Yandicoogina Iron Ore Mine and Railway — Extension of Mining Area, Change to Environmental Conditions

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Hamersley Iron Pty Limited

Section 46 Report and Recommendations
of the Environmental Protection Authority

Environmental Protection Authority
Perth, Western Australia
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Summary and recommendations

Hamersley Iron Pty Limited is proposing to extend the mining area of the existing Yandicoogina Iron Ore Mine. The extension area is approximately 300 hectares (ha) and would roughly double the area of the approved mine.

Section 46(3) of the *Environmental Protection Act 1986* requires the EPA to report to the Minister for the Environment on whether or not the proposed changes to conditions and procedures should be allowed. In addition, the EPA may make recommendations as it sees fit.

This report provides the EPA's advice and recommendations to the Minister for the Environment on the environmental factors, conditions and procedures relevant to the proposal.

Relevant environmental factors

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

(a) Groundwater quantity — short-term effects on groundwater systems as a result of dewatering and long-term effects of the final mine void;

(b) Groundwater quality — long-term changes in salinity due to the final mine void; and

(c) Surface water quality — long-term changes in salinity due to the final mine void.

Conclusion

The EPA has considered the proposal by Hamersley Iron Pty Limited to extend the mining area of the Yandicoogina Iron Ore Mine and has concluded that it can be managed to meet the EPA's objectives for the relevant environmental factors.

In assessing this proposal the task of the EPA has been made easier by the progress the proponent has made in planning for the closure of the mine and the management of long-term impacts of the final mine void. In the EPA's previous assessment of the Yandicoogina Iron Ore Mine and Railway, the EPA recognised that there was lack of full scientific certainty regarding the impacts to local and regional groundwaters. The work carried out by the proponent, in preparing an acceptable closure plan for the mine void, has increased scientific certainty and will continue to do so as the plan is further refined.

In addition to the above, the EPA considers that conditions attaching to the environmental approval should be updated by the addition of a requirement to develop and implement an environmental management system for the project.

Recommendations

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

1. That the Minister notes that this report is pursuant to Section 46(3) of *the Environmental Protection Act 1986* and thus is limited to consideration of proposed changes to the original conditions.

2. The Minister notes that the proposed change is to extend the mining area of the previously approved Yandicoogina Iron Ore Mine and Railway.

3. The EPA recommends that the Minister considers the report on the relevant environmental factors as set out in Section 3.

4. That the Minister notes that the EPA has concluded that the modified proposal can be managed to meet the EPA's objectives, and thus not impose an unacceptable impact on the environment provided there is satisfactory implementation by the proponent of the amended conditions, including the proponent's commitments, as set out in Section 4.

5. The Minister imposes the amended conditions, commitments and procedures recommended in Appendix 4 of this report.

Conditions

The EPA recommends that the following conditions, which are set out in detail in Appendix 4, be imposed if the proposal by Hamersley Iron Pty Limited is approved for implementation:

1 The existing Environmental Conditions applied to the project (Ministerial Statement 417 published on 24 May 1996), be subject to modifications necessary to:

- extend the mining area; and
- include additional proponent commitments.

2. An additional condition which is routinely applied to mining operations of this size, namely:

- that the project should be managed in accordance with a comprehensive environmental management system to be developed by the proponent to the requirements of the EPA.

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1. Introduction and background

The Minister for the Environment has requested the Environmental Protection Authority (EPA) to consider and provide advice under Section 46(3) of the *Environmental Protection Act 1986* on Hamersley Iron Pty Limited's proposal to extend the mining area of the existing Yandicoogina Iron Ore Mine project.

The Yandicoogina Iron Ore Mine and Railway was initially referred to the EPA in 1995 and the level of assessment set at "Consultative Environmental Review". This level of assessment was set in recognition of the substantial scale of the proposal, the requirement for dewatering during construction and operational phases, the potential to affect rare and endangered flora and fauna, and the uncertainty of environmental impacts in the long term. In its report and recommendations (EPA 1996) the EPA concluded that the proposal was environmentally acceptable subject to a number of environmental conditions. The proposal was subsequently given environmental approval, with conditions, by the Minister for the Environment on 24 May 1996 (Statement 417).

Construction of the Yandicoogina Iron Ore Mine and Railway commenced in 1997 and the first shipment of ore occurred in January 1999.

In 1998 Hamersley Iron Pty Limited's proposal to extend the mining area at Yandicoogina was referred to the EPA. The EPA chose to formally assess this proposal for much the same reasons as for the initial proposal. Furthermore, the EPA determined that assessment under Section 46 of the *Environmental Protection Act 1986* was most appropriate since, if the proposed extension was environmentally acceptable, both the initial mining area and the proposed extension would be operated as one project and should be subject to a single set of environmental conditions.

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

A list of people and organisations that made submissions is included in Appendix 1 and References are listed in Appendix 2. Environmental Condition Statement No 417, published on 24 May 1996, is presented in Appendix 3. The recommended conditions and procedures and proponent's commitments are provided in Appendix 4.

Appendix 5 contains a summary of the public submissions and the proponent's response. The summary of public submissions and the proponent's response is included as a matter of information only and do not form part of the EPA's report and recommendations. The EPA has considered issues arising from this process relating to identifying and assessing relevant environmental factors.

2. The proposal

The current proposal is for an extension of the mining area of the Yandicoogina Iron Ore Mine. The extension area is approximately 300 hectares (ha) and would roughly double the area of the mine.

The currently approved Yandicoogina Iron Ore Mine and Railway (also known as "Yandi (HIY) Project") is located approximately 90 kilometres north west of the town of Newman (refer to Figure 1). This currently approved project involves the construction and operation of:

- an open cut iron ore mine;
- facilities to crush and screen ore and convey it to the rail loadout facility; and
- a 90 kilometre rail section which connects the mine to the Central Pilbara Railway.

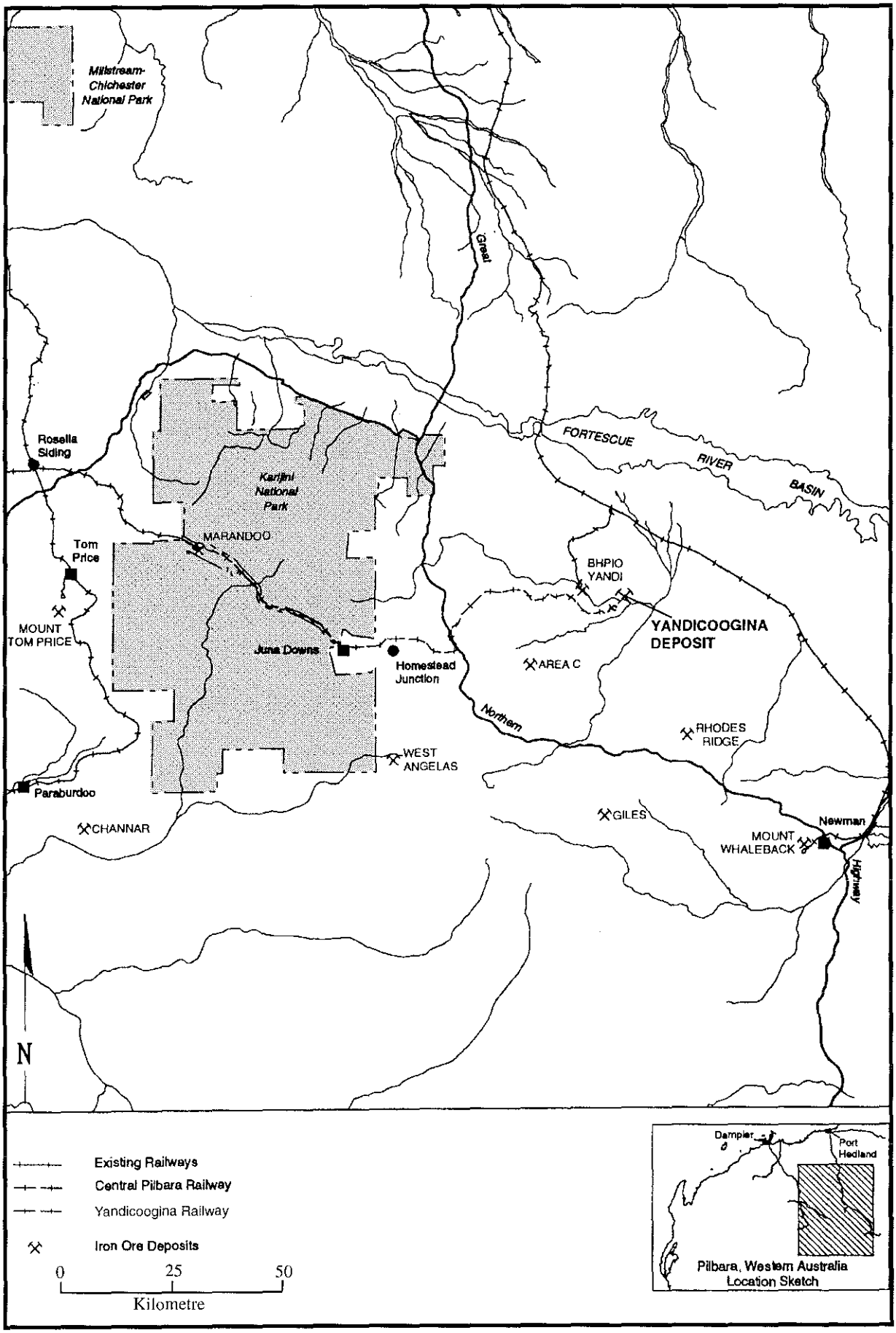

Figure 1. Location plan of the Yandicoogina project (Source: Hamersley, 1999).

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 region.

Compared with the approved project the proposed mining area extension will:

- increase the length of the mining area along the CID by 4.75 km (refer to Figure 2);
- increase the mining area by 300 ha;
- extend the projected mine life by 10 to 15 years;
- have a similar pit profile;
- increase (initially) the current maintenance dewatering from 10-15 ML/d to 15-20 ML/d, thereafter returning to the same maintenance dewatering rate;
- change the number of dewatering borefields from two to three and their location;
- relocate the dewatering discharge points toward the end of mine life;
- use the same mine support infrastructure (workshops, camp, power, administration offices);
- ultimately require an additional new ore processing plant or re-location of the existing one; and
- involve the same approach of backfilling with overburden material as mining progresses.

Table 1 summarises the key project characteristics of the approved project and proposed extension. A detailed description of the proposal is provided in Section 2 of the Section 46 Environmental Review document (Hamersley Iron, 1999)

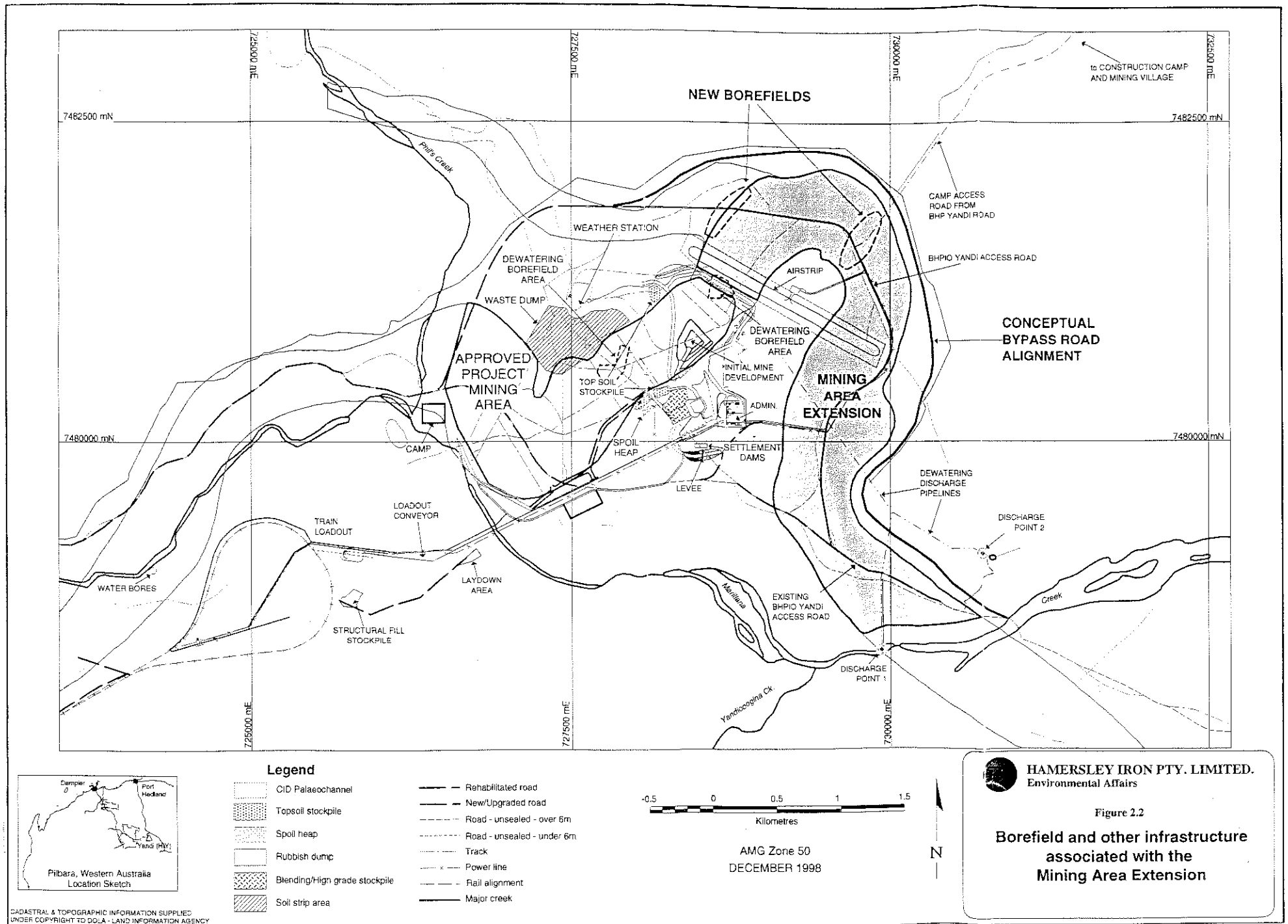

Figure 2. Approved project layout and mining area extension (Source: Hamersley Iron, 1999).

Table 1: Key characteristics of approved project and proposed extension.

Aspect	Approved Project	Mining Area Extension	Change *(compared with Approved Project)*
Length of CID to be mined	SL12.2km to SL15.0km	SL15.0km to a point 750m beyond SL19.0km (equivalent to 19.75km)	Additional 4.75km
Area of CID to be mined	300ha	300ha	Additional 300ha
Initial mining rate	About 8Mt/a, increasing to design capacity of 15Mt/a	About 15Mt/a, maintaining design capacity	No change
Ore reserve to be mined	140Mt	160Mt, bringing total to 300Mt	Additional 160Mt
Estimated mine life	15-20 years	25-30 years	Additional 10-15 years
Mine pit profile	About 65m deep; 40m below pre-mine watertable	About 65m deep; 40m below pre-mine watertable	No change
Dewatering requirements	Initial: 30ML/d Maintenance: 10-15ML/d	Initial: 15-20ML/d Maintenance: 10-15ML/d	Initial - lower Maintenance - same
Volume of dewatering used	5ML/d	5ML/d	No change
Number of dewatering borefields	Two: • a Permanent borefield • a Sacrificial borefield	Three: • an existing Permanent borefield • a new Permanent borefield on Phils Creek CID • a new Sacrificial borefield in the main CID	An additional Permanent borefield and a replacement Sacrificial borefield in the CID
Proportion of waste material backfilled (versus out-of-pit)	100% (after first three years, all waste reports as backfill, with out-of-pit waste used as backfill upon mine closure)	100% (waste reports as backfill from commencement of mining or is stockpiled and returned as backfill later)	No change
Proportion of mine void to be filled with overburden	About 50%	About 50%	No change
Mine infrastructure requirements	Refer CER and Section 1.2 and Figure 1.2 of this document	Utilise existing infrastructure until additional ore processing plant (or re-location of existing one) needed. Some new haul roads also.	Additional or re-located ore processing plant. More haul roads.

Notes: CID Channel Iron Deposit
ML/d megalitres per day
Mt/a million tonnes per annum
ha hectares
SL drill Section Line

3. Relevant environmental factors

Section 46(3) of the *Environmental Protection Act 1986* requires the EPA to report to the Minister for the Environment on whether or not the proposed changes to conditions or procedures should be allowed. In addition, the EPA may make recommendations as it sees fit.

Having considered appropriate references, public and government submissions and the proponent's response to submissions, it is the EPA's opinion that its inquiry into the proposed modification to the existing Yandicoogina Iron Ore Mine and Railway should address the following relevant factors:

(a) Groundwater quantity — short-term effects on groundwater systems as a result of dewatering and long-term effects of the final mine void;

(b) Groundwater quality — long-term changes in salinity due to the final mine void; and

(c) Surface water quality — long-term changes in salinity due to the final mine void.

The above relevant factors were identified from the EPA's consideration and review of all environmental factors (preliminary factors) generated from the Section 46 Environmental Review document and the submissions received, in conjunction with the proposal characteristics (including significance of the potential impacts), the adequacy of the proponent's response and commitments, and the effectiveness of current management. On this basis, the EPA considers that other factors not listed above do not require further evaluation by the EPA.

The identification process for the relevant factors is summarised in Table 2.

The environmental significance of the above issues of the proposal and their assessment are discussed in Sections 3.1 to 3.3 of this report. The description of each issue shows how it relates to the project. The assessment of each issue, combined with the consideration of the environmental factors relevant to it, is where the EPA considers if the proposal can be managed to meet its environmental objectives.

A summary of the EPA's assessment is presented in Table 3.

Table 2: Identification of Relevant Environmental Factors

FACTOR	PROPOSAL COMPONENT WITH POSSIBLE IMPACT	GOVERNMENT AGENCY AND PUBLIC COMMENTS	IDENTIFICATION OF RELEVANT ENVIRONMENTAL FACTORS
BIOPHYSICAL			
Vegetation communities	The extended mining area will clear an additional 300 ha of vegetation overlying the Channel Iron Deposit. Smaller areas will also be cleared for haul roads and processing facilities. No locally or regionally significant vegetation communities will be directly affected by clearing.	No comments received.	It is noted that no locally or regionally significant vegetation communities will be directly affected by proposed extension. In addition, the proponent has an approved Environmental Management Programme (EMP) for the existing mining area which addresses the management and monitoring of vegetation communities. The Proponent has given a commitment to extend the EMP to cover the mining area extension (Commitment 31). Although the proposed extension has no additional direct impacts on riverine vegetation as a result of dewatering, potential long term changes to hydrogeological systems of the area, due to the final mine void, could affect riverine vegetation. Such impacts on riverine vegetation are considered under the factor "Groundwater". **Factor does not require further evaluation as proponent's commitments are adequate.**
Declared Rare and Priority Flora	Flora surveys have been conducted which establish that there are no Declared Rare and Priority Flora within the area of the proposed extension.	No comments received.	It is noted that no Declared Rare and Priority Flora will be affected by proposal extension. In addition, the proponent has an approved Environmental Management Programme (EMP) for the existing mining area which addresses the management and monitoring of Declared Rare and Priority Flora. The Proponent has given a commitment to extend the EMP to cover the mining area extension (Commitment 31). Proponent is required to comply with the *Wildlife Conservation Act 1950.* **Factor does not require further evaluation as issues are addressed by proponent's commitments and other legislation.**

Terrestrial Fauna	Mining of the extended mining area will result in the loss of fauna habitat. However, no regional or locally significant habitats occur in the extension area.	No comments received.	It is noted that the loss of habitat as a result of this proposal is not considered regionally or locally significant. Other impacts on fauna are minimised through the EMP including a workforce induction programme which reiterates the need to protect fauna through the banning of firearms and pets, and the observance of safe driving speeds within the project area. **Factor does not require further evaluation as it is adequately addressed in the existing Environmental Management Programme.**
Subterranean Fauna	Mining of the extension area will increase the duration and spatial extent of dewatering operations. Local aquifers are not considered likely to support subterranean fauna and preliminary sampling supports this assessment.	<u>WA Museum</u> • The mine will involve extensive dewatering and so the impact of the project on any stygofauna communities needs to be assessed. Yandicoogina appears on hydrogeology maps as a calcrete area. Many groundwater calcretes and coarse alluvial deposits in the Pilbara contain rich relictual stygofauna communities containing higher taxa new to Australia.	Potential habitats (calcrete areas) occur upstream and downstream of the mining area approximately 10 km away. The proponent has advised that dewatering operations will not affect these habitats. Maintenance of these potential habitats in the longer-term is addressed through consideration of regional groundwater levels and quality under the factors "Groundwater quantity" and "Groundwater quality". The proponent has given an undertaking to continue sampling on an opportunistic basis and present findings in its annual environmental reports. In accordance with Commitment 31, the EMP will need to be revised to address stygofauna management and monitoring. **Factor does not require further evaluation as proponent's commitments are adequate.**

Specially Protected (Threatened) Fauna	Excavation of the mining area may disturb the following Specially Protected (Threatened) Fauna either known, or expected, to occur in this area: • Pilbara Olive Python (*Morelia olivacea barroni*) a Schedule 1 (Rare) species; • Pink Cockatoo (*Cacatua leadbeateri*) a Schedule 4 (otherwise in need of protection) species; • Peregrine Falcon (*Falco peregrinus*) a Schedule 4 species; • Pebble-mound Mouse (*Pseudomys chapmani*), no longer listed as a specially protected species, but shifted onto CALM's list of Priority 4 species (in need of monitoring); and • Grey Falcon (*Falco hypoleucos*) a Priority 4 species. The habitats of these species are common in the region.	No comments received.	No critical habitats or populations of the listed species will be affected by this proposal. The habitats of these species are widespread throughout the region and therefore the loss of habitat will not be regionally significant. Many of the species are highly mobile and, should they occur in the mining area extension, would be expected to be displaced into nearby habitats. For the approved project area the proponent has carried out a translocation programme for the Pebble-mound mouse, however, it believes that such a programme is unlikely to be warranted in the extension area. This is a matter which can be addressed in the revised EMP, noting any advice which CALM provides. Proponent is required to comply with the *Wildlife Conservation Act 1950*. **Factor does not require further evaluation as issues are addressed by proponent's commitments and other legislation.**
Watercourses	The extended mining area does not intersect any local creeks. Levees to prevent floodwaters entering the pit, will be extended. Changes in Marillana Creek resulting from discharge from the dewatering operations will be extended from 15-20 years to 25-30 years as a result of the extended mine life.	No comments received.	The current EMP for the approved area addresses surface water (mine) management. The Proponent has given a commitment to extend the EMP to cover the mining area extension (Commitment 31). Environmental impacts associated with changes to Marillana Creek will primarily occur at the beginning and end of the project. In the intervening period a transient ecosystem based on a greater water availability will establish itself. Extension of the duration of this transient ecosystem is unlikely to have any significant additional environmental impact. **Factor does not require further evaluation as proponent's commitments are adequate.**

Groundwater quantity	The increased duration and spatial extent of dewatering operations will affect local aquifers while the mine is in operation. Mining below the water table, in general, has the potential for long-term effects on regional groundwater levels, depending on the design of the final void.	CALM • It is pleasing to see the filling of the final void after decommissioning so that there is no surface water exposed.	**Considered to be a relevant factor.** Includes impacts on riverine vegetation.
Landform	The area occupied by the final mine pit void will be extended by ~300 ha.		The existing approved proposal is subject to a decommissioning condition routinely applied to substantial mining operations (refer to Condition 5 of Statement 417) which requires plans to be prepared within five years of commencing operation. The proponent has already submitted a plan which addresses the hydrogeological aspects of the final mine void, and has given a commitment to submit the balance of the plan within six months of approval of the extension. **Factor does not require further evaluation as proponent's commitments and standard condition are adequate.**
POLLUTION			
Surface water quality	Discharge of fresh to brackish water from dewatering operations will be extended from 15-20 years to 25-30 years as a result of the extended mine life. Mining below the water table, in general, has the potential for long-term effects on surface water quality, depending on the design of the final void.	No comments received.	The extended lifetime of dewatering operations is not considered to have any significant environmental impact on surface water quality. Pools that form in Marillana Creek are expected to be of similar quality to those which develop after cyclonic rainfall events. However, potential long-term impacts due to the final mine void require further assessment by the EPA. **Considered to be a relevant factor.**

Groundwater quality	Mining below the water table, in general, has the potential for long-term effects on regional groundwater quality (salinity), depending on the design of the final void.	WRC The WRC offered the following advice in regard to the closure plan for the final mine void. • It is the intrinsic water quality which represents the base from which the beneficial use of a water resource is defined, and not the pre-mining water use. • Salinity trigger levels should be based on a proportional increase above background levels. • The closure plan correctly states that additional monitoring and data collection is necessary before any final agreement can be reached on compliance levels.	**Considered to be a relevant factor.**
SOCIAL SURROUNDINGS			
Aboriginal culture and heritage	The extended mining area will disturb an additional 300 ha. In addition, smaller areas will also be disturbed by other facilities. Two archaeological sites exist within the mining area extension. No ethnographic sites have been recorded in the mining area extension.	AAD • Hamersley Iron has satisfactorily addressed Aboriginal heritage issues. The same management measures, commitments, and agreements made for the Approved project are likely to applied to the extended area. This includes continued consultation with the local Aboriginal communities and keeping the Aboriginal Affairs Department informed when required.	It is noted that Aboriginal Heritage site clearances have been obtained for the mining area extension, but that more detailed archaeological surveys are also proposed The proponent has given a commitment (Commitment 33) to involve the Gumala Aboriginal Corporation in the detailed archaeological surveys. Project is subject to the requirements of the *Aboriginal Heritage Act* 1972. **Factor does not require further evaluation as issues are addressed by proponent's commitments and other legislation.**

3.1 Groundwater quantity

Description

The increased duration and spatial extent of dewatering operations will affect local aquifers while the mine is in operation. As a result of the mining area extension and associated increase in mine life, the mine dewatering operations would continue for an additional ten to fifteen years. Also, dewatering operations would need to move into the ore body within the mining area extension as it is mined. In order to achieve this, it is proposed that a new permanent borefield will be installed in the Phil's Creek CID and that a new sacrificial borefield, which moves in advance of mining, will be used.

Mining below the water table, in general, has the potential for long-term effects on regional groundwater levels, depending on the design of the final void. The final mine void can affect the surrounding groundwater systems by exposing groundwater to increased evaporation and thereby reducing surrounding groundwater levels.

The current beneficial use of groundwater in the area is to support phreatophytic vegetation in the nearby creeks. In addition, the Water and Rivers Commission has indicated that there are likely to be useful groundwater resources in the vicinity of Waterloo Bore (refer to Figure 3) in the Weeli Wolli drainage that may be utilised in the future.

Agency and public comments

The Department of Conservation and Land Management (CALM) was pleased by the proponent's proposal to fill the final void after decommissioning so that there is no surface water exposed.

Assessment

The areas considered for assessment of this factor are the groundwater systems of the project area.

The EPA's environmental objective for this factor is to maintain the quantity of groundwater so that existing and potential uses, including ecosystem maintenance, are protected.

With regard to short-term impacts on groundwater levels due to dewatering operations during the mine life, the EPA notes that the hydrological impacts of dewatering operations have been modelled and the predicted incremental impacts are localised and minor for most aquifers.

As the Yandicoogina mine is close to another iron ore mine (approximately 11 km) operated by BHP Iron Ore (which has its own dewatering operations upstream of the Yandicoogina Mine), predictions of groundwater impacts during mining depend to some extent on the rate of dewatering discharge from the BHP Iron Ore (BHPIO) operation. Within its modelling the proponent has considered the two discharge scenarios: that BHPIO discharge is continued; and that BHPIO discharge ceases. In the following discussion only the worst case of each of these scenarios is presented.

For the groundwater in the CID and the Marillana Creek alluvium, modelling predicts there is no significant change downstream of the mine, but there will be localised lowering of groundwater levels upstream of the confluence with Phil's Creek. At the end of the dry season, upstream water levels would fall by 5 m or more within 3 km of the void. These water levels would recover as a result of stream flow in wet seasons. As part of the existing project, the proponent has in place monitoring programmes for phreatic vegetation which may be affected by dewatering. For the alluvium of Weeli Wolli Creek, there would be no effects on groundwater levels or flow rates.

Within the faults and joints of the basement rocks of the area, there would be drawdown over the life of the mine, but this is unlikely to have any substantive impact on any beneficial uses of groundwater.

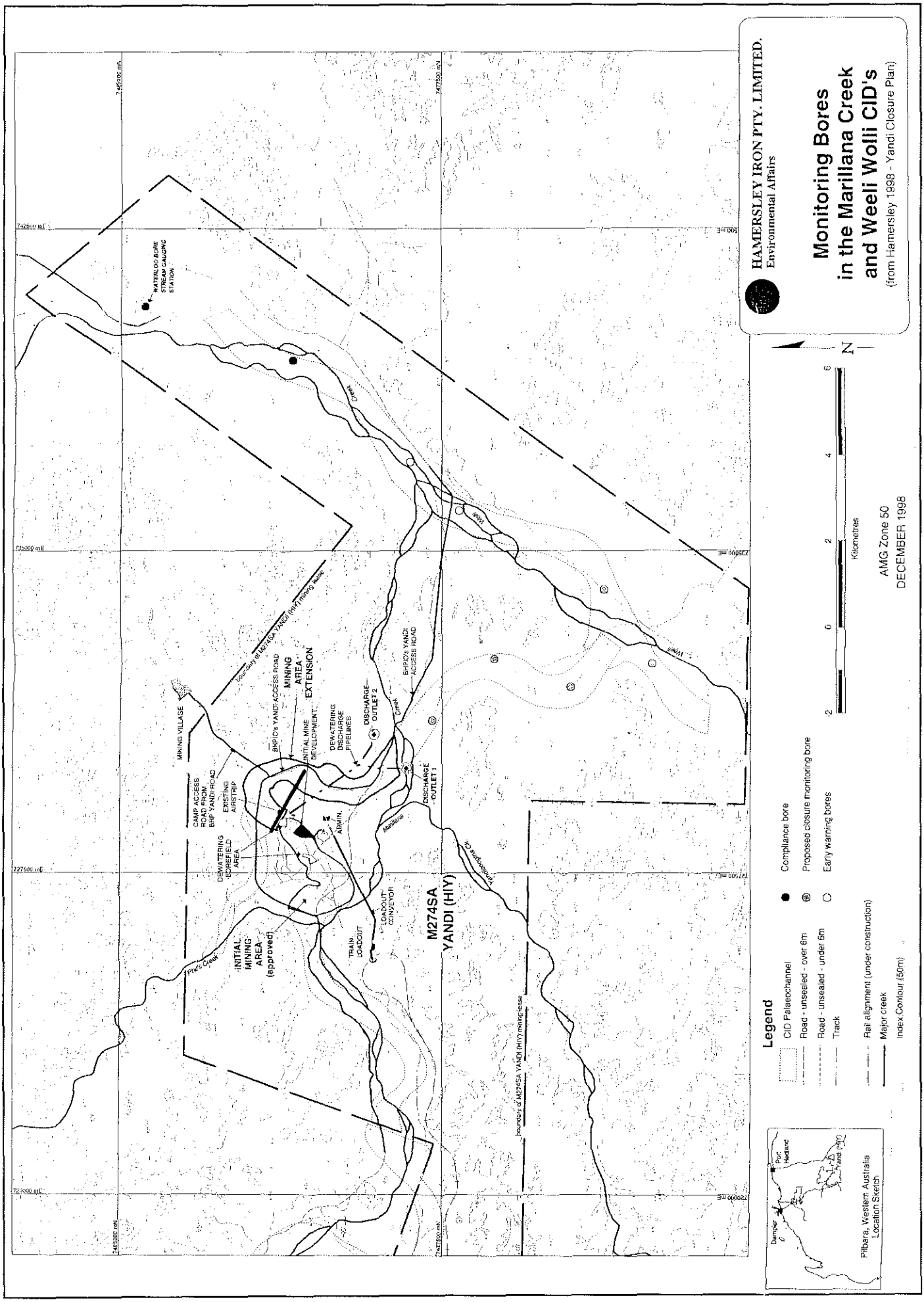

Figure 3. Groundwater and surface water features near the project area (Source: Hamersley Iron, 1999).

With regard to long-term impacts on groundwater levels due to the final mine void, the EPA notes that the proponent has prepared a closure plan (Hamersley Iron, 1999, Appendix D) for the approved and extended mining areas which addresses the hydrogeological aspects of the mine void. This closure plan was submitted by the proponent in order to fulfil one of the requirements of environmental conditions set on the currently approved Yandicoogina Iron Ore Mine and Railway (refer to Condition 5.1 of Appendix 3). The plan has been reviewed by the relevant government agencies (Water and Rivers Commission, Department of Minerals and Energy, and the Department of Environmental Protection) and approved by the Department of Environmental Protection (DEP).

In preparing the closure plan the proponent considered a number of options which were evaluated against three key success criteria: environmental impacts, risk of failure, and cost. The option chosen was the only one to meet all three criteria. This option involves backfilling the entire void to RL 490 using all available waste rock and some additional material from either: a nearby borrow pit or hill, or areas abutting the mine void. Modelling (A J Peck and Associates, 1998) indicates that backfilling to RL 490 will result in average water levels throughout the void that are approximately 1 m below the level of the backfill and that the direction of groundwater flow in the CID toward Weeli Wolli Creek would be maintained.

The closure plan includes a number of monitoring programmes to confirm model predictions and to be used to refine the closure plan. The proposed closure monitoring covers groundwater quality in the Weeli Wolli CID, impacts on phreatic vegetation, and pit water quality. Closure monitoring will be used to assess performance of the closure plan against compliance criteria. The current dewatering monitoring programme will be extended and the results used to refine the closure plan as more information is accumulated.

The chosen closure option will result in some long-term loss of groundwater from the system due to increased evaporation, however, this should not significantly affect any existing or potential uses of this groundwater. Longer-term modelling closure predicts that there will be no impacts on phreatic vegetation further than 2 km from the pit wall. The potential loss of phreatic vegetation within 2 km of the mine is not considered regionally significant given the length of these creek systems and the fact that similar vegetation is likely to become established in the mine void in the long-term. In addition, modelling predicts that there will be no significant fall of groundwater levels at Waterloo Bore.

Given that potential subterranean fauna habitats (calcrete areas) are 10 km from the mine, the results of both short- and long-term modelling suggest that that these habitats are unlikely to be affected by the proposed mining area extension.

Summary

Having particular regard to:

(a) the proponents approved closure plan; and;

(b) model predictions for short-term and long-term impacts on groundwater systems,

it is the EPA's opinion that the proposal would not unduly compromise the EPA's environmental objectives.

3.2 Groundwater quality

Description

Mining below the water table, in general, has the potential for long-term effects on groundwater quality, depending on the design of the final mine void. Final mine voids can affect the surrounding groundwater quality by exposing groundwater to increased evaporation and causing the formation of highly saline water within the pit which can then migrate into surrounding groundwater and surface water systems.

The current beneficial use of groundwater in the area is to support phreatophytic vegetation in the nearby creeks. In addition, the Water and Rivers Commission has indicated that there are likely to be useful groundwater resources in the vicinity of Waterloo Bore in the Weeli Wolli drainage that may be utilised in the future.

Agency and public comments

The Water and Rivers Commission (WRC), while having no objection to the closure plan in principle, offered the following advice in regard to the proposed compliance standards within the Weeli Wolli CID:

> "It is the intrinsic water quality which represents the base from which the beneficial use of a water resource is defined, and not the pre-mining water use.
>
> Salinity trigger levels should be based on a proportional increase above background levels. The suggested trigger levels for an aquifer that has potable water are: 20% to initiate detailed modelling and investigation, and 50% to require implementation of mitigation measures.
>
> The closure plan correctly states that additional monitoring and data collection is necessary before any final agreement can be reached on compliance levels."

Assessment

The areas considered for assessment of this factor are the groundwater systems of the project area.

The EPA's environmental objective for this factor is to ensure that the beneficial uses of groundwater can be maintained, consistent with the draft WA Guidelines for Fresh and Marine Waters (EPA, 1993)

The EPA notes that this proposal in entirely consistent with the approved closure plan and that WRC's comments reiterate those the Commission made when evaluating this plan. The EPA believes these comments have been made in order to once again highlight the Commission's view that the compliance criteria may need some refinement as a better understanding of the Weeli Wolli groundwater system is developed. The EPA accepts this view, in principle, and believes that the proposed periodic review of the closure plan is an appropriate method for any changes to the compliance criteria to be considered. This is in accordance with the approval of the closure plan given by the DEP under delegation from the EPA.

The current closure plan for the mine void (refer to Section 3.1) includes modelling of long-term changes to groundwater quality and compliance criteria for groundwater downstream of the mine. The chosen closure option (backfilling to RL 490), although not resulting in the formation of a permanent pit lake, will increase losses of groundwater to evaporation and therefore lead to increased salinity levels in the groundwater. These increases, however, are not unacceptably high, with modelling indicating that the long-term salinity of ground water in the mine pit will be limited to 2500 mg/L. This should be compared with earlier estimates of salinity within the mine void (13 000 mg/L) for the approved project at the time of its original assessment (EPA 1996). Further downstream of the mine at Waterloo Bore (refer to Figure 2), there is expected to be some small increase in salinity at the bottom of the aquifer in the long-term.

In the closure plan the proponent has provided initial compliance criteria based on modelling and the current understanding of the Weeli Wolli groundwater system and its present beneficial use (stock watering). The initial compliance criterion for groundwater in the Weeli Wolli CID is that a TDS (Total Dissolved Solids) concentration of 2 500 mg/L should not be exceeded at a compliance bore situated between the confluence of Marillana and Weeli Wolli Creeks and Waterloo Bore. Although this would meet requirements for stock watering, it is unlikely to comply with the compliance criteria proposed by the WRC in its comments on this proposal and the closure plan.

In order to improve closure plan predictions the proponent has scheduled two additional studies of the Weeli Wolli CID. Between 1999 and 2001 Hamersley Iron proposes to further investigate the hydraulic properties of, and the water quality in, the Weeli Wolli CID. Based on the results of these studies, modelling estimates will be improved and changes to the closure plan may be made. The closure plan is to be reviewed and updated every five years.

In the DEP's approval of the closure plan (refer to Appendix D of Hamersley Iron, 1999), it is made clear that the compliance criteria in the closure plan are still subject to future revision based on information arising from further groundwater studies and the advice of the WRC. The EPA concurs with the WRC that additional modelling and data collection is necessary before any final agreement can be reached on compliance levels.

Summary

Having particular regard to:

(a) the proponent's approved closure plan;

(b) model predictions for long-term impacts on groundwater quality; and

(c) the fact that the closure plan will be subject to periodic review,

it is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objective for groundwater quality.

3.3 Surface water quality

Description

Discharge of fresh to brackish water from dewatering operations will be extended from 15-20 years to 25-30 years as a result of the extended mine life.

Mining below the water table, in general, has the potential for long-term effects on surface water quality, depending on the design of the final void. Final mine voids can affect the surrounding surface water quality by exposing groundwater to increased evaporation and causing the formation of highly saline water within the pit which can then migrate into surrounding groundwater and surface water systems.

Assessment

The areas considered for assessment of this factor are the surface water systems of the project area, principally Marillana and Weeli Wolli Creeks (refer to Figure 3).

The EPA's environmental objective for this factor is to ensure that existing and potential beneficial uses of surface water can be maintained, consistent with the draft WA Guidelines for Fresh and Marine Waters (EPA, 1993) (and the NHMRC / ARMCANZ Australian Drinking Water Guidelines - National Water Quality Management Strategy [NHMRC/ARMCANZ, 1996]).

The EPA notes that the approved closure plan has been developed taking into account possible long-term impacts on surface water quality and that the chosen closure option is not expected to have any unacceptable impacts on the water quality of Marillana or Weeli Wolli Creeks. A description of the closure plan is provided in Section 3.1 of this report and in the Section 46 Environmental Review document (Hamersley Iron, 1999, Appendix D).

In the immediate vicinity of the mine, and in particular Marillana Creek, it is streamflow which recharges the underlying aquifers (alluvium and CID aquifers). Therefore any changes in groundwater quality within the final void would not affect the water quality of Marillana Creek, because the final void will be hydraulically lower than stream flow in Marillana Creek.

Modelling of the closure plan indicates that water quality in the Weeli Wolli braided area (an area immediately downstream of the Marillana/Weeli Wolli confluence) is most likely to remain unaffected by the existence of the final mine void. The worst case scenario for the chosen void configuration predicts salinity in the Weeli Wolli braided area rising to 1000 mg/L. Based

Table 3: Summary of Assessment of Relevant Environmental Factors

RELEVANT FACTOR	RELEVANT AREA	EPA OBJECTIVES	EPA ASSESSMENT	EPA ADVICE
Groundwater quantity	The groundwater systems of the project area.	Maintain the quantity of groundwater so that existing and potential uses, including ecosystem maintenance, are protected.	The EPA notes that the hydrological impacts of dewatering operations during mining have been modelled and the predicted incremental impacts are localised and minor for most aquifers. The EPA notes that the proponent has developed, in parallel with this proposal, a closure plan for approved and extended mining areas which addresses the hydrogeological aspects of the mine void. This plan has been reviewed by the relevant government agencies (WRC, DME, DEP) and approved by the DEP. The closure plan involves backfilling the final mine void to above RL 490. Modelling indicates that backfilling to this level will maintain groundwater flow towards Weeli Wolli Creek and prevent the formation of a permanent pit lake. However, the final pit void will result in increased evaporation of groundwater and therefore some reduction in groundwater quantity. The closure plan includes a number of monitoring programmes to confirm model predictions and to be used to refine the closure plan. The EPA understands that closure modelling predicts there will not be any regionally significant impacts on riparian vegetation in the long term. Monitoring of vegetation is proposed to confirm this.	Having particular regard to: • the proponent's approved closure plan; and • model predictions for short-term and long-term impacts on groundwater systems, it is the EPA's opinion that the proposal would not unduly compromise the EPA's environmental objectives.

Groundwater quality	The groundwater systems of the project area.	Ensure that the beneficial uses of groundwater can be maintained, consistent with the draft WA Guidelines for Fresh and Marine Waters (EPA, 1993).	The WRC has reiterated a number of comments it made on the approved closure plan regarding beneficial uses and proposed groundwater quality compliance criteria. The EPA understands that the closure plan is to be reviewed and updated every five years and that as further groundwater data is obtained for the Weeli Wolli Channel Iron Deposit the beneficial uses and compliance values will be subject to these reviews. While acknowledging that the compliance criteria and the assigned beneficial uses attributed to the groundwater resources are still subject to further review, the EPA notes that the present closure plan is expected to limit groundwater salinities to 2500 mg/L (worst case in-pit salinity). The EPA believes that future revisions of the closure plan, based on the results of continuing monitoring, is an appropriate method for resolving the matters which the WRC has raised.	Having particular regard to: • the proponent's approved closure plan; • model predictions for long-term impacts on groundwater quality; and • the fact that the closure plan will be subject to periodic review, it is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objective.
Surface water quality	Surface water systems of the project area, principally Marillana and Weeli Wolli Creeks.	Ensure that existing and potential beneficial uses of surface water can be maintained, consistent with the draft WA Guidelines for Fresh and Marine Waters (EPA, 1993) (and the NHMRC / ARMCANZ Australian Drinking Water Guidelines - National Water Quality Management Strategy [NHMRC/ARMCANZ, 1996]).	The EPA notes that the approved closure plan has been developed taking into account possible long-term impacts on surface water quality. The chosen closure option is expected not to affect water quality in the Weeli Wolli braided area, and the worst case scenario predicts salinity in the Weeli Wolli braided area rising to 1000 mg/L. This proposal is consistent with the closure plan.	Having particular regard to: • the proponent's approved closure plan; and • model predictions for long-term impacts on surface water quality, it is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objective.

upon taste, the NHMRC/ARMCANZ guideline for drinking-water is that TDS should not exceed 500 mg/L, although TDS values up to 1000 mg/L may be acceptable to many communities. The draft WA guidelines recommend a TDS value of less than 1000 mg/L for the protection of aquatic ecosystems (fresh waters). Therefore taking into account the range of modeling predictions and their probabilities, there seems little risk of unacceptable impacts on surface water quality in Weeli Wolli Creek.

Summary

Having particular regard to:

(a) the proponent's approved closure plan; and

(b) model predictions for long-term impacts on surface water quality,

it is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objective for surface water quality.

4. Conditions and commitments

Section 46(3) of the *Environmental Protection Act 1986* requires the EPA to report to the Minister for the Environmental Protection Act 1986 on whether or not the proposed changes to conditions or procedures should be allowed. In addition, the EPA may make recommendations as it sees fit.

4.1 Recommended commitments

Hamersley Iron Pty Limited has made changes to commitments to reflect discussions with the DEP which have been part of the assessment process. The proponent's commitments as set out in the Section 46 document (Hamersley Iron, 1999) and subsequently modified, as shown below (Table 4), should be made enforceable conditions.

4.2 Recommended conditions

Having considered the proponent's commitments and the information provided in this report, the EPA recommends that the following conditions be imposed if the proposal by Hamersley Iron Pty Limited is approved for implementation:

1 The existing Environmental Conditions applied to the project (Ministerial Statement 417 published on 24 May 1996), be subject to modifications necessary to:

- extend the mining area; and
- include additional proponent commitments.

2. An additional condition which is now routinely applied to mining operations of this size, namely:

- that the project should be managed in accordance with a comprehensive environmental management system to be developed by the proponent to the requirements of the EPA.

The amended conditions and amended Consolidated Commitments statement are presented in Appendix 4.

Table 4: Summary of proponent's additional commitments relating to the extension of the mining area of the Yandicoogina Iron Ore Mine and Railway

No.	Issue	Objective	Action	Phase	Require-ments (Advice)
31	Environmental Management Programme (EMP)	To manage environmental impacts of the mining area extension.	Review and revise where relevant the Environmental Management Programme for the Approved Project for the purpose of extending the environmental management and monitoring to address issues arising from the Mining Area Extension.	Pre-mining (of Mining Area Extension)	DEP (WRC, DME, and CALM)
32	Decommissioning and rehabilitation plan	To satisfactorily decommission the mine site and rehabilitate the site and its environs.	Prepare a conceptual decommissioning and rehabilitation plan covering all infrastructure associated with the Yandi (HIY) Project area. The plan will incorporate the Approved Project and the Mining Area Extension.	Pre-mining (of the Mining Area Extension) — within six months of the Mining Area Extension being approved	DEP (DME and WRC)
33	Aboriginal heritage (archaeological) sites	To identify any archaeological sites	Involve the Gumala Aboriginal Corporation in a detailed archaeological survey to identify any sites within the areas to be disturbed. The findings of this survey shall be reported to the Aboriginal Affairs Department.	Pre-mining (of Mining Area Extension)	DEP (AAD)

Notes:
DEP Department of Environmental Protection
DME Department of Minerals and Energy
WRC Water and Rivers Commission
CALM Department of Conservation and Land Management
AAD Aboriginal Affairs Department

5. Conclusions

The EPA has considered the proposal by Hamersley Iron Pty Limited to extend the mining area of the Yandicoogina Iron Ore Mine and has concluded that it can be managed to meet the EPA's objectives for the relevant environmental factors.

In assessing this proposal the task of the EPA has been made easier by the progress the proponent has made in planning for the closure of the mine and the management of long-term impacts of the final mine void. In the EPA's previous assessment of the Yandicoogina Iron Ore Mine and Railway, the EPA recognised that there was lack of full scientific certainty regarding the impacts to local and regional groundwaters. The work carried out by the proponent in preparing an acceptable closure plan for the mine void, has increased scientific certainty and will continue to do so as the plan is further refined.

In addition to the above, the EPA considers that conditions attaching to the environmental approval should be updated by the addition of a requirement to develop and implement an environmental management system for the project.

6. Recommendations

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

1. That the Minister notes that this report is pursuant to Section 46(3) of *the Environmental Protection Act 1986* and thus is limited to consideration of proposed changes to the original conditions.
2. The Minister notes that the proposed change is to extend the mining area of the previously approved Yandicoogina Iron Ore Mine and Railway.
3. The EPA recommends that the Minister considers the report on the relevant environmental factors as set out in Section 3.
4. That the Minister notes that the EPA has concluded that the modified proposal can be managed to meet the EPA's objectives, and thus not impose an unacceptable impact on the environment provided there is satisfactory implementation by the proponent of the amended conditions, including the proponent's commitments, as set out in Section 4.
5. The Minister imposes the amended conditions, commitments and procedures recommended in Appendix 4 of this report.

Appendix 1

List of Submitters

State/Local Government

- Department of Conservation and Land Management
- Department of Resources Development
- Pilbara Development Commission
- Shire of East Pilbara
- Water and Rivers Commission
- Western Australian Museum of Natural Science

Appendix 2

References

EPA (1993) *Western Australian Water Quality Guidelines for Fresh and Marine Waters.* Environmental Protection Authority Bulletin 711, October 1993. Perth.

EPA (1996) *Yandicoogina iron ore mine and railway: Report and recommendations of the Environmental Protection Authority.* Environmental Protection Authority Bulletin 809, April 1996. Perth.

Hamersley Iron (1999), *Yandi (HIY) Project Mining Area Extension: Section 46 Environmental Review (Change to environmental conditions)*, Hamersley Iron Pty Limited, Perth.

NHMRC/ARMCANZ (1996) *National Water Quality Management Strategy: Australian Drinking Water Guidelines*, National Health and Medical Research Council; Agriculture and Natural Resource Management Council of Australia and New Zealand, 1996. Canberra.

A J Peck and Associates (1998), *Hydrological Review for Proposed Extended Mine Closure Plan*, prepared for Hamersley Iron Pty Limited, A.J. Peck and Associates Pty Ltd, Subiaco.

Appendix 3

Statement of Environmental Conditions of Approval for Initial Proposal (24 May 1996)

Ass # 979
Bull # 809
State # 417

MINISTER FOR THE ENVIRONMENT WESTERN AUSTRALIA

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

YANDICOOGINA IRON ORE MINE & RAILWAY
90 KILOMETRES NORTH WEST OF NEWMAN
HAMERSLEY RANGE (979)

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 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.

Published on

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12th Floor, Dumas House, 2 Havelock Street, West Perth, Western Australia 6005
Telephone (09) 321 2222 Facsimile (09) 322 5149

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 construction, the proponent shall prepare an Environmental Management Programme to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection.

This Programme 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 Marillana 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

8 development of a comprehensive monitoring, management and reporting programme for the above.

The reporting programme shall provide for:

1 annual reports outlining implementation of the Environmental Management Programme;

2 triennial reports reviewing the implementation of the Environmental Management Programme; and

3 six yearly reports reviewing the environmental objectives and implementation of the Environmental Management Programme 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, the 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 five years following commissioning of 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 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, the 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 and compliance with the conditions, periodic reports on the implementation of the proposal are required.

7-1 The proponent shall submit periodic Performance 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.

Hon Peter Foss QC MLC
MINISTER FOR THE ENVIRONMENT

24 MAY 1996

Proponent's Environmental Management Commitments

April 1996

YANDICOOGINA IRON ORE MINE & RAILWAY
90 KILOMETRES NORTH WEST OF NEWMAN
HAMERSLEY RANGE (979)

HAMERSLEY IRON PTY LIMITED

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 the 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 4	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.	5 6 7	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 programme will be implemented to the satisfaction of the Minister for the Environment on advice from DEP.	Pre-construction, Construction and Post-commissioning.

Hydrogeological data collection	Collect further hydrogeological data to develop a model for the final void.	8 9 10	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 minimize long term impacts of mining on local and regional groundwater resources to the satisfaction of the Minister for the Environment on advice of 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.	11 12	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.	13	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.

Environmental Management Programme (EMP)	Prepare an EMP for the construction and operation of the project.	14	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 the DEP, and to the satisfaction of the Minister for the Environment. The EMP will provide details on the following: 1 groundwater and surface water management during mining and post-mining 2 sheet and gully drainage management along the railway 3 dust and noise emissions 4 waste management 5 flora and fauna protection 6 fire and weed management 7 environmental inductions for construction and operation personnel 8 rehabilitation of disturbed areas, and 9 monitoring programmes.	Pre-construction and Post-commissioning.
Biological	Minimise impacts on riverine vegetation.	15 16 17	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.	18 19	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.

Sewage Treatment Plants	Ensure sewage treatment plants are approved.	20	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.	21	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.	22	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.	23	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.	24	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.	25	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.
Disturbance to Aboriginal Sites	Comply with *Aboriginal Heritage Act.*	26	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.	27	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.	28	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.	Post-commissioning.
		29	The plan will be submitted to Government at least two years prior to decommissioning of the project.	
		30	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.	

Appendix 4

Recommended Environmental Conditions and Proponent's Consolidated Commitments for Extended Proposal

Statement No.

STATEMENT TO AMEND CONDITIONS APPLYING TO A PROPOSAL (PURSUANT TO THE PROVISIONS OF SECTION 46 OF THE ENVIRONMENTAL PROTECTION ACT 1986)

YANDICOOGINA IRON ORE MINE & RAILWAY
90 KILOMETRES NORTH WEST OF NEWMAN
HAMERSLEY RANGE

Proposal: The Yandicoogina Iron Ore Mine and Railway (also known as "Yandi (HIY) Project") is located approximately 90 kilometres north west of the town of Newman. The proposal involves the construction and operation of: an open cut iron ore mine; facilities to crush and screen ore and convey it to the rail loadout facility; and a 90 kilometre rail section which connects the mine to the Central Pilbara Railway.

Proponent: Hamersley Iron Pty Limited

Proponent Address: 152-158 St Georges Terrace, Perth, WA 6000

Assessment Number: 1174

Previous Assessment Number: 979

Previous Statement Number: Statement No. 417 (published on 24 May 1996)

Report of the Environmental Protection Authority: Bulletin 946

Previous Reports of the Environmental Protection Authority: Bulletin 809, April 1996

The implementation of this proposal is now subject to the conditions and procedures contained in Ministerial Statement No. 417 (May 1996), subject to the amendment and addition of the following conditions and procedures:

Condition 1 of Statement No. 417 is deleted and the following conditions are inserted:

1 Proponent Commitments

1-1 The proponent shall implement the consolidated environmental management commitments of April 1996 as amended on 12 July 1999 and documented in schedules 2 and 3 of this statement.

1-2 The proponent shall implement environmental management commitments which the proponent makes or has made as part of the fulfilment of conditions and procedures in this and the previous statement issued for this proposal.

Condition 2 of Statement No. 417 is deleted and the following conditions are inserted:

2 Implementation

2-1 Subject to these conditions and procedures, the proponent shall implement the proposal as documented in schedule 1 of this statement.

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

2-3 Where the proponent seeks to change any aspect of the proposal as documented in schedule 1 of this statement in any way that the Minister for the Environment determines, on advice of the Environmental Protection Authority, is not substantial, those changes may be effected.

The following conditions are added after Condition 7 of Statement No. 417:

8 Environmental Management System

8-1 In order to manage the environmental impacts of the project, and to fulfil the requirements of the conditions and procedures in this statement, prior to mining within the extended mining area, the proponent shall demonstrate to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection that there is in place an environmental management system which includes the following elements:

1 An environmental policy and corporate commitment to it;

2 Mechanisms and processes to ensure:

(1) planning to meet environmental requirements;

(2) implementation and operation of actions to meet environmental requirements;

(3) measurement and evaluation of environmental performance; and

3 Review and improvement of environmental outcomes.

8-2 The proponent shall implement the environmental management system referred to in condition 8-1.

Schedule 1

Proposal

The Yandicoogina Iron Ore Mine and Railway (also known as "Yandi (HIY) Project") is located approximately 90 kilometres north west of the town of Newman. The proposal involves the construction and operation of: an open cut iron ore mine; facilities to crush and screen ore and convey it to the rail loadout facility; and a 90 kilometre rail section which connects the mine to the Central Pilbara Railway.

Table 1 summarises the key project characteristics of the approved project and proposed extension.

Table 1: Key project characteristics

Aspect	Approved Project	Mining Area Extension	Change *(compared with Approved Project)*
Length of CID to be mined	SL12.2km to SL15.0km	SL15.0km to a point 750m beyond SL19.0km (equivalent to 19.75km)	Additional 4.75km
Area of CID to be mined	300ha	300ha	Additional 300ha
Initial mining rate	About 8Mt/a, increasing to design capacity of 15Mt/a	About 15Mt/a, maintaining design capacity	No change
Ore reserve to be mined	140Mt	160Mt, bringing total to 300Mt	Additional 160Mt
Estimated mine life	15-20 years	25-30 years	Additional 10-15 years
Mine pit profile	About 65m deep; 40m below pre-mine watertable	About 65m deep; 40m below pre-mine watertable	No change
Dewatering requirements	Initial: 30ML/d Maintenance: 10-15ML/d	Initial: 15-20ML/d Maintenance: 10-15ML/d	Initial - lower Maintenance - same
Volume of dewatering used	5ML/d	5ML/d	No change
Number of dewatering borefields	Two: • a Permanent borefield • a Sacrificial borefield	Three: • an existing Permanent borefield • a new Permanent borefield on Phils Creek CID • a new Sacrificial borefield in the main CID	An additional Permanent borefield and a replacement Sacrificial borefield in the CID
Proportion of waste material backfilled (versus out-of-pit)	100% (after first three years, all waste reports as backfill, with out-of-pit waste used as backfill upon mine closure)	100% (waste reports as backfill from commencement of mining or is stockpiled and returned as backfill later)	No change
Proportion of mine void to be filled with overburden	About 50%	About 50%	No change
Mine infrastructure requirements	Refer CER and Section 1.2 and Figure 1.2 of this document	Utilise existing infrastructure until additional ore processing plant (or re-location of existing one) needed. Some new haul roads also.	Additional or re-located ore processing plant. More haul roads.

Notes: CID Channel Iron Deposit
ML/d megalitres per day
Mt/a million tonnes per annum
ha hectares
SL drill Section Line

Figures

Figure 1 Project layout map of the approved project and proposed extension

Schedule 2

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 the 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 4	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.	5 6 7	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 programme will be implemented to the satisfaction of the Minister for the Environment on advice from DEP.	Pre-construction, Construction and Post-commissioning.

Hydrogeological data collection	Collect further hydrogeological data to develop a model for the final void.	8 9 10	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 minimize long term impacts of mining on local and regional groundwater resources to the satisfaction of the Minister for the Environment on advice of 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.	11 12	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.	13	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.

Environmental Management Programme (EMP)	Prepare an EMP for the construction and operation of the project.	14	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 the DEP, and to the satisfaction of the Minister for the Environment. The EMP will provide details on the following: 1 groundwater and surface water management during mining and post-mining 2 sheet and gully drainage management along the railway 3 dust and noise emissions 4 waste management 5 flora and fauna protection 6 fire and weed management 7 environmental inductions for construction and operation personnel 8 rehabilitation of disturbed areas, and 9 monitoring programmes.	Pre-construction and Post-commissioning.
Biological	Minimise impacts on riverine vegetation.	15 16 17	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.	18 19	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.

Sewage Treatment Plants	Ensure sewage treatment plants are approved.	20	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.	21	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.	22	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.	23	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.	24	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.	25	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.
Disturbance to Aboriginal Sites	Comply with *Aboriginal Heritage Act.*	26	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.	27	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.	28	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.	Post-commissioning.
		29	The plan will be submitted to Government at least two years prior to decommissioning of the project.	
		30	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.	

Schedule 3

Proponent's Additional Environmental Management Commitments

12 July 1999

Yandicoogina Iron Ore Mine & Railway
90 Kilometres north west of Newman
Hamersley Range
(979/1174)

Hamersley Iron Pty Limited

No.	Issue	Objective	Action	Phase	Require-ments (Advice)
31	Environmental Management Programme (EMP)	To manage environmental impacts of the mining area extension.	Review and revise where relevant the Environmental Management Programme for the Approved Project for the purpose of extending the environmental management and monitoring to address issues arising from the Mining Area Extension.	Pre-mining (of Mining Area Extension)	DEP (WRC, DME, and CALM)
32	Decommissioning and rehabilitation plan	To satisfactorily decommission the mine site and rehabilitate the site and its environs.	Prepare a conceptual decommissioning and rehabilitation plan covering all infrastructure associated with the Yandi (HIY) Project area. The plan will incorporate the Approved Project and the Mining Area Extension.	Pre-mining (of the Mining Area Extension) — within six months of the Mining Area Extension being approved	DEP (DME and WRC)
33	Aboriginal heritage (archaeological) sites	To identify any archaeological sites	Involve the Gumala Aboriginal Corporation in a detailed archaeological survey to identify any sites within the areas to be disturbed. The findings of this survey shall be reported to the Aboriginal Affairs Department.	Pre-mining (of Mining Area Extension)	DEP (AAD)

Notes:

DEP	Department of Environmental Protection
DME	Department of Minerals and Energy
WRC	Water and Rivers Commission
CALM	Department of Conservation and Land Management
AAD	Aboriginal Affairs Department

Appendix 5

Summary of Public Submissions and Proponent's Response

Yandi (HIY) Project
Extension of Mining Area - Section 46 document
Responses to summary of issues raised during public review

ABORIGINAL AFFAIRS DEPARTMENT

Comment: *Hamersley has satisfactorily addressed Aboriginal heritage issues. The same management measures, commitments and agreements made for the Approved Project are likely to be applied to the extended area. This includes continued consultation with the local Aboriginal communities and keeping the Aboriginal Affairs Department informed when required.*

Response:
The current management measures, commitments, agreements and practices applying to the Approved Project will be extended to the proposed Mining Area Extension.

DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT

Comment: *It is pleasing to see the filling of the final void after decommissioning so that there is no surface water exposed.*

Response:
Comment noted.

DEPARTMENT OF ENVIRONMENTAL PROTECTION

Comment: *The addition of a new ore processing plant (or re-location of the existing one) would require a Works Approval and Licence under Part V of the* Environmental Protection Act 1986.

Response:
If the evaluation of options for processing shows that a new or re-located processing plant is needed for the Mining Area Extension, Hamersley will apply for a Works Approval from the Department of Environmental Protection prior to construction of the plant and a Licence to operate the plant once it is constructed.

SHIRE OF EAST PILBARA

Comment: *All new buildings or developments must be submitted for approval through the Shire.*

Response:
Hamersley will issue plans for new buildings to the Shire of East Pilbara for approval (as required), as was done for the Approved Project.

WESTERN AUSTRALIAN MUSEUM

Comment: *The mine will involve extensive dewatering and so the impact of the project on any stygofauna communities needs to be assessed. Yandicoogina appears on hydrogeology maps as a calcrete area. Many groundwater calcretes and coarse alluvial deposits in the Pilbara contain rich relictual stygofauna communities containing higher taxa new to Australia.*

Response:

Hamersley recognises that stygofauna communities are an issue in certain areas of the Pilbara - principally where karst limestone formations occur.

The Channel Iron Deposit (CID) within the mining area does not contain calcrete. Some calcrete does occur upstream at Flat Rocks and downstream around Weeli Wolli Creek - around 10km from the mine. This is based on recent detailed surface geological mapping of the region developed by Hamersley. Groundwater in those formations will not be impacted by mining within the CID.

The basal aquifer surrounding the CID is a fractured rock aquifer hosted in the Weeli Wolli Formation - comprised of banded iron, chert and dolorite. It is unlikely to contain stygofauna, based on current information about their occurrence elsewhere.

The bed of Marillana Creek contains coarse alluvials and some poorly developed calcretes (not karstic). Fauna in this area are most likely stream fauna rather than stygofauna.

Hamersley has already undertaken some sampling for stygofauna at several alluvium monitoring sites; no stygofauna were identified. Hamersley will continue to sample on an opportunistic basis and provide findings to Government through its annual reporting. Hamersley has liaised with the Museum's stygofauna specialist to determine the most effective means of sampling.

WATER AND RIVERS
COMMISSION

YOUR REF 428/97
OUR REF 8761
ENQUIRIES Melissa Patt
DIRECT TEL (08) 9278 0385

DEPARTMENT OF ENVIRONMENTAL PROTECTION
16 APR 1999
File No 1 428/97 Name M. HOGARTH
File No 2 _____ Name _____
File No 3 _____ Name _____

Murray Hogarth
Department of Environmental Protection
Westralia Square
141 St Georges Terrace
PERTH WA 6000

Dear Mr Hogarth

Re: Yandicoogina Iron Ore Mine and Railway – Extension of Mining Area (1174).

Thank you for referring the above plan to the Water and Rivers Commission for comment. The Commission would have no objection to the plan in principle, however, would like to highlight concerns with the section dealing with compliance standards in the Weeli Wolli CID (pp 33-35). This issue has been covered in great depth in the Closure Plan (Vol. 2, Appendix D, Section 5.1). The Commission would like to offer the following advice:

- The concept of **'Beneficial Use'** is fundamental to establishing a context for evaluating environmental implications of mining below the water table. Beneficial use is defined as *an environmental value or use of the environment or any element or segment of the environment which is conducive to public health, welfare, safety or aesthetic enjoyment and which requires protection from pollution sources* (WRC 1998). The intrinsic water quality represents the base which regulators work when defining the beneficial use of a water resource and not the pre-mining water use as such.

  Any predicted impact on the water resource is assessed in terms of balancing any potential reduction in future beneficial use options against the overall economic and social benefits of the project, and the present beneficial use supporting the project (ANZECC 1994).

- Salinity trigger levels should be based on a proportional increase of salinity above background levels. This must take into account the variations in quality within the aquifer. The envisaged commitment for an aquifer that has potable water should be:

1. 20% increase on current levels to initiate detailed monitoring and investigations to determine the cause of the increase,and
2. 50% increase on current levels, sustained over a period of two years, to implement mitigation measures.

The Closure Plan correctly states that additional monitoring and data collection is necessary before any final agreement can be reached on compliance levels. This whole issue is currently receiving attention by the State as several developers have indicated that they

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consider the Marillana/Weeli Wolli Creek CID aquifer as a possible source of water for other mines in the central Hamersley Ranges.

Should you have any queries relating to this particular issue please do not hesitate to contact Alan Wright of the Water and Rivers Commission on 9278-0499. If you have any further queries please contact Melissa Patt on (08) 9278 0385.

Yours sincerely

for Greg Davis
A/MANAGER
STRATEGIC PROJECTS

14th April 1999