Newman Satellite Development
Mining of Orebody 23 below the watertable

BHP Iron Ore Pty Ltd

Report and recommendations
of the Environmental Protection Authority

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Summary and recommendations

BHP Iron Ore Pty Ltd proposes to mine the Orebody 23 iron ore deposit, located approximately 13 km northeast of Newman, below the watertable. This report provides the Environmental Protection Authority's (EPA's) advice and recommendations to the Minister for the Environment on the environmental factors, conditions and procedures relevant to the proposal.

Section 44 of the *Environmental Protection Act 1986* requires the EPA to report to the Minister for the Environment on the environmental factors relevant to the proposal and on the conditions and procedures to which the proposal should be subject, if implemented. In addition, the EPA may make recommendations as it sees fit.

Relevant environmental factors

Although a number of environmental factors were considered by the EPA in the assessment, 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) Subterranean Fauna - impact of mine dewatering on aquifer habitat of stygofauna;

(b) Groundwater quantity - impact of dewatering on phreatophytic vegetation; and

(c) Groundwater quality - salinity increase due to evaporation from mined-out pit.

Conclusion

The EPA has considered the proposal by BHP Iron Ore Pty Ltd to mine below the watertable at the Orebody 23 iron ore deposit. The main issues of concern relate to dewatering and management of the mined-out pit. The EPA has recommended conditions to ensure that an effective plan is in place to manage possible impacts on subterranean fauna and any potential impacts on the surrounding vegetation and aquifer.

The EPA has concluded that the proposal can be managed to meet the EPA's objectives, provided that the conditions recommended in Section 4 and set out in Appendix 3 are imposed.

Recommendations

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

1. That the Minister considers the report on the relevant environmental factors of Subterranean Fauna, Groundwater quantity, and Groundwater quality as set out in Section 3.
2. That the Minister notes that the EPA has concluded that the proposal can be managed in an environmentally acceptable manner, provided there is satisfactory implementation by the proponent of the recommended conditions set out in Section 4.
3. That the Minister imposes the conditions and procedures recommended in Appendix 3.

Conditions

Having considered the proponent's commitments and the information provided in this report, the EPA has developed the following set of conditions which the EPA recommends be imposed if the proposal by BHP Iron Ore Pty Ltd to mine below the watertable at Orebody 23 is approved for implementation. These conditions are presented in Appendix 3. Matters addressed in the conditions include the following:

(a) the proponent shall fulfil the commitments in the Consolidated Commitments statement set out as an attachment to the recommended conditions in Appendix 3; and

(b) in order to manage the relevant factors and EPA objectives contained in this bulletin, and subsequent conditions and procedures authorised by the Minister for the Environment, the proponent shall demonstrate that there is in place an environmental management system which includes the following elements:

- environmental policy and commitment;
- planning of environmental requirements;
- implementation and operation of environmental requirements;
- measurement and evaluation of environmental performance; and
- review and improvement of environmental outcomes.

Contents

1. Introduction and background

The mining of Orebody 23 below the water table is an open cut iron ore mining project, referred to the Environmental Protection Authority (EPA) on 14 July 1997 and a Consultative Environmental Review (CER) level of assessment was set.

The minesite is located approximately 13 kilometres northeast of Newman (Figure 1) on the southern side of the Ophthalmia Range, at the junction of Homestead Creek and the Fortescue River at Ethel Gorge (Figure 2).

BHP Iron Ore Pty Ltd (BHPIO) is the proponent for the project. Mining of scree ore commenced at Orebody 23 in July 1992, and mining of bedrock commenced in May 1993, pursuant to a commitment to restrict mining to above the watertable.

Ore is currently hauled to the Orebody 25 plant for processing and trainloading (Figure 3). It is proposed that ore from Orebody 23, mined from below the watertable, will continue to be hauled by off-highway trucks approximately 6 kilometres to the existing Orebody 25 crusher location which is adjacent to the rail siding. No additional infrastructure is required.

The proponent's CER (BHPIO, 1997) was available for public review for four weeks from 1 September 1997 to 29 September 1997. Nine submissions were received, including five from government agencies. The submissions have been summarised by the DEP and BHPIO submitted a response to submissions on 19 January 1998 that included some additional work (BHPIO, 1998). Issues discussed in submissions centred around existing environmental factors identified in the guidelines, however, one submission from the WA Museum raised a new environmental factor, that of subterranean fauna.

Further details of the proposal are presented in Section 2 of this Report. Section 3 discusses environmental factors relevant to the proposal. 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 conclusion and Section 6 comprises the EPA's recommendations.

A list of people and organisations that made submissions is included in Appendix 1. References are listed in Appendix 2, and recommended conditions and procedures and proponent's commitments are provided in Appendix 3.

The DEP's summary of submissions and the proponent's response to those submissions has been published separately and is available in conjunction with this report.

2. The proposal

Mining of Orebody 23 below the water table is an open cut iron ore mining project. BHPIO proposes to extend bedrock mining at the current Orebody 23 operation to approximately 140 metres below the water table level. The project involves mining approximately 12 million tonnes (Mt) of ore at a rate of 2 to 4 Mt per annum, extending the life of the mine for a further four years. It is estimated that approximately 50 Mt of overburden would also be removed and dumped.

Dewatering will be required for recovery of the ore and will lead to drawdown effects extending approximately 6 km upstream of Homestead Creek, 5.5 km upstream on the Fortescue River, 6 km on Shovelanna Creek and 5 km downstream on the Fortescue River. Figure 4 indicates these watercourses and the extent of the unconfined groundwater system, and shows the predicted 2 m, 10 m and 20 m drawdown contours caused during dewatering.

Following mining, it is proposed to leave the mine pit open. Groundwater throughflow will cause the pit to slowly fill with water, and it is anticipated that the pit water will become progressively saline due to evapotranspiration. The proponent has predicted through modelling that rising salt levels in the water in the pit will cause salinity in the surrounding aquifer to increase from 900 mg/L to 1,700 mg/L over the next 40 years.

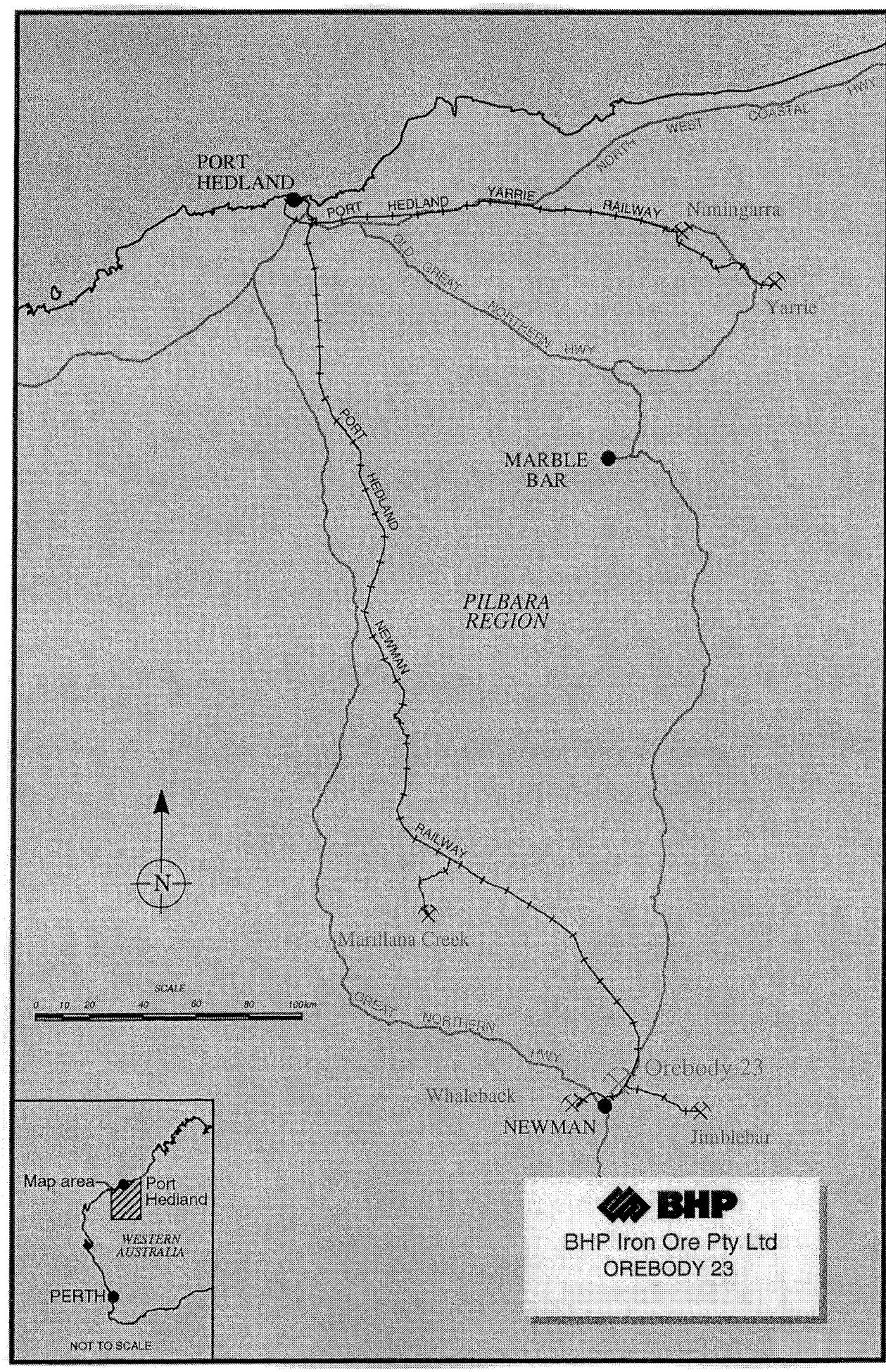

Figure 1. Location of the proposal (Source: BHPIO, 1997).

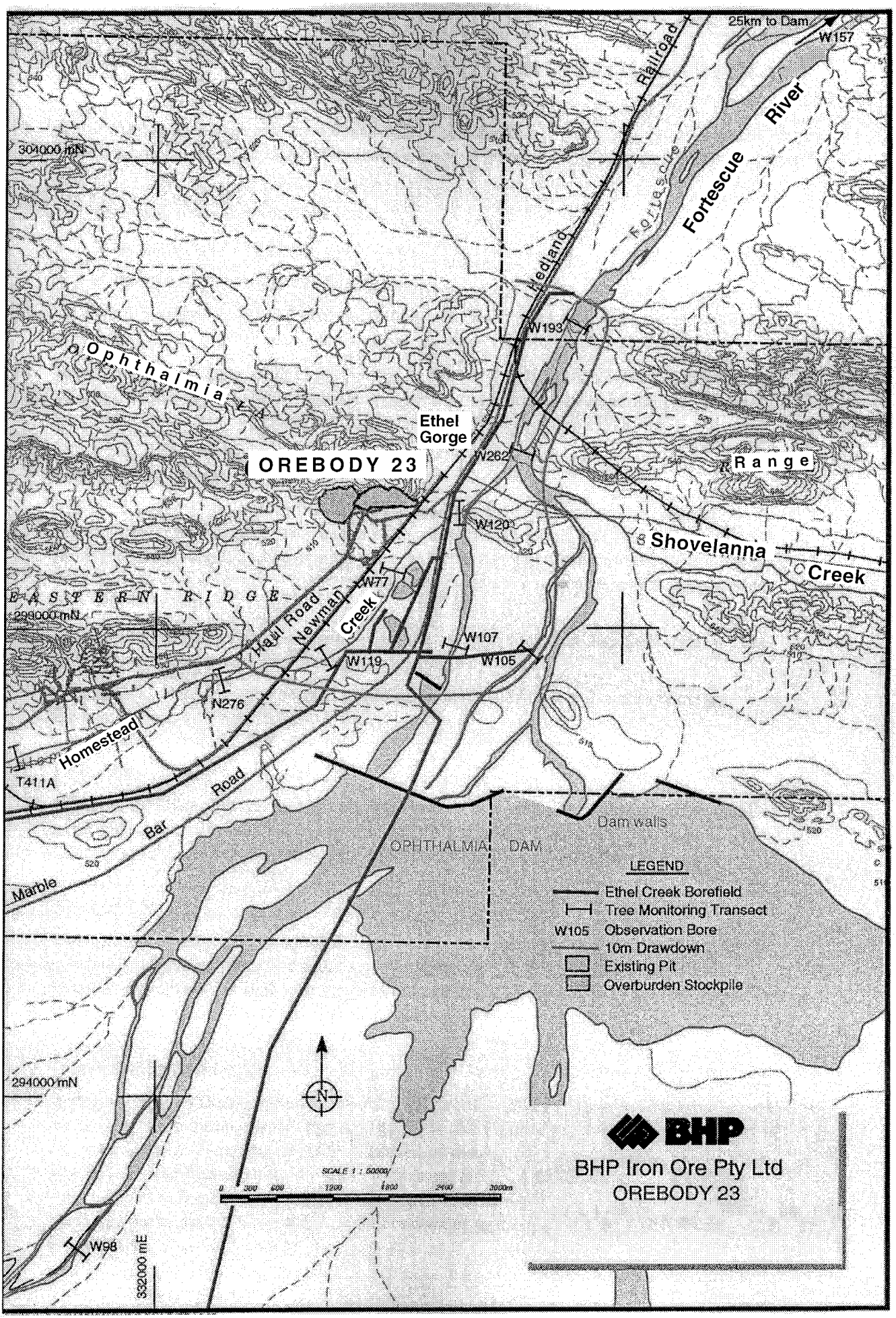

Figure 2. Proposal location and proposed tree monitoring transects (Source: BHPIO, 1997).

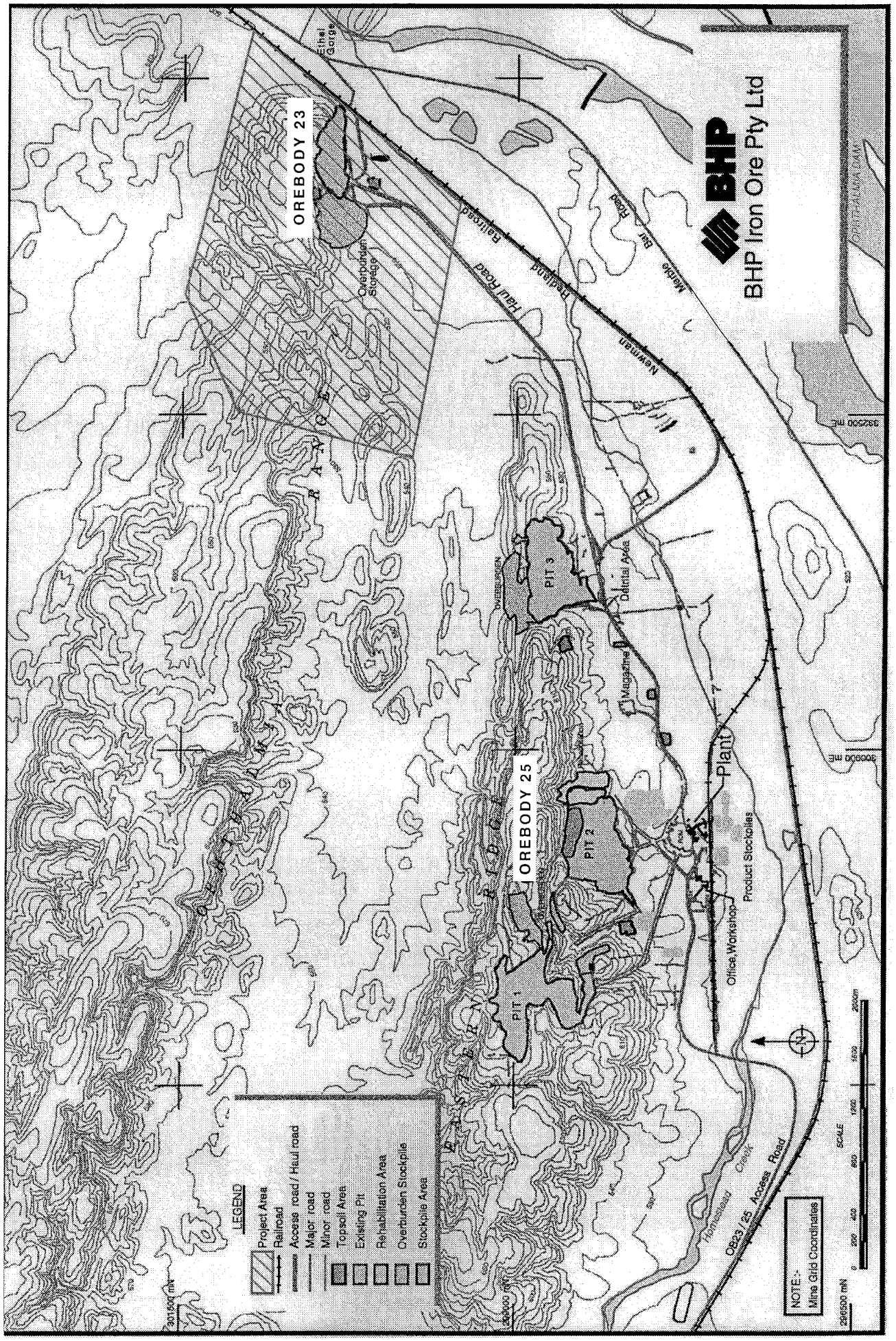

Figure 3. 'Project area' of Orebody 23 & location of an adjacent iron ore mine, Orebody 25 (Source: BHPIO, 1997).

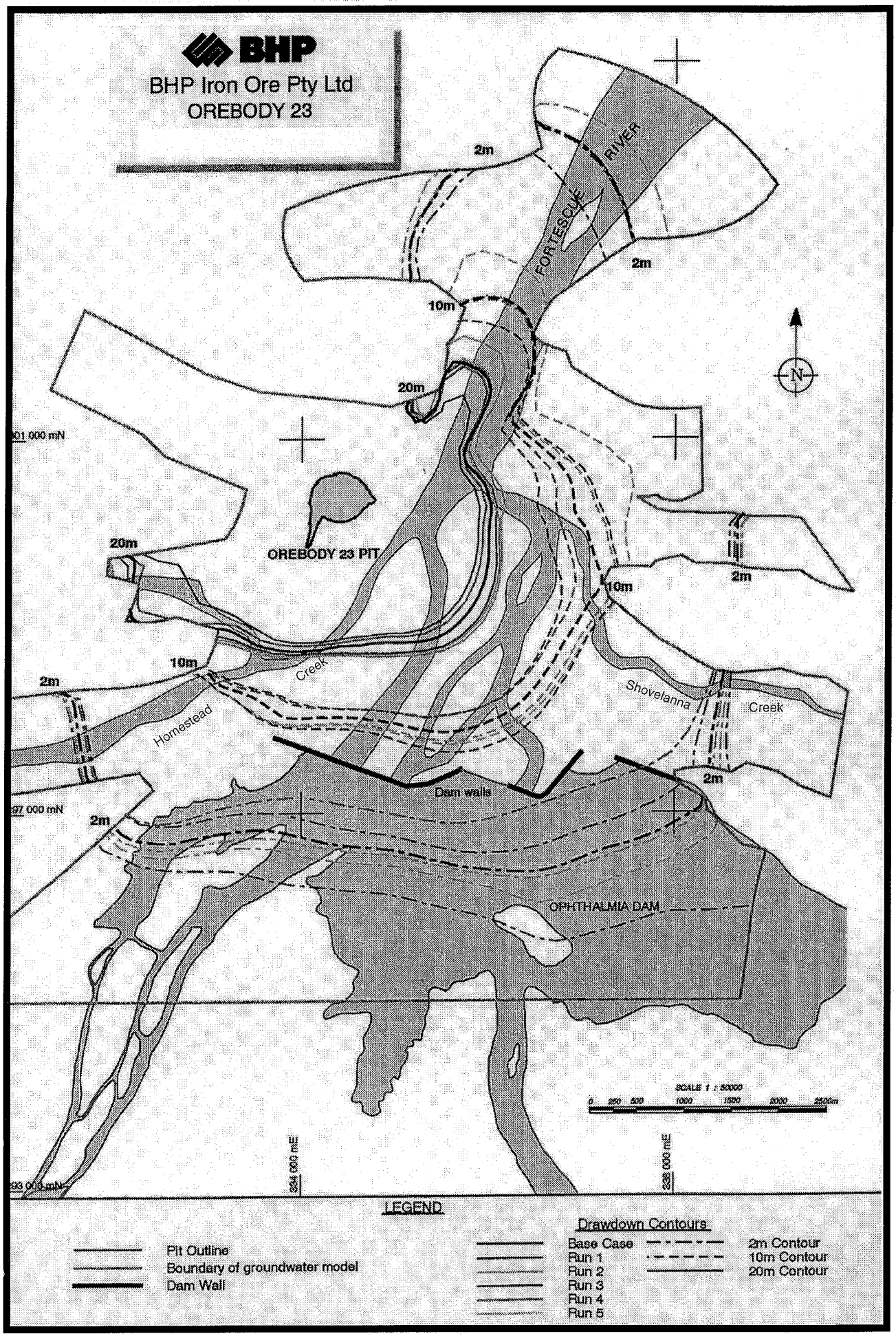

Figure 4. Regional hydrology and dewatering drawdown contours (Source: BHPIO, 1998).

Ore from Orebody 23, mined from below the watertable, will be hauled by off-highway trucks approximately 6 kilometres to the existing Orebody 25 crusher location (Figure 3). No additional infrastructure is required.

The proponent undertook additional work as a result of submissions to clarify issues raised. Following additional consultation with the Water and Rivers Commission (WRC), the Department of Conservation and Land Management (CALM) and the WA Museum, the proponent has not substantially changed the proposal, however an additional commitment has been made in relation to subterranean fauna (Commitment 8).

This proposal is subject to the *Iron Ore (Mount Newman) Agreement Act 1964*. As a result, routine environmental provisions usually imposed under the *Mining Act 1978* do not apply. Accordingly, environmental performance is regulated through the provisions of the Agreement Act and the *Environmental Protection Act 1986*.

The CER document contains a detailed table identifying likely impacts from the proposal and their proposed management (BHPIO, 1997). The main aspects of the proposal are summarised in Table 1.

Table 1. Summary of proposal

Element	Description
Life of Project	4 years
Ore Reserves	12 Million tonnes
Ore Mining Rate	2 - 4 Million tonnes per annum
Overburden	50 Million tonnes
Average Stripping Rates	4.2 : 1
Pit Depth (below existing plain level)	140 metres
Pit Area	32 hectares
Overburden Storage Area	105 hectares
Total Area Disturbed	137 hectares
Water Abstraction	38,000 kilolitres per day (max)
Area within the 10 m drawdown contour	360 hectares
Ore Processing and Trainloading	Will utilise Orebody 25 infrastructure
Workforce (shared with Orebody 25)	60 people (existing - no additional people required for this proposal)

3. Environmental factors

3.1 Relevant environmental factors

Section 44 of the *Environmental Protection Act 1986* requires the EPA to report to the Minister for the Environment on the environmental factors relevant to the proposal and on the conditions and procedures to which the proposal should be subject, if implemented. In addition, the EPA may make recommendations as it sees fit.

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

(a) Subterranean Fauna - impact of mine dewatering on aquifer habitat of stygofauna;

(b) Groundwater quantity - impact of dewatering on phreatophytic vegetation; and

(c) Groundwater quality - salinity increase due to evaporation from mined-out pit.

The above relevant factors were identified from the EPA's consideration and review of all environmental factors (preliminary factors) generated from the CER document and the submissions received, in conjunction with the proposal characteristics (including significance of the potential impacts), the adequacy of the proponent's response and commitments, and the effectiveness of current management and alternative approval processes which ensure that the factors will be appropriately managed.

On this basis, the EPA considers that the factors of vegetation communities, declared rare and priority flora, terrestrial fauna, specially protected (threatened) fauna, watercourses, groundwater quantity - downstream flows, landform, dust, groundwater quality - pyritic shale, surface water quality, noise, public health and safety, visual amenity and Aboriginal culture and heritage, and other issues raised in the submissions do not require further evaluation by the EPA. These factors either have manageable impacts, are addressed by proponent's commitments, or are covered by other environmental control processes. The identification of relevant environmental factors is summarised in Table 2, and a summary of their assessment is set out in Table 3.

The relevant environmental factors are discussed in Sections 3.2 to 3.4 of this report.

3.2 Subterranean Fauna - impact of mine dewatering on aquifer habitat of stygofauna

Description

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

In its submission on the CER, the WA Museum stated that calcretes generally contain isolated relictual communities of stygofauna. Calcrete occurs in the vicinity of the Ethel Gorge and in the upper Fortescue River system, within the area of influence of dewatering activities for the proposed mine. The potential impact on stygofauna in the vicinity of Orebody 23 is the drying of the calcrete aquifer as a result of dewatering activities.

Dr Humphreys of the WA Museum has sampled 13 bores in the vicinity of Orebody 23 and has found stygofauna present in this area, although no systematic identification of the specimens has been carried out at this time. There are five stygofauna species declared as Specially Protected (Threatened) fauna under the *Wildlife Conservation Act 1950.*

Permanent aquifers are found in shallow alluvial calcretes and in the deeper sand and gravel deposits. Some of the basement rock formations also form good aquifers. Groundwater investigations of the Ethel Gorge - Newman area and test pumping at Orebody 23 has confirmed that there is hydraulic connection between the various aquifers (BHPIO, 1998).

Assessment

The area considered for assessment is the area within the influence of dewatering.

The EPA's objective in regard to this environmental factor is to maintain the abundance, species diversity and geographical distribution of subterranean fauna.

Table 2. Identification of relevant environmental factors

Preliminary Environmental Factor	Proposal Characteristic	Government Agency and Public Comments	Identification of Relevant Environmental Factors
BIOPHYSICAL			
Vegetation communities	Space required for storage of overburden will disturb additional 100 ha of vegetation.	Anomalies in nomenclature suggest further work is required. Extent of flora surveys undertaken is unclear. (CALM)	Proponent carried out a flora survey of the entire project area in 1997. Vegetation will be rehabilitated on all impacted areas, other than the open water body. Factor does not require further EPA evaluation.
Declared rare and priority flora	Space required for storage of additional overburden will disturb 3 individuals of a Priority 2 species (*Scaevola acacioides*).	Further survey work should be undertaken on *S. acacioides* to determine its regional distribution. Specific searches for *S. acacioides* were not made over the entire project area. A comprehensive survey of the entire project area is required. (CALM)	As a result of this submission, proponent carried out an additional survey in November 1997. Two populations of *S. acacioides* of more than 100 individuals each were identified in the project area of which only 3 individuals will be impacted. An additional two populations outside the project area were also identified. Factor does not require further EPA evaluation.
Terrestrial fauna	Space required for storage of overburden will disturb additional 100 ha of vegetation. The proponent intends to leave an open waterbody up to 140 m deep with a surface area of 32 ha.	Native fauna may become dependent on the water in the mined-out pit, however will be unable to use it when salinity reaches a critical level. The water supply may enable feral animals to increase in number. (CALM) The invertebrate fauna of the project area has not been surveyed.	The area in which Orebody 23 is located contains abundant alternative and more accessible fresh water habitat, including Ophthalmia Dam. Invertebrate fauna is not routinely surveyed for most development projects. For this proposal, subterranean invertebrate fauna is discussed separately below. Factor does not require further EPA evaluation.
Specially protected (threatened) fauna	Three species of conservation significance recorded in 'Project Area' (honeyeater, falcon and Pilbara Olive Python). A further nine species have the potential to occur.	no comments received	Clearing will be limited and areas rehabilitated during and after mining. The area to be disturbed does not present suitable habitats for the majority of these species. Factor does not require further EPA evaluation.
Subterranean fauna - impact of mine dewatering on aquifer habitat of stygofauna	Dewatering required for life of mine (4 yrs).	Calcretes generally contain isolated relictual communities. Stygofauna must be considered in dewatering operations throughout the arid zone of WA where calcretes are most well developed. (WA Museum)	Calcrete occurs in the vicinity of Orebody 23. Potential impact on stygofauna as a result of this proposal from drying of the calcrete aquifer. Considered to be a relevant environmental factor.

Preliminary Environmental Factor	Proposal Characteristic	Government Agency and Public Comments	Identification of Relevant Environmental Factors
Watercourses	Dewatering required for life of mine (4 yrs) and discharge to Fortescue River could cause ponding.	no comments received	Discharge to the Fortescue River will be spread across areas of river bed sufficient to minimise surface ponding and any associated environmental impacts. Factor does not require further EPA evaluation.
Groundwater quantity - impact of dewatering on phreatophytic vegetation	Dewatering required for life of mine (4 yrs). Tree watering proposed for phreatophytic vegetation, as required, until the groundwater levels return to current levels. Groundwater and vegetation monitoring programme will be implemented in areas adjacent to the mining operation.	To what extent does the dominant species (River Red Gum) rely on groundwater? Effects of dewatering drawdown may not be evident if the Gum's are obtaining enough moisture from the lateral root network. (CALM) Proponent compares project area with Marillana Creek, but the riverine systems are markedly different. Watertable drawdown can have a marked effect on the health of River Red Gums. (CALM) Tree monitoring program is not scientifically rigorous. (CALM) Drawdown of the watertable will also affect the understorey of small shrubs and grasses. (CALM)	Considered to be a relevant environmental factor.
Groundwater quantity - downstream flows	Dewatering required for life of mine (4 yrs).	Change in volume of water through Ethel Gorge may affect Fortescue Marsh. No data to support the statement that flow through Ethel Gorge is not a major contributor to the water balance of downstream areas. (CALM)	Groundwater flow to the Fortescue Marsh will be maintained, as augmentation flows will contribute to the throughflow during mining, and the aquifer levels will recover post mining. Total surface water flows to the Fortescue Marsh have been estimated to range between 32,000 to 1,525,000 ML/year. Groundwater throughflow from Ethel Gorge equates to approx 180 to 225 ML/year. Factor does not require further EPA evaluation.
Landform	Space required for storage of overburden will disturb additional 100 ha of vegetation and will leave a mined out pit of 32 ha, 140 m deep. Overburden storage area will be contoured, stabilised and revegetated during and after mining.	Sites requiring rehabilitation should be seeded with seeds from a local provenance. The proposal increases the opportunity for the spread of the weed Ruby Dock - the proponent must be required to control and eradicate Ruby Dock from the project area. (CALM) Design of the dumping procedures and reshaping design should enable the long outslopes to be broken by berms to improve surface water runoff control. It is doubtful that sufficient topsoil would be available for all rehabilitated areas. (DME)	Landform already altered as a result of current mining at Orebody 23. Detail of overburden storage and topsoil management can be managed through EMP. Proponent may rehabilitate using benign overburden material as a growth medium. Proponent will implement a weed control program where required. This factor does not require further EPA evaluation.

Preliminary Environmental Factor	Proposal Characteristic	Government Agency and Public Comments	Identification of Relevant Environmental Factors
POLLUTION			
Dust	Existing mining operation generates dust from blasting activities, ore and overburden mining, road haulage and truck unloading. Controlled by watering from trucks, jets and sprays. Proposal to mine below watertable will not cause additional dust.	Water should be reused for dust suppression.	The proponent's commitment and control under Part V of the Environmental Protection Act are considered adequate. This factor does not require further EPA evaluation.
Groundwater quality - salinity increase due to evaporation from mined-out pit	Proposed to leave open mined out pit (32 ha) that will fill with water and gradually become saline. Modelling indicates that this may cause the palaeovalley aquifer to increase in salinity from 900 mg/L to 1,700 mg/L after 40 years.	Preferable for pit to be backfilled. (CALM) Trigger levels of salinity too high and could allow the groundwater resource to become contaminated. (WRC) Some indication of the remedial actions available is required. An increase in salinity in the palaeovalley aquifer may take decades or centuries to develop. A long-term commitment to monitoring is required. (CALM) Beneficial uses should be agreed now, rather than waiting until the water quality begins to deteriorate.	Considered to be a relevant environmental factor.
Groundwater quality - pyritic shale	Mining below the watertable will intercept potentially acid-generating pyritic black shale. Up to 2 Mt is proposed to be stored within the overburden material.	The exposed pyritic shale on the wall is proposed to be sealed to prevent exposure to air. The proponent should demonstrate that the sealant will indefinitely seal the exposed wall and that the remaining waterbody will not become acidic in the future. (CALM) What is the method of encapsulation in the base of the overburden storage to prevent leakage by downward percolation, and should a base drainage system be installed to collect any water infiltration?	Sealant used on the pit wall is only required while dewatering is operational (ie. max 4 yrs). When the watertable recovers, the pyritic material will be covered by water, preventing oxidation of pyritic shale and generation of acid. Monitoring bores will be established at the base of the overburden storage area and surface water will also be monitored. The proponent has made a commitment to manage the pyritic shale so as to prevent the acid-generating process occurring, on advice of DME. This factor does not require further EPA evaluation.

Preliminary Environmental Factor	Proposal Characteristic	Government Agency and Public Comments	Identification of Relevant Environmental Factors
Surface water quality	Surface water runoff is intercepted by silt traps and water is discharged through settling ponds. Proposed mining below watertable will continue these practices.	no comments received	The proponent's commitment and control under Part V of the Environmental Protection Act are considered adequate. Factor does not require further EPA evaluation.
Noise	Existing mining operation involves blasting, operation of mine machinery and movement of light vehicles. Proposal to mine below watertable will not cause additional noise.	no comments received	The proponent's commitment and control under Part V of the Environmental Protection Act are considered adequate. Factor does not require further EPA evaluation.
SOCIAL SURROUNDINGS			
Public health and safety - waterborne diseases	Proposal to leave an open waterbody up to 140 m deep with a 32 ha surface area.	The availability of surface water resulting from the abandoned mine may provide permanent habitat for mosquitos.	The nearby Ophthalmia Dam has a surface area of up to 1,500 ha in comparison with the 32 ha surface of the proposed future Orebody 23 pit waterbody. Factor does not require further EPA evaluation.
Visual amenity	Pit area, overburden storage areas and haul roads impact on visual amenity of the area. Disturbed areas are progressively rehabilitated.	no comments received	The proponent's commitment to prepare an EMP including rehabilitation is considered adequate. Factor does not require further EPA evaluation.
Aboriginal culture and heritage	One Aboriginal site has been identified, and approval to disturb was granted in 1985. A number of archaeological and ethnographic sites identified in the area of influence of dewatering. These sites will not be disturbed by the proposal.	no comments received	The proponent's commitment to prepare an EMP including Aboriginal heritage is considered adequate. Factor does not require further EPA evaluation.

Table 3. Summary of Assessment of Relevant Environmental Factors

Relevant Factor	Relevant Area	EPA Objective	EPA Assessment	EPA Advice
Subterranean fauna - impact of mine dewatering on aquifer habitat of stygofauna	Area of influence of dewatering	Maintain the abundance, species diversity and geographical distribution of subterranean fauna.	• Stygofauna have been found in the vicinity of Orebody 23. • Groundwater investigations of the Ethel Gorge - Newman area and test pumping at Orebody 23 has confirmed that there is a hydraulic connection between the various aquifers. • Stygofauna are mobile and there is hydraulic connectivity between, and within, the regional aquifer systems. Therefore, provided the area of impact is as small as possible and of short duration, the impact to various species of stygofauna may be negligible as stygofauna have the opportunity to move both within and between habitats. • The proponent has made an additional commitment to: 1. identify the stygofauna already sampled; 2. assess their conservation significance; 3. map the local distribution of existing samples; and 4. undertake further sampling in the Ophthalmia region.	Having particular regard to: • stygofauna sampling already undertaken; • proponent's commitment to do further study into stygofauna and take further action if stygofauna is assessed as a significant conservation issue; and • proponent's statutory obligations under the *Wildlife Conservation Act 1950,* it is the EPA's opinion that the proposal can be managed to meet the EPA's objective.
Groundwater quantity - impact of dewatering on phreatophytic vegetation	Area of influence of dewatering	Maintain the quantity of groundwater so that existing and potential uses, including ecosystem maintenance, are protected.	• Tree monitoring will assess the ongoing impact of dewatering on tree health and understorey species. • Riverine trees will be artificially irrigated if trees become stressed. • A study conducted in NSW has demonstrated that replenishment of the shallow alluvial aquifer can alleviate stress in trees.	Having particular regard to: • the proponent's commitment to monitor tree and understorey health; and • the proponent's commitment to implement a tree watering system if required, it is the EPA's opinion that the proposal can be managed to meet the EPA's objective.

Relevant Factor	Relevant Area	EPA Objective	EPA Assessment	EPA Advice
Groundwater quality - salinity increase due to evaporation from mined-out pit	Pit waterbody and Ethel Gorge Aquifer	Maintain or improve the quality of groundwater to ensure that existing and potential uses, including ecosystem maintenance are protected consistent with the draft WA Guidelines for Fresh and Marine Water (EPA, 1993) and the NHMRC/ARM CANZ Australian Drinking Water Quality - National Water Quality Management Strategy	As a result of submissions, the proponent has set the salinity trigger levels at: • 20% increase on current levels to initiate detailed monitoring and investigations to determine the cause of the increase; and • 50% increase on current levels, sustained over a period of one year, to implement mitigation measures. The proponent has put forward some options if remedial action is required and has also agreed to conduct further research into other options available.	Having particular regard to: • additional modelling and consultation undertaken by the proponent; • the proponent's commitment to initiate detailed monitoring and investigation to determine the cause of an increase in aquifer salinity of 20% over baseline levels; and • the proponent's commitment to implement mitigation measures if an increase in aquifer salinity of 50% over baseline levels is sustained over a period of one year, it is the EPA's opinion that the proposal can be managed to meet the EPA's objective, to the extent that the beneficial uses of the aquifer will be protected.

In response to issues raised in submissions, the proponent undertook further work with regard to this factor in collaboration with the WA Museum and CALM, and has made a commitment additional to those presented in the CER (Commitment 8). The proponent has made a commitment to:

1. identify the stygofauna species already sampled;
2. assess the conservation significance of species found by reference to the Protected fauna list and to other known collections;
3. map the local distribution of species sampled, particularly Protected fauna, as well as any "new" species; and
4. if the species distribution is assessed as a significant conservation issue, undertake further sampling in the Ophthalmia region to further identify stygofauna distribution.

Stygofauna are mobile in the vertical direction, suggesting there would also be a degree of mobility in terms of lateral movement (BHPIO, 1998). As there is hydraulic connectivity evident between the regional aquifer systems and within themselves, stygofauna have the opportunity to move both within and between habitats. Therefore, the impact to various species of stygofauna may be negligible, provided the area of impact is as small as possible and of short duration (BHPIO, 1998).

In response to BHPIO's observation that stygofauna have the opportunity to move within and between habitats, CALM concur that this connectivity would reduce the chances that the stygofauna found in that area would meet the criteria for special legal protection as threatened species under the *Wildlife Conservation Act 1950*. CALM conclude that the sampling regime for Orebody 23 could therefore be less intensive than in other regions such as Cape Range.

Having particular regard to:

- stygofauna sampling already undertaken;
- proponent's commitment to do further study into stygofauna and take further action if stygofauna is assessed as a significant conservation issue; and
- proponent's statutory obligations under the *Wildlife Conservation Act 1950*,

it is the EPA's opinion that the proposal can be managed to meet the EPA's objective for subterranean fauna - impact of mine dewatering on aquifer habitat of stygofauna.

3.3 Groundwater quantity - impact of dewatering on phreatophytic vegetation

Description

Dewatering will be required for the remaining life of the mine (4 yrs). Drawdown of the watertable will extend approximately 6 km upstream of Homestead Creek, 5.5 km upstream on the Fortescue River, 6 km on Shovelanna Creek and 5 km downstream on the Fortescue River (Figure 2).

Based upon monitoring of riverine vegetation in Marillana Creek since 1991, BHPIO has concluded that River Red Gums (*Eucalyptus camaldulensis*) show the ability to adapt to a reduction in groundwater of up to 10 m and could survive drawdowns of this magnitude for a period of time without any artificial watering (BHPIO, 1997). A drawdown of greater than 10 m over a prolonged period may cause stress in River Red Gums which may or may not be reversible. The 10 m drawdown contour for dewatering at Orebody 23 is shown on Figure 4.

Assessment

The area considered for assessment is the area within the influence of dewatering.

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

The proponent has made commitments to monitor groundwater levels (Commitment 2), and to establish a comprehensive tree monitoring programme (Figure 4), on advice of CALM, that will assess the impact of dewatering on the vegetation along the creek systems (Commitment 5). Following a submission from CALM, the proponent has agreed to extend the scope of the tree monitoring programme to include appropriate understorey species.

If the tree monitoring programme indicates that dewatering is having an adverse impact on riverine vegetation, the proponent will implement a tree watering system to sustain riverine vegetation in areas as determined by the monitoring (Commitment 6). The watering system will operate during mining and dewatering activities. The watering system will cease when the groundwater level, in identified areas, has returned to pre-mining levels, estimated to be approximately 3 years after mining.

A study conducted in NSW has demonstrated that replenishment of a shallow alluvial aquifer can alleviate stress in trees. In additional work undertaken as a result of issues raised in public submissions, the proponent has also cited a number of other studies to demonstrate the merit of using a tree watering system to alleviate stress (BHPIO, 1998).

The EPA has accepted the implementation of this management technique for other iron ore proposals within the Pilbara, such as the Yandi (EPA, 1995) and Yandicoogina (EPA, 1996) Mines.

Waterlogging following tree watering may have a detrimental effect on sensitive plants. To avoid this problem, the proponent will ensure that the irrigation regime will avoid having ponded water in the riverbed for more than 3 months (Commitment 6).

Having particular regard to:

- the proponent's commitment to monitor tree and understorey health; and
- the proponent's commitment to implement a tree watering system if required,

it is the EPA's opinion that the proposal can be managed to meet the EPA's objective for groundwater quantity - impact of dewatering on phreatophytic vegetation.

3.4 Groundwater quality - salinity increase due to evaporation from mined-out pit

Description

At the completion of mining and thus dewatering, watertable levels will recover to near pre-dewatering levels within approximately 3 years (BHPIO, 1997). As the mined out pit is not proposed to be backfilled, the pit will gradually fill with water due to groundwater throughflow.

Evapotranspiration will cause the resulting open body of water to gradually increase in salinity over time.

Increases in salinity may eventually impact upon the Ethel Gorge Aquifer immediately adjacent to and downstream of the pit. Current beneficial uses of the aquifer are natural vegetation requirements and Whaleback Mine operation water supply.

The proponent made a commitment in the CER that when salinity levels in monitoring bores reach 1,500 mg/L investigations would be initiated to limit further increases. Where sustained levels in excess of 2,000 mg/L were recorded for more than 12 months, techniques would be implemented to maintain water quality consistent with the beneficial uses at the time (BHPIO, 1997).

Submitters were concerned that the trigger levels proposed were too high, effectively allowing contamination of the aquifer prior to any action being undertaken. The WRC suggested that trigger levels should represent a proportional increase of salinity above background levels. This method of monitoring salinity would give a more accurate description of changes to the salinity of the aquifer, as the aquifer has differing baseline salinity levels.

Assessment

The area considered for assessment is the pit waterbody and the Ethel Gorge Aquifer.

The EPA's objective in regard to this environmental factor is to maintain or improve the quality of groundwater to ensure that existing and potential uses, including ecosystem maintenance are protected consistent with the draft WA Guidelines for Fresh and Marine Water (EPA, 1993) and the National Health and Medical Research Council / Agriculture and Resource Management Council of Australia and New Zealand, Australian Drinking Water Guidelines - National Water Quality Management Strategy (NHMRC/ARMCANZ, 1996).

As a result of submissions, the proponent undertook a substantial review of this aspect of the proposal, principally with regard to modelling and proposed actions if salinity is experienced. Figure 5 is a modelled representation of how salinity may change over a 100 year period. The model plots an arbitrary distance of 100 metres from the pit, starting at a background level of 900 mg/L, however salinity is not homogenous in this aquifer.

Extensive consultation with WRC has resulted in the modification of the salinity trigger levels, and the revised commitment is to set the levels at:

- 20% increase on current levels to initiate detailed monitoring and investigations to determine the cause of the increase (approximately 1,100 mg/L); and

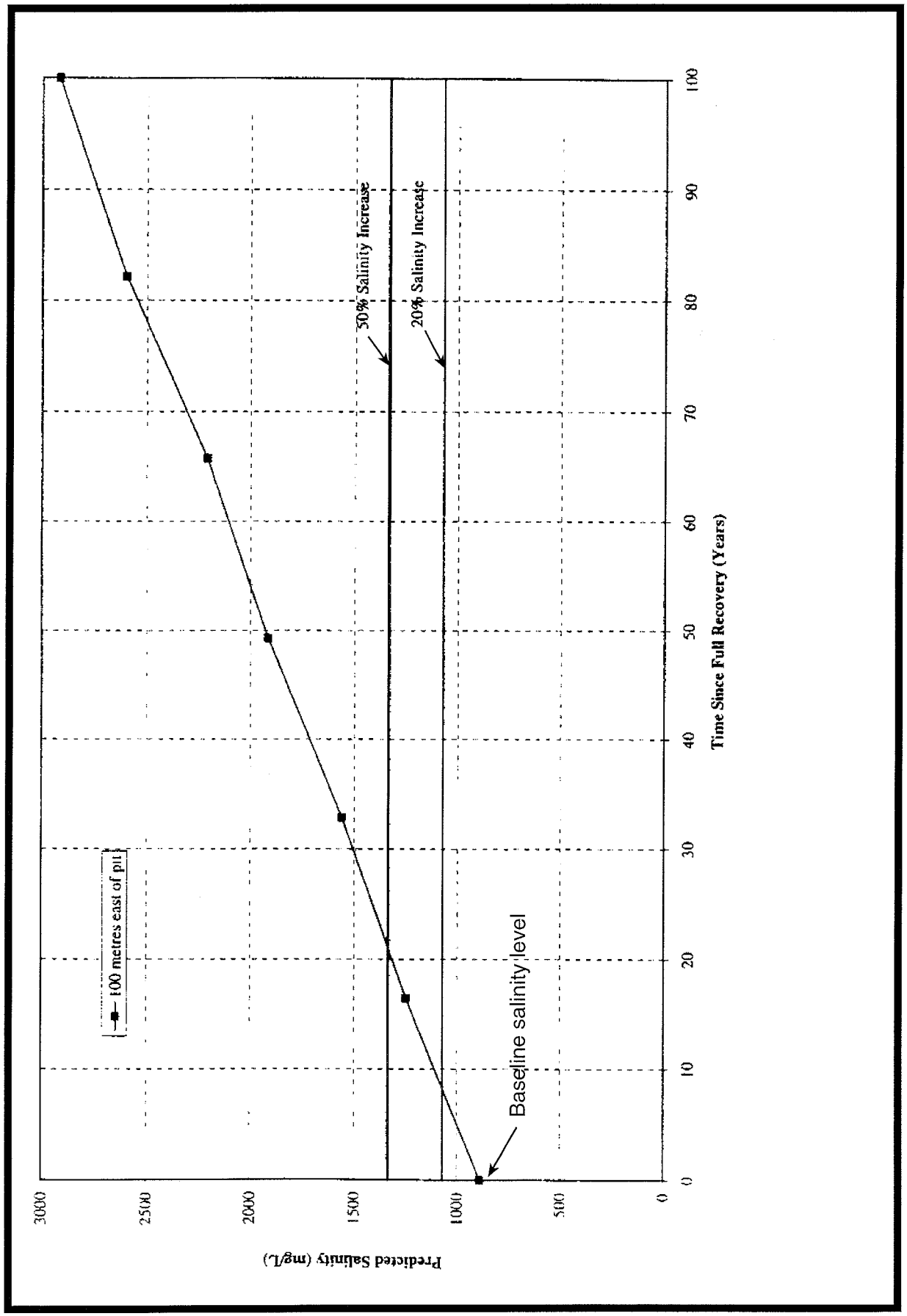

Figure 5. Predicted salinity levels (Source: BHPIO, 1998).

- 50% increase on current levels, sustained over a period of one year, to implement mitigation measures (approximately 1,350 mg/L).

The proponent has put forward some options for remediation of the saline pit, including backfilling, and has also agreed to conduct further research into other options available.

Having particular regard to:

- additional modelling and consultation undertaken by the proponent;
- the proponent's commitment to initiate detailed monitoring and investigation to determine the cause of an increase in aquifer salinity of 20% over baseline levels; and
- the proponent's commitment to implement mitigation measures if an increase in aquifer salinity of 50% over baseline levels is sustained over a period of one year,

it is the EPA's opinion that the proposal can be managed to meet the EPA's objective for groundwater quality - salinity increase due to evaporation from the mined-out pit, to the extent that the beneficial uses of the aquifer will be protected.

4. Conditions

Section 44 of the *Environmental Protection Act 1986* requires the EPA to report to the Minister for the Environment on the environmental factors relevant to the proposal and on the conditions and procedures to which the proposal should be subject, if implemented. In addition, the EPA may make recommendations as it sees fit.

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

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

The EPA may, of course, also recommend conditions additional to that relating to the proponent's commitments.

Having considered the proponent's commitments and the information provided in this report, the EPA has developed a set of conditions which the EPA recommends be imposed if the proposal by BHP Iron Ore Pty Ltd to mine Orebody 23 below the watertable, is approved for implementation. These conditions are presented in Appendix 3. Matters addressed in the conditions include the following:

(a) the proponent shall fulfil the commitments in the Consolidated Commitments statement set out as an attachment to the recommended conditions in Appendix 3; and

(b) in order to manage the relevant factors and EPA objectives contained in this bulletin, and subsequent conditions and procedures authorised by the Minister for the Environment, the proponent shall demonstrate that there is in place an environmental management system (EMS) which includes the following elements:

- environmental policy and commitment;
- planning of environmental requirements;
- implementation and operation of environmental requirements;
- measurement and evaluation of environmental performance; and
- review and improvement of environmental outcomes.

5. Conclusions

The EPA has considered the proposal by BHP Iron Ore Pty Ltd to mine below the watertable at the Orebody 23 iron ore deposit. The main issues of concern relate to dewatering and management of the mined-out pit. The EPA has recommended conditions to ensure that an effective plan is in place to manage possible impacts on subterranean fauna and any potential impacts on the surrounding vegetation and aquifer.

The EPA has concluded that the proposal can be managed to meet the EPA's objectives, provided that the conditions recommended in Section 4 and set out in Appendix 3 are imposed.

6. Recommendations

Section 44 of the *Environmental Protection Act 1986* requires the EPA to report to the Minister for the Environment on the environmental factors relevant to the proposal and on the conditions and procedures to which the proposal should be subject, if implemented. In addition, the EPA may make recommendations as it sees fit.

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

1. That the Minister considers the report on the relevant environmental factors of Subterranean Fauna, Groundwater quantity, and Groundwater quality as set out in Section 3.
2. That the Minister notes that the EPA has concluded that the proposal can be managed in an environmentally acceptable manner, provided there is satisfactory implementation by the proponent of the recommended conditions set out in Section 4.
3. That the Minister imposes the conditions and procedures recommended in Appendix 3.

Appendix 1

List of submitters

Members of the public

Confidential submitter

Central Metropolitan College of TAFE:
Francoise Becu
Lauren Goodall
Jennifer Higbid
Donald Jones
Jenny Potts
Nicol Rudrum
Maziar Shaban

Interest Groups

Conservation Council of Western Australia

Government Departments

Department of Conservation and Land Management

Department of Minerals and Energy

Department of Resources Development

Water and Rivers Commission

Western Australian Museum

Appendix 2

References

BHP Iron Ore Pty Ltd (1997). *Consultative Environmental Review for the Newman Satellite Development - Mining of Orebody 23 Below the Watertable*. BHP Iron Ore Pty Ltd, Western Australia.

BHP Iron Ore Pty Ltd (1998). *Response to Public Submissions for the Newman Satellite Development - Orebody 23 Mining Below the Watertable*. BHP Iron Ore Pty Ltd, Western Australia.

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

Environmental Protection Authority (1995). *Duplication of iron ore mining operation, Yandi Mine, BHP Iron Ore Pty Ltd - Report and Recommendations of the EPA*. EPA Bulletin 802. Environmental Protection Authority, Western Australia.

Environmental Protection Authority (1996). *Yandicoogina iron ore mine and railway, Hamersley Iron Pty Ltd - Report and Recommendations of the EPA*. EPA Bulletin 809. Environmental Protection Authority, Western Australia.

Environmental Protection Authority (1997). *Extensions to Exmouth Marina Harbour, Landcorp - Report and Recommendations of the EPA*. EPA Bulletin 868. Environmental Protection Authority, Western Australia.

Humphreys, W. F. (1997). Submission to the EPA regarding the Orebody 23 Consultative Environmental Review. WA Museum.

National Health and Medical Research Council / Agriculture and Resource Management Council of Australia and New Zealand (1996). *Australian Drinking Water Guidelines - National Water Quality Management Strategy.*

Appendix 3

List of recommended Ministerial Conditions and Proponent's consolidated commitments

Statement No.

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

Title: NEWMAN SATELLITE DEVELOPMENT - MINING OF OREBODY 23 BELOW THE WATERTABLE

Proposal: The mining of iron ore from the Orebody 23 deposit on the Ophthalmia Range, including dewatering operations, approximately 13 kilometres northeast of Newman, Shire of East Pilbara, as documented in schedule 1 of this statement.

Proponent: BHP Iron Ore Pty Ltd

Proponent Address: 200 St George's Terrace, Perth WA 6000

Assessment Number: 1142

Report of the Environmental Protection Authority: Bulletin 888

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

1 Implementation

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

2 Proponent Commitments

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

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

3 Environmental Management System

3-1 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 construction, the proponent shall demonstrate that there is in place an environmental management system (EMS) which includes the following elements:

- environmental policy and commitment;
- planning of environmental requirements;

- implementation and operation of environmental requirements;
- measurement and evaluation of environmental performance; and
- review and improvement of environmental outcomes.

3-2 The proponent shall implement the Environmental Management System referred to in condition 3-1.

4 Performance Review

4-1 Within two years following the commencement of mining below the watertable, the proponent shall submit a Performance Review to evaluate the environmental performance relevant to:

1 environmental objectives reported on in Environmental Protection Authority Bulletin 888;

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

3 Environmental Management System environmental management targets;

4 Environmental Management Programs and Plans; and

5 environmental performance indicators;

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

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

5 Changes to Implementation

5-1 Where, in the course of implementing the proposal, 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.

6 Proponent

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

6-2 Any request for the exercise of that power of the Minister referred to in condition 7-1 shall be accompanied by a copy of this statement endorsed with an undertaking by the proposed replacement proponent to carry out the proposal in accordance with the conditions and procedures set out in the statement.

6-3 The proponent shall notify the Minister for the Environment of any change of proponent contact name and address within 30 days of such change.

7 Commencement

7-1 The proponent shall provide evidence to the Minister for the Environment within five years of the date of this statement that the proposal has been substantially commenced.

7-2 Where the proposal has not been substantially commenced within five years of the date of this statement, the approval to implement the proposal as granted in this statement shall lapse and be void. The Minister for the Environment will determine any question as to whether the proposal has been substantially commenced.

7-3 The proponent shall make application to the Minister for the Environment for any extension of approval for the substantial commencement of the proposal beyond five years from the date of this statement.

7-4 Where the proponent demonstrates to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority that the environmental parameters of the proposal have not changed significantly, then the Minister may grant an extension not exceeding five years for the substantial commencement of the proposal.

8 Compliance Auditing

8-1 The proponent shall submit periodic Performance and Compliance Reports, in accordance with an audit program prepared in consultation between the proponent and the Department of Environmental Protection.

8-2 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.

8-3 Where compliance with any condition is in dispute, the matter will be determined by the Minister for the Environment.

Note

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

Schedule 1

The Proposal

The proposal is to mine iron ore at Orebody 23, approximately 13 km north east of Newman, Shire of East Pilbara, on the Ophthalmia Range in the vicinity of the Fortescue River. Mining below the water table to a maximum depth of 140 metres will require dewatering operations.

Key characteristics table

Element	Description
Life of Project	4 years
Ore Reserves	12 Million tonnes
Ore Mining Rate	2 - 4 Million tonnes per annum
Overburden	50 Million tonnes
Average Stripping Rates	4.2 : 1
Pit Depth (below existing plain level)	140 metres
Pit Area	32 hectares
Overburden Storage Area	105 hectares
Total Area Disturbed	137 hectares
Water Abstraction	38,000 kilolitres per day (max)
Area within the 10 m drawdown contour	360 hectares
Ore Processing and Trainloading	Will utilise Orebody 25 infrastructure
Workforce (shared with Orebody 25)	60 people (existing - no additional people required for this proposal)

Plans, Specifications, Charts

Figure 1: Location Plan

Figure 2: Project Area, including proposed pit and overburden area outlines

Schedule 2

Proponent's Consolidated Environmental Management Commitments

September 1997

Newman Satellite Development
Mining of Orebody 23 below the watertable (1142)

BHP Iron Ore Pty Ltd

TABLE 5-1
SUMMARY OF PROPONENT'S COMMITMENTS

Commitment	Objective	Action	Timing	Whose Advice	Measurement/Compliance Criteria
Commitment 1: Pyritic Shales					
BHP Iron Ore will ensure that potentially reactive pyritic shales are managed within the overburden storage areas to prevent acid generating processes occurring. Pyritic materials exposed in the pit walls will be sealed to prevent exposure to air.	To ensure that potentially reactive material is managed to prevent the generation of acid rock drainage.	Pyritic material will be stored above the groundwater table in dedicated cells within the overburden storage area.	During mining.	DME	Annual Pyritic Materials Management Report to DME.
Commitment 2: Water Monitoring					
BHP Iron Ore will supplement the existing water monitoring system to measure watertable levels throughout the Ethel Gorge Wellfield. Additionally, the quality of the water will be measured at various strategic locations throughout the system. Monitoring will take place during the mining/dewatering phase and after cessation of mining for the period of time until the aquifer has reached near pre-mining levels.	To minimise the short and long-term effects caused by groundwater use. To monitor for changes in groundwater level and quality both during mining and for an indefinite period following the completion of mining to ensure that the beneficial use of the resource is protected.	An ongoing groundwater monitoring programme will be developed and implemented to meet the requirements of the DEP.	During mining and dewatering and post-mining.	WRC DEP	WRC/DEP approved groundwater monitoring programme developed and implemented. Annual reporting to DEP/WRC.
Commitment 3: Pit Waterbody Monitoring					
BHP Iron Ore will monitor the quality of water in the pit and the adjacent aquifer following the completion of mining at Orebody 23. In addition, appropriate perimeter monitoring bores, representing aquifer water quality adjacent to the pit, will be selected with the agreement of the DEP and WRC.	To monitor for changes in pit water quality for an indefinite period following the completion of mining to ensure that the beneficial use of the resource is protected.	An ongoing pit water monitoring programme will be developed and implemented to meet the requirements of the DEP and WRC.	Post-mining.	DEP and WRC.	Pit water monitoring programme in operation. Annual reporting to DEP/WRC

Commitment	Objective	Action	Timing	Whose Advice	Measurement/Compliance Criteria
Commitment 4: Pit Waterbody Management					
A salinity "trigger" level for the Ethel Gorge aquifer monitoring program will be set at a value that corresponds to a statistically significant 20% increase on background levels where the increase corresponds to similar salinity increases in the flooded pit (as measured by Total Dissolved Solids). Mitigation measures will be implemented when statistically significant sustainable levels in excess of a 50% increase are recorded over a period of 12 months and corresponds to similar salinity increases in the flooded pit.	To minimise the short and long-term effects caused by groundwater use.	Investigate and, if required, implement techniques to maintain water quality consistent with agreed beneficial uses. Potential management techniques include: • infilling the pit • re-engineer local drainage system • operate Ophthalmia recharge facility • pump open pit for water supply	During and post-mining.	DEP	Investigations undertaken, if required, into techniques to maintain water quality. Implement, if required, agreed management techniques to maintain water quality.
Commitment 5: Tree Monitoring					
BHP Iron Ore will establish a comprehensive tree monitoring programme that will assess the impact of dewatering on the vegetation along the creek systems.	To detect potential impacts of groundwater drawdown on the phreatophytic vegetation of the area.	Develop and implement a tree monitoring programme which meets the requirements of the DEP and CALM.	Before dewatering starts.	DEP CALM	Approved Tree Monitoring Programme developed and implemented. Annual reporting to DEP/CALM.
Commitment 6: Tree Watering					
If the tree monitoring programmes (Commitment 5) indicates that dewatering is having an adverse impact on riverine vegetation, BHP Iron Ore will implement a tree watering system to sustain riverine vegetation in areas as determined by the monitoring. The watering system will operate during mining/dewatering and after the cessation of mining until the groundwater level, in identified areas, has returned to near pre-mining levels.	To minimise the impacts of groundwater drawdown on the phreatophytic vegetation of the area.	Develop and implement a tree watering programme, if required, which meets the requirements of the DEP and CALM.	If indicated as required by tree monitoring programme in Commitment 5.	DEP CALM	Implementation of approved Tree Watering Programme as required. Annual reporting to DEP/CALM.

Commitment	Objective	Action	Timing	Whose Advice	Measurement/Compliance Criteria
Commitment 7: Development of a Life of Project Environmental Management Plan					
BHP Iron Ore will prepare, to a timetable agreed with the Department of Environmental Protection, and implement a Life of Project Environmental Management Plan (EMP) for the Orebody 23 Project. The EMP will be developed in accordance with statutory conditions applied to the approved operations. The EMP will be reviewed and updated as required. The EMP will address and BHP Iron Ore will commit to practice guidelines and management programs for the following environmental factors: • surrounding environment; • vegetation and topsoil management; • overburden storage; • surface water; • groundwater; • flora; • fauna; • Aboriginal heritage; • noise; • dust; • waste and hazardous materials; • rehabilitation; • decommissioning; • contracting; and • continuous improvement.	To manage the environmental impact of the Project.	Develop and implement a Life of Project Environmental Management Plan to meet the requirements of the DEP and DME.	Prior to the commence-ment of mining.	DEP DME	Life of Project Environmental Management Plan developed.

Commitment	Objective	Action	Timing	Whose Advice	Measurement/Compliance Criteria
Commitment 8: Subterranean Fauna					
In collaboration with the Museum of Western Australia, BHP Iron Ore will: • identify the stygofauna species collected in the vicinity of OB 23 by the Museum • assess the conservation significance of species found • map the local distribution of species sampled • undertake sampling in the Ophthalmia region if species distribution is found to be a significant conservation issue.	To determine the risk and consequence of any species of stygofauna becoming threatened or extinct as a result of future mining operations.	Design and implement an approved stygofauna assessment program in collaboration with the Museum of Western Australia.	Prior to the commence-ment of mining.	Museum of WA DEP	Approved assessment program implemented.