO's rail wagons loaded with Yandi ore. In this characteristic, Hamersley's ore will be similar to that of BHPIO's.

Experience with the existing section of the Central Pilbara Railway indicates that many vertebrates (particularly large vertebrates) favour the use of railway culverts for shelter and as a thoroughfare across the railway alignment.

Q5.3 There was no discussion or information supplied on dust impacts of vehicle traffic, both industrial and social, travelling from Yandicoogina to Tom Price through the Karijini National Park on the rail access road or the regular road systems in the park.

There is no proposal to upgrade the existing service road adjacent to the Central Pilbara Railway extension.

The issue of dust in relation to the use of the Central Pilbara Railway and the adjacent service road within the corridor through the Karijini National Park has already been addressed as part of the Marandoo project approval process.

6. SOCIAL

Q6.1. There are no commitments that the contract workforce shall be local.

Whether contract or Hamersley, the workforce will be sourced as far as practicable from within Western Australia. The opportunities for recruitment of local candidates will be the same as for non-local candidates.

Q6.2 Will firearms be allowed on any part of the project area?

Section 6.5 of the CER lists some measures to be adopted by Hamersley to minimise impacts on fauna. One of these measures specifies that "all employees will be required to undertake an induction programme that contains aspects of fauna protection, including regulations for the banning of firearms and pets....". This exclusion of firearms has been standard practice at all Hamersley mine sites and exploration areas for many years, as it has for most of the mining industry.

Q6.3 Will domestic pets or animals be permitted on any portion of the Yandicoogina site or any other areas related to the project?

Refer to the response provided to Question 6.2.

Q6.4 Will recreational off-road vehicle movements be permitted in the areas surrounding the Yandicoogina site?

The induction programme referred to in the response to Question 6.2 will also include provisions for the exclusion of recreational use of off-road vehicles by the workforce. The current induction in place for the exploration programme at the Junction Deposit contains provisions for the exclusion of private off-road vehicles from the site. Hamersley can maintain controls over its workforce in the mine area; however, it has no control over tourists or other members of the public who may legally use recreational off-road vehicles in the surrounding area.

Community consultation

Q6.5 The proponent's commitment to social responsibility in its dealings with Aboriginal people is clearly apparent in the successes of the Aboriginal Training and Liaison Unit. However, in respect to this particular project proposal there is no clear indication that the Unit has, or is intending to, undertake any activities with the relevant Aboriginal communities and individuals directly involved in the project area.

Section 6.11.4 of the CER provides details of the existing programmes that have been developed by Hamersley for, and in conjunction with, the local Aboriginal community. The focus of these programmes is on Aboriginal people who have an interest in the land on which Hamersley operates or wishes to operate. These programmes are inclusive of the relevant Aboriginal communities directly involved in the project area.

As stated in the CER, Hamersley will continue to explore with Aboriginal communities potential opportunities to further address their training, employment, enterprise development and community development needs. The Yandicoogina Project offers an opportunity to further develop or expand existing programmes and implement new ones. The exact form and scope of such programme expansion will obviously depend on ongoing negotiations between Hamersley and the local Aboriginal people.

Q6.6 Best Practice Environmental Management in Mining clearly identifies community consultation as being fundamental in establishing good environmental management and interaction at all levels with the community. This CER fails to do this. There is no indication or report in the CER of community consultation with the Pilbara Environmental Group (Karratha), the Nicol Bay Naturalists (Karratha) or the Local Environment Affinity Force (Port Hedland). The area is being treated purely as a resource rather than having any community significance or ownership.

Section 5.1 of the CER indicates that a range of government and community groups were consulted, either through meetings or by letter. These groups included:

- the Conservation Council of Western Australia
- the Pilbara Development Commission
- the Newman Chamber of Commerce
- the Shire of East Pilbara
- the Shire of Ashburton

Consultation with the Conservation Council of Western Australia (the umbrella group for conservation organisations in Western Australia) did not raise the need to consult with the various groups cited in the above question. It is noted that none of these groups made a submission to either Hamersley's or BHPIO's CERs despite advertisements in the local press.

An extensive consultation process was also undertaken by Hamersley with Aboriginal communities. This consultative approach will continue to incorporate discussions with elders, community leaders and members, and representative bodies, including land councils.

7. CUMULATIVE IMPACTS/REGIONAL IMPLICATIONS

Q7.1 The expected future development along the CID would result in many exposed water bodies and their associated problems. The cumulative impacts and long term have not been addressed.

The impact of the ultimate development of numerous pits along the CID is uncertain. Hamersley has only sought environmental approval for a single pit as described in the CER. Other than BHPIO's recent proposal to duplicate its current Yandi mine, there are no other mining proposals for the CID. Until such time that firm proposals are put forward to extend existing or approved mines, there are no specific details upon which to assess the cumulative environmental impacts of mining along the CID. Any future proposal to mine areas along the CID (other than those already outlined) will need to take into account existing and approved mines when environmental approvals are sought.

Section 6.3 of the CER takes into account BHPIO's existing mine and proposed duplication in describing the expected cumulative environmental impact on Marillana Creek and the CID of Hamersley's Yandicoogina Project. The cumulative impacts and long term management will be the subject of future research to be undertaken by Hamersley (refer Commitments 3, 5, 8 and 19 in the CER).

Hamersley's EMP will have a system-wide approach, so that it is capable of assessing the impacts of any future mines within Hamersley's Yandicoogina leases.

Q7.2 The proponent fails to deal with the cumulative impacts of dewatering discharge from the BHPIO Yandi project. It is stated that the dewatering pools created by the BHPIO Yandi expansion will terminate before reaching Phil's Creek prior to going subsurface. What is not addressed is how the Yandicoogina dewatering discharge will perform and relate to the Yandi subsurface water body or for that matter, what will happen should other ore bodies in the CID be developed.

Refer to the responses provided to Questions 1.2 and 7.1.

Q7.3 The cumulative impact of discharge water would have the ability to create surface flow over large areas, and through loose scree ore, would have increased turbidity.

Surface flow from the mine water discharge point will only occur downstream along the existing creekline, which is comprised of washed sand and rocks, not loose scree ore. Marillana Creek is subject to periodic flood events with floodwater that has a very high turbidity. Since surface flow along the creek from the discharge point would not affect any existing waterbody, increase in turbidity is not a relevant issue.

Q7.4 The potential cumulative impacts of increased water flow and raising salinity have not been properly evaluated in relation to its impacts down stream on the Fortescue Marshes. Pilbara miners must start considering their responsibilities to the more permanent industries of pastoralism, horticulture and tourism. These are based on the renewable resources of land and water being maintained and protected. Protecting the water resource is critical to the long term sustainability of the Pilbara.

The CER addresses the potential for impacts on the Fortescue Marshes - refer Section 6.3. The best hydrogeological advice on the long term impacts of the proposed project on land and water resources is that the impacts will be confined to within several kilometres of the mine site and have negligible effects elsewhere.

The potential future use of land and water resources downstream of the Junction Deposit will be taken into account, together with all other relevant issues, in the development and implementation of long term management strategies.

Regional implications

Q7.5 The expansion of all the various mining proposals in the region is not being considered in a holistic manner. The only reference to the regional cumulative impacts

is a commitment to evaluate the impact of mining on the Marillana Creek system in conjunction with BHPIO. Unfortunately this evaluation is to take place after cessation of mining with little chance of carrying out remedial in-pit filling to address salinity problems associated with the in-pit exposed water bodies.

Impact evaluation will not just commence after cessation of mining. Hamersley has already commenced, and will continue through the pre-construction, construction and post-commissioning phases of the project, to evaluate the impacts of mining and decommissioning on Marillana Creek and the CID jointly with BHPIO to improve the understanding of the hydrogeological system so that options for long term management strategies can be developed.

Hamersley also notes that that the effects and management of mining below the water table in the Pilbara are being considered from a Government perspective by the Pilbara Iron Ore Environmental Management Committee. Hamersley interacts with that committee and understands that a working group comprising representatives of the Departments of Resources Development, Minerals and Energy, Environmental Protection and the Waters and Rivers Commission is to be formed to develop strategies and make recommendations to Government on this issue, with an initial focus on the Marillana Creek system.

Q7.6 The proponent's response in Section 6.11.2 that potential cumulative impacts cannot be determined without firm details is not acceptable. Whilst specifics such as start up time may not be available, location of ore bodies, projected tonnage, expected rail requirements and what level of dewatering that will be needed are available from the proponent through their own records, from DOME or from DRD.

Refer to the response provided to Question 7.1.

Q7.7 The proponent does not take into account any proposals by Hope Downs Limited which are subject to State Agreement Act 1992. This project also envisages a rail line transecting the Yandicoogina rail system at some location.

Refer to the response provided to Question 7.1.

Specific details of the Hope Downs project have not yet been made available to Hamersley, nor has a definite decision been made to develop this deposit. It is therefore not possible to evaluate the cumulative impact of Hamersley's project with any future development of that particular iron ore deposit. When a decision is made to develop the project, it will be subject to environmental impact assessment by the EPA. Any such assessment is likely to address the potential cumulative impact of that project with existing operating mines or those that have been approved, but not yet developed. This situation applies to all other potential mining projects in the region that are at varying stages of advancement in terms of development.

Hamersley has taken into account existing mining operations and projects that have been approved (or recommended to be approved) in preparing the CER. The environmental approval process of any future project will need to address its associated cumulative impact taking into account existing and approved projects.

Q7.8 With this proposal, the development is being addressed in a purely pecuniary manner by the proponent. It does not take into account the environmental impacts of future developments either by themselves; BHPIO, Robe River or Hope Downs or collectively.

The Regional Iron Ore Mines listed below have also not been taken into consideration in the CER and yet in one way or another will have cumulative impacts on current proposals:

Devans Mine	**Angelas**	**Area C**	**Bakers**
East Angelas 1 & 2	**Giles Central**	**Hope Downs 1**	**Rhodes**
Luncheon Tree	**Mystery 2**	**Mystery 1**	**Mystery**
Mulga Downs	**Pamella S**	**Rhodes W**	**Yandi**
Pamella Ridge	**Rhodes N & E**	**Ross**	**Wonmunna**
Shivani Ridge	**Syncline 19**	**Wonmunna S**	**Wonmunna N**

Refer response provided to Question 7.1 and 7.7.

8. OTHER

Q8.1 On Page 6-5, the proponent states that it will continue to evaluate the impacts of mining and decommissioning on Marillana Creek and the CID jointly with BHPIO to develop long term management strategies. What guarantee does Hamersley have that BHPIO will continue to work jointly with them on this issue?

The evaluation of the impacts of mining and decommissioning on Marillana Creek and the CID is recognised to be most effective if done on a system-wide basis. Any long term management strategy will need to incorporate prevailing hydrogeological conditions over the area of influence of the mine. Hamersley will take into account the system-wide approach in mine design and decommissioning planning, whether or not BHPIO works jointly with Hamersley. Refer also to the response provided to Question 1.12.

Q8.2 How does Hamersley propose to manage the project's impact in relation to the spread of weeds, particularly *Argenome mexicana*?

The Agricultural Protection Board (APB) advises that this species does not occur in Western Australia. The probable species referred to is *Argemone ochroleuca*, or Mexican poppy, which is a close relative of *A. mexicana*. *A. ochroleuca* is a declared plant in Western Australia and is widely distributed in the pastoral areas, mainly along river systems, moist flats and sand dunes. Appendix B of the CER indicates that the project area already contains the weed. The EMP will provide details of any weed control programme to be implemented.

Q8.3 As usual, this document does not provide an EMP and therefore no evaluation can be carried out. The development of EMP's after assessment of the CER is not satisfactory and does not allow the public to participate in the process.

The EPA guidelines for the CER (Appendix A of the CER) do not require an EMP to be prepared, but indicate that the purpose of the CER is to, in part, "provide the basis of the proponent's environmental management programme, which shows that the environmental issues resulting from the proposal can be acceptably managed." It is normal practice for an EMP to be prepared following the release and assessment of the CER. This approach ensures that any relevant issues that are raised during the review process can be addressed in the EMP.

Q8.4 There is no description of (sewage) processes to be used; there is merely reference made to processes used at other sites (Marandoo and Nammuldi). No discussion takes place in relation to the proximity of Marillana Creek, in particular the issue that two systems would be needed - one on either side of the creek. There is no discussion of the regional cumulative impact, ie. several mines along the CID and creek system.

Section 3.2.6 of the CER states that two sewage treatment systems will be required; however, it does not indicate that they will be located on either side of the Marillana Creek. Both systems will be located on the northern side of Marillana Creek. The construction/mining village sewage treatment system will have the highest nutrient load of the two systems, but will be located 4.5 km from Marillana Creek. The cumulative impact of an additional two sewage treatment systems within the Yandicoogina district will be negligible.

The type of sewage treatment systems to be used will be determined as part of the final detailed engineering studies being undertaken by Hamersley. Sewage treatment systems such as those cited in the CER have been operated in many places in the Pilbara without significant environmental impacts. Details of any sewage treatment system to be used will be provided to the Health Department for approval.

Under current best practice guidelines, any sewage treatment system will involve the containment of effluent within lined evaporation ponds. There will be no surface or seepage release of effluent to the environment.

Appendix 3

List of submitters

Conservation Council of Western Australia (Inc)
Department of Aboriginal Affairs
Department of Conservation and Land Management
Department of Minerals and Energy
Department of Resources Development

Appendix 4

Proponent's revised list of environmental management commitments

Table 7.1 Summary of environmental commitments.

Issue	Objective	Commit-ment number	Commitment	Phase
Legislation	Comply with relevant legislation.	1	The construction and operation of the project will be undertaken in accordance with the requirements of relevant Commonwealth and State legislation and regulations.	Pre-construction and Post-commissioning.
Amendments to the project	Refer significant project amendments for assessment.	2	Details of any plan to alter the project from that outlined in this CER that is likely to result in significant environmental impacts will be provided to the EPA for environmental assessment.	Pre-construction and Post-commissioning.
Understanding hydrogeological system	Understand hydrogeological systems and develop and evaluate options for long term management.	3	Hamersley will continue to evaluate the impacts of mining and decommissioning on Marillana Creek and the CID jointly with BHPIO for the purposes of further understanding the hydrogeological system in order to develop and evaluate options for viable and compatible long term management strategies. Results of evaluations will be reported to the Pilbara Iron Ore Environmental Management Committee	Pre-construction, Construction and Post-commissioning.
Groundwater monitoring in Marillana Creek	Monitor groundwater in the Marillana Creek alluvium.	4	Hamersley will establish groundwater monitoring bores in the alluvium to monitor surface and groundwater levels before dewatering commences. The results of this monitoring will be submitted to the State on an annual basis. The monitoring program will be implemented to the satisfaction of the Minister for the Environment on advice from DEP.	Pre-construction, Construction and Post-commissioning.

Table 7.1 Summary of environmental commitments.

Issue	Objective	Commit-ment number	Commitment	Phase
Hydrogeological data collection	Collect further hydrogeological data to develop a model for the final void.	5	Hamersley will continue to collect necessary hydrogeological data for the development of a model to predict long term water levels and quality in the final void. This model will be applied to assist design the final void to minimise long term impacts of mining on local and regional groundwater resources to the satisfaction of the Minister for the Environment on advice from DEP. A report on this model and the final outcome will be prepared and submitted to the DEP before finalising the decommissioning plan.	Pre-construction, Construction and Post-commissioning.
Environmental Audits	Conduct regular environmental reviews.	6	Hamersley will conduct internal environmental reviews during the construction (every 6 months) and operation (annually) of the project. These environmental reviews will assess compliance with project commitments, relevant Works Approval and Operating Licence conditions and any other environmental requirements.	Pre-construction, Construction and Post-commissioning.
Environmental Reporting	Prepare reports on environmental management and monitoring.	7	Annual and triennial reports that describe the actions taken to comply with environmental management conditions and monitoring commitments will be prepared by Hamersley and issued to the State.	Post-commissioning.

Table 7.1 Summary of environmental commitments.

Issue	Objective	Commit-ment number	Commitment	Phase
Environmental Management Programme (EMP)	Prepare an EMP for the construction and operation of the project.	8	Hamersley will submit and implement an EMP for the project prior to the commencement of major construction activities. The EMP will be developed in consultation with DEP, and to the satisfaction of the Minister for the Environment. The EMP will provide details on the following: • groundwater and surface water management during mining and post mining • sheet and gully drainage management along the railway • dust and noise emissions • waste management • flora and fauna protection • fire and weed management • environmental inductions for construction and operation personnel • rehabilitation of disturbed areas. • monitoring programmes.	Pre-construction and Post-commissioning.
Biological	Minimise impacts on riverine vegetation.	9	During the project life, Hamersley will undertake monitoring to assess the impacts of dewatering on riverine vegetation. If unacceptable impacts are detected, management strategies for the riverine vegetation will be implemented to the satisfaction of the Minister for the Environment on advice from DEP. The results of this monitoring and management will be submitted to the State on a triennial basis.	Pre-construction, Construction and Post-commissioning.
Waste Disposal	Manage wastes in an appropriate manner.	10	Burning will not be permitted as a means of rubbish or other waste disposal within the project area. All putrescible, biodegradable, inert substances and other general rubbish will be disposed of in a fenced, excavated waste pit that will be regularly backfilled to cover the waste material.	Post-commissioning.

Table 7.1 Summary of environmental commitments.

Issue	Objective	Commit -ment number	Commitment	Phase
Sewage Treatment Plants	Ensure sewage treatment plants are approved.	11	Plans for sewage treatment plants proposed at Yandicoogina will be submitted by Hamersley for approval by the Western Australian Department of Health.	Pre-construction.
Hydrocarbons	Appropriate storage of hydrocarbons.	12	All bunding for hydrocarbon storage areas will be constructed in accordance with the requirements of AS1940 - 1993.	Construction and Post-commissioning.
Contaminated Surface Runoff	Ensure that contaminated surface runoff does not enter natural drainage.	13	Management procedures will be put in place to ensure that stormwater runoff from areas that may result in contamination by hydrocarbons does not enter natural drainage channels without prior treatment.	Post-commissioning.
Dust	Minimise dust.	14	Dust suppression measures, including application of water from tankers, will be implemented to minimise dust generation during site preparation and construction activities.	Construction and Post-commissioning.
Pastoral Activities	Minimise potential disruption to pastoral activities.	15	Hamersley will enter into negotiations with the Marillana pastoral station manager on the issue of means of managing any potential disruptions to pastoral activities.	Pre-construction, Construction and Post-commissioning.
Archaeological and Ethnographic Sites in Railway Corridor	Obtain archaeological and ethnographic clearance for the railway corridor.	16	Once suitable access has been established, Aboriginal people involved in the earlier site survey process with Hamersley will be invited to inspect the route of the surveyed railway alignment to identify any significant archaeological or ethnographic sites.	Pre-construction.

Table 7.1 Summary of environmental commitments.

Issue	Objective	Commit-ment number	Commitment	Phase
Disturbance to Aboriginal Sites	Comply with *Aboriginal Heritage Act.*	17	If any Aboriginal site is required to be disturbed, a written application, as required under Section 18 of the *Aboriginal Heritage Act*, will be made to the Trustees of the Western Australian Museum for consent by the Minister for Aboriginal Affairs.	Pre-construction and Construction.
Rehabilitation	Ensure disturbed areas are rehabilitated.	18	Vegetation and topsoil removed during site preparation will be used to progressively rehabilitate disturbed areas.	Construction and Post-commissioning.
Decommissioning Plan	Prepare plan for decommissioning of the project.	19	A conceptual decommissioning plan will be prepared in consultation with DEP, DOME and the Water and Rivers Commission to the satisfaction of the Minister for the Environment for subsequent implementation. The plan will be submitted to Government at least two years prior to decommissioning of the project. The plan will address post-mining water management issues giving due consideration to the known results of environmental management at other mines on the channel iron deposit.	Post-commissioning.