West Angelas Iron Ore Project – East Pilbara, Ashburton, Roebourne

Robe River Mining Co. Pty. Ltd.

Report and recommendations
of the Environmental Protection Authority

Environmental Protection Authority
Perth, Western Australia
Bulletin 924
January 1999

ISBN. 07309 8126 6
ISSN. 1030 - 0120
Assessment No. 1144

Summary and recommendations

This report provides Environmental Protection Authority (EPA) advice to the Minister for the Environment on the proposal by Robe River Mining Co. Pty. Ltd. to develop an iron ore mine and processing operation at West Angelas, construct a railway line from West Angelas to the Robe Pannawonica-Cape Lambert railway and expand port facilities at Cape Lambert.

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

Relevant environmental factors

In the EPA's opinion, the following are the environmental factors relevant to each component of this proposal:

Environmental factor	Minesite	Railway	Port
Vegetation communities – impacts from direct disturbance	*	*	
Declared Rare and Priority flora – impacts from direct disturbance	*	*	
Specially Protected (Threatened) fauna	*	*	
Surface water - sheet flows	*	*	
Subterranean fauna – impact of groundwater abstraction from the borefield and mine dewatering on aquifer habitat of stygofauna	*		
Groundwater quantity	*		
Aboriginal culture and heritage	*	*	
Marine flora and mangroves			*
Specially Protected (Threatened) marine fauna			*
Marine water and sediment quality			*
Millstream-Chichester National Park – impact on park purpose and usage		*	

Conclusions

The EPA has considered the proposal by Robe River Mining Co. Pty. Ltd and concluded that, whilst the proposal is largely able to meet the EPA's environmental objectives, some portions of the proposed rail line are unable to do so.

The over-riding environmental issue which has arisen during the assessment of this proposal is the proposed construction of a new railway line, particularly where the proposed route crosses national parks or areas of high conservation value.

Millstream-Chichester National Park Sections

Use and purpose of national parks

The EPA's view is that national parks have been recognised and dedicated by Government for their special values and a new railway should not normally be located in a national park. The EPA has considered the options for a railway in this area. As a hierarchy of preferences:

(a) the first preference is for Robe River Mining to use the existing Hamersley Iron line within the national park;

(b) secondly, to build a new line outside the park;

(c) thirdly to build a new railway close to the existing Hamersley Iron line (inside a 1km nominal rail corridor) within the park; and

(d) lastly and by far the least preferred option, is for the proponent to construct a new alignment through the national park.

Environmental values

Irrespective of which railway route is proposed, the environmental values that may be affected need to be clearly identified. The proposed Mt Leal route was considered unacceptable because of potential impacts to the wilderness values in the Millstream-Chichester National Park. The proponent has advised that this option will not be implemented and its preference is now for a rail route close to the Hamersley line in the southern part of the national park.

For the Hamersley Parallel Western Route (in the northern part of the park) advice from the Department of Conservation and Land Management (CALM) indicates that there may be an opportunity to rationalise the location of the existing and proposed railway lines and the proposed Mt Tom Price Road into one new corridor to reduce the overall impacts on environmental values.

It is the EPA's view that the construction of a new railway line through the Millstream-Chichester National Park cannot be managed to meet the EPA's environmental objectives for national parks and A-class conservation reserves.

However, it is the EPA's view that expanded usage of the existing rail line through the park could be managed to meet EPA environmental objectives. The EPA encourages the proponent to pursue this option.

Should the Government decide to approve a new railway line within the Millstream-Chichester National Park, it should be within one kilometre of the existing line to lessen the adverse impacts on the purpose and use of the park. If approval for such a line is given, the approval should be conditional upon access to the line being available to others, to reduce the need for additional lines in the future.

At the time of this assessment insufficient information was available on the specific alignment, environmental values, or management proposed along a rail route through the national park that would fall wholly within one kilometre of the existing line. The EPA is hence unable to provide firm advice on the acceptability of a specific route. The proponent would need to consult closely with CALM and EPA on these specific details if a new rail route in the Millstream-Chichester National Park is to meet environmental objectives.

Where the terrain renders the construction of the rail line within 1km of the existing line to be impractical (eg. the gorge of the Harding River), the proposed route should be selected in consultation with CALM and demonstrate, to the satisfaction of the EPA, that significant environmental impacts will not occur. The EPA is of the view that this is by far the least preferred environmental outcome but it does recognise that, in terms of engineering feasibility, it may be the only practical option.

Coondewanna Flats Section

The EPA is concerned that rail routes through Coondewanna Flats may compromise environmental values associated with significant mulga vegetation associations, through disturbance to surface hydrology.

The EPA considers that the risk of substantial impacts are much more likely for the Coondewanna West route than for other routes. Consequently, the Coondewanna West route is not environmentally acceptable.

Modifications to the alignment of this route are understood to be under consideration by Robe. These realignments could result in reduced environmental impacts but no detailed comparison of this Modified Coondewanna West route with the CALM Mt Robinson route has been provided to the EPA for assessment.

The alternative route to the east of Coondewanna Flats proposed by CALM is strongly preferred because it substantially avoids impacts on sensitive vegetation communities and could be located largely in areas already disturbed by the Great Northern Highway. It is considered from field inspections and advice from CALM that this route could be made environmentally acceptable.

The proponent's Mt Robinson route option, while being less undesirable than the proposed Coondewanna West route, may compromise significant vegetation associations in the northern area of Coondewanna Flats by disturbance to local hydrology and is hence regarded as being environmentally unacceptable.

Karijini Section

The EPA considers that the Marandoo Corridor through the Karijini National Park has been created by Government specifically to cater for rail traffic. A new line would be environmentally acceptable provided it was entirely within this existing one kilometre corridor. The construction of a new railway line completely within the existing corridor could be difficult but the proponent has advised that this is feasible. If construction within the corridor is found not to be feasible and as a result the Government considers adjusting the corridor, then advice should be sought from CALM and the maximum width should not exceed one kilometre, as is currently the case.

Other Railway Sections

The proposed railway alignment can otherwise be managed to meet the EPA's environmental objectives.

Other Proposal Components

The components of the project consisting of mining of Deposits A and B, the borefield and the port expansion can be managed to meet the EPA's environmental objectives. Insufficient information has been provided on the environment and management of Deposits C to H to determine whether the EPA's environmental objectives could be met there. Hence development of these deposits has not been assessed as part of this proposal.

Other Advice

The EPA believes that the Government should give consideration to the rationalisation of future rail, road and other corridors in the Pilbara and to the means to ensure that the cumulative environmental impacts of future cumulative access proposals are acceptable.

Development of conservation reserves in the Pilbara region should be progressed so that the broader cumulative issues relating to proposed access corridors, groundwater usage and future developments in the Pilbara can be considered in the light of factors arising from the location of known conservation reserves.

The assessment of developments in the Pilbara is hampered by the absence of consolidated information on the regional distributions of terrestrial fauna, subterranean fauna and an adequate database of significant vegetation associations in the region. It is understood that a large

database of significant vegetation associations in the region. It is understood that a large number of vegetation surveys have been carried out in the region to date, but the results of these remain dispersed among different mining companies and Government agencies. Robe has committed to making available to government the data collected during surveys commissioned for this proposal.

Mineral developments are large users of groundwater. Proposed developments may utilise common or connected aquifers. The extraction of groundwater may lead to impacts on vegetation, existing water features and the supply available for other users.

In providing advice on this proposal, the EPA considers that its implementation wholly as proposed by the proponent would not be environmentally acceptable. Regarding the Other Advice provided in Section 5, the EPA has concluded:

- that Government should give consideration to the rationalisation of rail and infrastructure corridors in the Pilbara through the Central Pilbara Mineral Province Study, and to the means to ensure that the cumulative environmental impacts of future cumulative access proposals are acceptable;
- that a project to consolidate vegetation and fauna data for the Pilbara to facilitate assessment of future proposals should be initiated and coordinated by the DEP and CALM; and
- that a coordinated regional approach led by the Water and Rivers Commission for managing groundwater resources in the Pilbara should be developed.

Recommendations

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

1. The EPA recommends that the Minister considers the report on the relevant environmental factors as set out in Section 3;
2. The EPA recommends that the Minister notes the EPA has concluded that Deposits A and B of the West Angelas mine, Cape Lambert port extension and the railway line, except where it passes through the Millstream-Chichester National Park and across Coondewanna Flats, can be managed to meet the EPA's environmental objectives, provided there is satisfactory implementation by the proponent of the recommended conditions and exclusions set out in Section 4 and set out in detail in Appendix 1, including the proponent's commitments;
3. The EPA recommends that the Minister notes that for subsequent mining of Deposits C to H within the project area, the EPA would require additional details on the environment there and the management proposed, to be referred to the EPA to enable the EPA to provide advice on the environmental effects of the proposals;
4. The EPA recommends that the Minister considers the EPA's strong preference for use of the existing Hamersley Iron line or for the location of the railway outside national parks, and notes that it is the EPA's opinion that the construction of a new rail line through the Millstream-Chichester National Park is inconsistent with the EPA's environmental objectives which are inherent in the designation of national parks and A-class conservation reserves;
5. The EPA recommends that the Minister notes that should the Government decide, after considering broader issues, to approve a new railway line within the Millstream-Chichester National Park, it should be within one kilometre of the existing line to lessen the adverse impacts on the purpose and use of the park. Where the terrain renders this impractical (eg. the gorge of the Harding River), the proposed route should be selected in consultation with CALM and demonstrate to the satisfaction of the EPA that significant environmental impacts do not occur;

6. The EPA recommends that the Minister notes that the EPA has recommended conditions consistent with the position of a new railway not being constructed within a national park (see Recommendation 2). However, it further recommends that the Minister be aware that an alternative condition in relation to a railway line within the Millstream-Chichester National Park has been included in brackets in Condition 10, dependent on the Minister's decision in Recommendation 5.

7. The EPA recommends that the Minister notes that the Mt Leal and Coondewanna West sections of the route do not meet EPA environmental objectives and are therefore not environmentally acceptable;

8. The EPA recommends that the Minister imposes conditions as set out in Appendix 1, but noting that the final wording will depend upon the decision taken by the Minister on Recommendation 5;

9. The EPA recommends that the Minister notes the Other Advice in Section 5 and takes appropriate action to ensure those agencies responsible (being DEP, CALM, DRD and WRC) are aware of this advice.

Contents

Figures

Tables

Appendices

1. Introduction

This report provides the advice and recommendations of the Environmental Protection Authority (EPA) to the Minister for the Environment on the environmental factors relevant to the proposal by Robe River Mining Co. Pty. Ltd. (the proponent) to develop an iron ore mine and processing operation at West Angelas, construct a railway line from West Angelas to the Robe Pannawonica-Cape Lambert railway and expand port facilities at Cape Lambert.

The proposal was referred to the EPA on 9 June 1997 and the level of assessment was set at "Environmental Review and Management Programme" (ERMP).

The ERMP report "Robe River Mining Co. Pty. Ltd. - West Angelas Project - Environmental Review and Management Programme" (Robe and Ecologia, 1998), referred to here as the ERMP, was available for public review from 16 March 1998 to 11 May 1998. It can be viewed at the Department of Environmental Protection (DEP) library.

In compiling this report, the EPA has considered the ERMP, issues raised by the public, specialist advice from government agencies, the proponent's responses to issues raised, the EPA's own research and research provided by other expert agencies.

The report sets out the environmental factors that the EPA considers are relevant to the proposal, outlines preferred options for the proposal, indicates areas where further information is required and provides recommendations on the conditions and procedures which should be applied if the proposal is to be implemented. The report also provides other recommendations that the EPA sees appropriate.

Further details of the proposal are presented in Section 2 of this Report. Section 3 discusses the 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 provides Other Advice by the EPA. Section 6 presents the EPA's Conclusions and Section 7 the EPA's Recommendations.

Appendix 1 contains the recommended environmental conditions and the proponent's commitments; people and organisations that made submissions are listed in Appendix 2; and references are listed in Appendix 3.

The DEP's summary of submissions and the proponent's response to those submissions has been published separately.

2. The proposal

The proposal is to:

- develop an iron ore mining and processing operation at West Angelas, 130 kilometres west of Newman;
- develop a Borefield at Turee Creek about 30 kilometres west of the mine site;
- construct a rail line from West Angelas through the Karijini and Millstream-Chichester National Parks to the Robe Pannawonica-Cape Lambert railway; and
- expand the proponent's port facilities at Cape Lambert.

A location map is shown in Figure 1.

A summary of the key characteristics of the proposal is presented in Table 1.

The proposal is based on mining iron ore from Deposits A and B. Although mining of six other sites, Deposits C to H, was foreshadowed in the ERMP, there was insufficient detail on the environment at those sites, or on proposed management practices, for the EPA to properly address the impacts or acceptability of mining these areas. Deposits C to H would require separate assessment by the EPA.

Mining of the ore will be undertaken using conventional open cut methods.

Table 1. Summary of key proposal characteristics (West Angelas Project).

Component	Proposal Characteristic	Description[a]
Mine	Mining rate	20 Mt/a
	Measured iron resource: • Deposits A & B	 458 & 236 Mt
	Life of project	27-30 years
	Mine pit area: • Deposit A • Deposit B	 460 ha 335 ha
	Maximum depth of pit: • Deposit A • Deposit B	 250 m 180 m
	Depth to water table: • Deposit A • Deposit B	 approx 102 m (Fig 5.2 ERMP) approx 114 m (Fig 5.3 ERMP)
	Area of overburden storage: • Deposit A • Deposit B	 850 ha 600 ha
	Dewatering requirements	Dewatering required to access ore below water table
	Dewatering discharge	Normally to process plant and dust control
	Area of disturbance	4031 ha (camps, infrastructure, Deposits A and B and overburden waste dumps)
	Airstrip (runway)	2.3 km
	Diesel fuelled power station	Maximum demand 7200kW
	Water pipeline (above ground)	30 km
	Location of mine accommodation village	12 km north-west of minesite
	Workforce (entire project): • Construction • Operation	 1200 450
	Water supply source • Construction • Operation	Turee Creek B Borefield 2 ML/day 4-6 ML/day
Railway	Length of railway	340 km
	Train movements (170 cars per train)	22 /week
Port	Ship loading	15-20 Mt/a
	Ships	397 /a
	Reclamation for port stockpile	44.4 ha
	Wharf extension	250 m
	Dredging volume	590,000 m^3
All	Greenhouse gases (CO_2)	approx. 0.140.Mt/a

[a] Definitions of units: "/a" means per annum; "km" means kilometres; "ML/day" means million litres per day; "Mt/a" means million tonnes per annum; "kW" stands for kilowatts; "m3" means cubic metres; "ha" means hectares (1 ha = 10,000 square metres); "m" means metres; "Mt" means million tonnes.

Dewatering will be required with the extracted water being used on site. Upon completion of mining areas, overburden wastes will be used to fill parts of the mine pit to a level above the natural water table.

The ore will be processed on site into sub-37.5 millimetre lump and sub-6.3 millimetre fines-sized material and stockpiled prior to rail outloading (Figure 2).

A desliming plant is being considered by the proponent but is not part of this proposal at this stage.

Support infrastructure for mining will include a private access road to the minesite from Great Northern Highway, a heavy vehicle and plant maintenance workshop and warehouse, offices, radio facilities, explosives storage facility, fuel storage tanks, accommodation village and an airstrip. Power will come from an on-site diesel-fired power station. Originally a gas-fired power station was proposed and this was to have been connected by gas pipeline to the Boonanchi Wells valve station 46km south east of the minesite.

The proponent also proposes to develop a borefield at Turee Creek about 30 kilometres west of the mine site.

Transport of the ore requires the construction of a rail link between the West Angelas minesite and Cape Lambert. The rail route proposed in the ERMP is shown in Figure 3. The route for the Coondewanna Flats section is shown in Figure 4 and the rail route through the Millstream-Chichester National Park revised during the assessment is shown in Figure 5.

An increase in the capacity of the proponent's existing port facilities at Cape Lambert is required to enable the shipping of West Angelas ore (Figure 6). Proposed additional land-based facilities include a new product stockpile pad on reclaimed land, rotary ore car dumper, tertiary screening pad, rail and plant control and maintenance facilities. The port facility will require a new shiploader, an extension to the existing wharf and associated dredging.

3. Relevant environmental factors

Section 44(1) of the Environmental Protection Act 1986 requires the EPA to report to the Minister for the Environment on the environmental factors relevant to the proposal and the conditions, if any, to which the proposal should be subject. In addition, the EPA may make recommendations as it sees fit.

This proposal is made up of three components – a minesite (including borefield), railway and port expansion. The substantially different nature and locations of each of these components meant that it was more sensible to separately assess the environmental factors for each component. Based on this approach, the identification process for the relevant factors is summarised in Table 2.

Having considered appropriate references, public and government submissions and the proponent's response to submissions, in the EPA's opinion, the following are the environmental factors relevant to the components of the proposal to which they apply:

Environmental factor	Minesite	Railway	Port
Vegetation communities – impacts from direct disturbance	*	*	
Declared Rare and Priority flora – impacts from direct disturbance	*	*	
Specially Protected (Threatened) fauna	*	*	
Surface water - sheet flows	*	*	

Subterranean fauna – impact of groundwater abstraction from the borefield mine dewatering on aquifer habitat of stygofauna	*		
Groundwater quantity	*		
Aboriginal culture and heritage	*	*	
Marine flora and mangroves			*
Specially Protected (Threatened) marine fauna			*
Marine water and sediment quality			*
Millstream-Chichester National Park – impact on park purpose and usage		*	

The minesite component was redefined to include the borefield.

Detail on the environmental factors and their assessment is contained in Sections 3.1 to 3.3. The Sections have been grouped as far as possible according to the minesite, railway and port components of the proposal. The description of each factor shows why it is relevant to the proposal and how it will be affected by the proposal.

The assessment of each factor is where the EPA decides whether or not a proposal meets the environmental objective set for that factor.

A summary of the assessment of the environmental factors is presented in Table 3.

3.1 Minesite and Borefield

3.1.1 Vegetation communities – impacts from direct disturbance

Description

Development of the minesite and associated infrastructure will disturb a substantial area resulting in the direct loss of native vegetation and potentially, impacts to vegetation associations of conservation significance.

The total area of disturbance for camps and mine infrastructure is about 600 hectares. Mining of Deposits A and B requires disturbance to approximately 2113 hectares. Overburden material will be stored in two waste dumps alongside each open pit, covering additional areas of 938 and 380 hectares respectively.

At a regional level, the West Angelas area lies entirely within Beard's (1975) Hamersley Plateau physiographic unit of the Fortescue Botanical District. The area is within the Pilbara Interim Biogeographical Region (Thackway and Cresswell, 1995).

The West Angelas area has a diverse flora for its size because of a variety of relief and geological types which combine to provide a great diversity of habitats. The particular diversity of habitat at West Angelas is unlikely to be often repeated. The Mulga is in good condition because the area has been subject to very little stock grazing. Many stands of Mulga have the geographically restricted *Acacia* aff. *catenulata* dominant.

Table 2. Identification of relevant environmental factors.

Preliminary Environmental Factor	Proposal		Government Agency and Public Comments	Identification of Relevant Environmental Factors
	Component	Characteristic		
BIOPHYSICAL				
Vegetation communities – impacts from direct disturbance	Borefield	Area to be cleared is limited to around bore sites and is therefore very small. Vegetation is of low to moderate conservation value.	No comments	ERMP states that bore sites will not be located where there is vegetation with moderate to high conservation value. Factor does not require further EPA evaluation for this component.
	Mine	Area of direct disturbance is 2113 ha for Deposits A and B, and 600 ha for camps and associated infrastructure, 4031ha total when overburden areas are included. Areas of medium to high conservation value may be indirectly or directly disturbed.	The mine is within an area proposed as multiple use conservation reserve. Management measures to avoid or minimise impacts are required (CALM).	Considered to be a relevant environmental factor for this component.
	Railway	Areas of moderate to high conservation value may be indirectly or directly disturbed.	Existing Hamersley Iron rail line is preferred (CALM and NPNCA). Vegetation assessment is required for Marandoo section (CALM). Proposed rail route through Millstream-Chichester National Park is opposed (CC).	Considered to be a relevant environmental factor for this component.
Declared Rare and Priority flora – impacts from direct disturbance	Borefield	No DRF or Priority flora identified.	No comments.	Factor does not require further EPA evaluation.
	Mine	Areas contain 1 DRF, 16 priority species and 47 other species that may be of conservation interest which may be indirectly or directly affected.	Mine is within an area proposed as multiple use conservation reserve. Management measures to avoid or minimise impacts are required (CALM).	Considered to be a relevant environmental factor for this component.
	Railway	A number of priority and other species that may be of conservation interest may be indirectly or directly affected.	Vegetation assessment is required for Marandoo section (CALM).	Considered to be a relevant environmental factor for this component.

Preliminary Environmental Factor	Proposal		Government Agency and Public Comments	Identification of Relevant Environmental Factors
	Component	Characteristic		
Terrestrial Fauna	Mine	Clearing may potentially cause a loss and degradation of fauna habitat. Other impacts may occur from dust, introduced weed and feral fauna species, changed fire regimes, noise and vibration disturbance and restrictions to fauna movement.	Fauna survey grid, while acceptable, was not an official CALM design (CALM).	Management measures to address the vegetation communities and sheet water flows will also address this factor. Management Plans can address monitoring of fauna. Factor does not require further EPA evaluation.
	Railway	As above.	Fauna survey was inadequate and used inconsistent methodologies along different parts of proposed route. The Western route and Mt Leal were sampled poorly (CALM). Sampling of vertebrate fauna was inadequate (NPNCA). Railway will (further) fragment national parks (CC).	Can be addressed through Specially Protected (Threatened) fauna factor. Factor does not require further EPA evaluation.
Specially Protected (Threatened) fauna	Mine	Specially protected fauna in the area considered to be potentially impacted.	Fauna survey grid, while acceptable, was not an official CALM design (CALM).	Considered to be a relevant environmental factor for this component
	Railway	Specially protected fauna in the Coondewanna West corridor to be potentially impacted.	Sampling of vertebrate fauna was inadequate (NPNCA). Railway will (further) fragment national parks (CC).	Considered to be a relevant environmental factor for this component.
Subterranean fauna – impact of groundwater abstraction and mine dewatering on aquifer habitat of stygofauna	Borefield	Groundwater extraction (up to 30 years).	Subterranean fauna may occur in calcrete and alluvial aquifers found in Pilbara. More information is required on the effect of changed hydrology on subterranean fauna (WA Museum).	Considered to be a relevant environmental factor for this component.
	Mine	Mine dewatering.	As for subterranean fauna.	Considered to be a relevant environmental factor for this component.

Preliminary Environmental Factor	Proposal		Government Agency and Public Comments	Identification of Relevant Environmental Factors
	Component	Characteristic		
Marine flora	Port	New stockpile pad will require reclamation of mudflats. Wharf will be extended 250 m seaward. Channel dredging required for 1 km seawards from new wharf head. Turbidity from dredging may impact primary producers. Dust from stockpiles may affect mangroves.	Definition of EQOs for Cape Lambert marine environment being progressed (DEP).	Considered to be a relevant environmental factor for this component.
Marine fauna	Port	Loss of mudflat and silty sand habitat.	Bird usage of mudflats should be examined (CALM).	Habitat impacted occurs extensively in the area. Factor does not require further EPA evaluation for this component.
Specially Protected (Threatened) marine fauna	Port	Loss of mudflat and silty sand habitat. No surveys undertaken for specially protected species.	Further fauna surveys should be conducted (CALM).	Considered to be a relevant environmental factor for this component.
Watercourses	Mine	Mine area will require watercourse diversions in the upper reaches of the Turee Creek sub-catchment.	Hydrological impacts not adequately addressed (CALM).	The proponent has committed to preparing Drainage Diversion Management Plans in consultation with WRC. Factor does not require further EPA consideration for this component.
	Railway	Proposed line crosses many drainage lines, from low gradients up to sixth order streams. Areas where streams are crossed have greatest species abundance although impacts are also more localised.	Hydrological impacts not adequately addressed (CALM).	Railway spanning major water courses should have minimal local impacts. Factor does not require further EPA evaluation for this component.
Surface water - sheet flows	Mine	Modification of drainage may affect Mulga communities.	As above.	Considered to be a relevant environmental factor for this component.
	Railway	As above.	Potential impacts to Mulga on Coondewanna Flats and Karijini NP from drainage interference (CALM, NPNCA). Rail route opposed (CALM). Effect of new line on surface hydrology of Coondewanna Flats will be too severe (CC).	Considered to be a relevant environmental factor for this component.

Preliminary Environmental Factor	Proposal		Government Agency and Public Comments	Identification of Relevant Environmental Factors
	Component	Characteristic		
Groundwater quantity	Borefield	Abstraction of 4 to 6 ML/d (16 ML/d with desliming plant) from Turee Creek (B) borefield where groundwater depth is 40-50 m below surface. Aquifer capacity is 8-9 ML/d. Drawdown up to 50 m locally and measurable (not quantified) out to 3-5 km including into Karijini NP. Potential impacts on downstream pools in Turee Ck.	Insufficient information provided in aquifer characteristics (WRC).	Considered to be a relevant environmental factor for this component.
Landform	Mine	Waste dumps areas will be 938 and 380 ha for Deposits A and B respectively.	Insufficient information provided on final designs and drainage management (CALM).	Construction and rehabilitation of waste dumps will be consistent with Department of Minerals and Energy guidelines. Factor does not require further EPA evaluation for this component.
POLLUTION				
Particulates/ dust	Mine	Dust generation from blasting, ore extraction, crushing and loading.	EMP should address dust (asbestos) monitoring during construction and operation (DEP).	EMP will address dust management and occupational asbestos impacts (compliance to DME guidelines). Environmental dust able to be managed under Part V of the Act. Factor does not require further EPA evaluation for this component.
	Railway	Dust generation from transport.	No comments received.	Factor does not require further EPA evaluation for this component.
	Port	Dust generation from unloading, stockpiles and handling.	Dust impacts at Wickham and Point Samson and from proposed quarry west of Wickham (Shire of Roebourne). EMP should address dust monitoring during construction and operation (DEP).	Nearest residence to Cape Lambert more than 2.5 km away. Able to be managed under Part V of the Act. Factor does not require further EPA evaluation for this component.
Greenhouse gases	Project	Greenhouse gases (CO2) will be emitted from electricity generation (0.049-0.087 mt/a), locomotives (0.054 mt/a) and trucks and excavators (0.015 mt/a). Total predicted emissions are 0.118-0.156 mt/a.	No comments received.	Proponent has committed to implementing Action Plan for the Greenhouse Challenge Program. Factor does not require further EPA evaluation for this component.

Preliminary Environmental Factor	Proposal		Government Agency and Public Comments	Identification of Relevant Environmental Factors
	Comp-onent	Characteristic		
Gaseous emissions (SO2)	Mine	Power generation will use diesel fuel.	No comments received.	Factor does not require further EPA evaluation for this component.
Gaseous emissions (NOx)	Mine	Nitrogen oxides emissions from former gas turbine power generation predicted to be 250 ppm. Data to be provided as a result of change to proposal .	No comments received.	Able to be managed under Part V of the Act. Factor does not require further EPA evaluation for this component.
Groundwater quality	Mine	Deposits A and B are below the water table. Groundwater quality may be affected by spillages of contaminants such as oils used in mining operations reaching the water table.	EMP should address groundwater monitoring during construction and operation (DEP). More information required on potential groundwater impacts (WRC).	Progressive backfilling of pits will reduce risk of contamination. Storage of contaminants and prevention of contamination of ground and surface waters able to be managed under Part V of the Act. Factor does not require further EPA evaluation for this component.
Surface water quality	Mine	Potential for sediment contamination of drainage channels from high rainfall periods. Surface water quality may be affected by spillages of contaminants such as oils used in mining operations. Except for cyclonic rainfall events, dewatered pit water will be used on site.	EMP should address runoff water monitoring during construction and operation (DEP).	Able to be managed by appropriate drainage design and controls such as settlement ponds. EMP will address prevention of contamination of ground and surface waters. Discharge of contaminants able to be managed under Part V of Act. Factor does not require further EPA evaluation for this component.
	Railway	Potential for sediment contamination following erosion during high rainfall events. Potential for contamination following rail accidents and fuels spills. Railway passes through part of Harding River drinking water supply catchment.	Within Chichester NP, preferred alignment is within existing rail corridor to minimise risks to Millstream public water supply catchment (WRC).	Proponent has committed to design drainage structures that minimises ponding and erosion based on advice from the WRC. Potential for accident causing contamination considered to be low. Factor does not require further EPA evaluation for this component.

Preliminary Environmental Factor	Proposal		Government Agency and Public Comments	Identification of Relevant Environmental Factors
	Comp-onent	Characteristic		
Marine water and sediment quality	Port	Potential for contamination of marine waters from ore handling and outloading and ships. Increased turbidity from dredging. Extra shipping may increase accidental discharges, discharge of sewage waste, ballast waters and TBT contamination.	EMP should address runoff water monitoring during construction and operation (DEP).	Considered to be a relevant environmental factor for this component.
SOCIAL SURROUNDINGS				
Aboriginal culture and heritage	Borefield	No ethnographic or archaeological sites of Aboriginal significance identified from surveys.	General lack of information provided by proponent on advice provided by Aboriginal consultants. Suggest provision of all reports to Aboriginal communities (AAD).	Considered to be a relevant environmental factor for this component.
	Mine	As above.	As above.	Considered to be a relevant environmental factor for this component.
	Railway	As above.	As above. Archaeological survey needed along rail route. Avoid sites exempted from coverage by Aboriginal Heritage (Marandoo) Act 1992 (AAD).	Considered to be a relevant environmental factor for this component.
Non-indigenous heritage	Project	No ethnographic or archaeological sites of non-indigenous significance identified.	No comments received.	Factor does not require further EPA evaluation for this component.
Public health and safety (risk and hazard)	Mine (gas pipeline)	Spur from Goldfields pipeline Boonanchi Wells valve station, 46km from mine. NOTE: this is no longer a consideration because power is to be generated on site using diesel fuel.	No comments received.	Proponent has committed to siting pipeline at least 1km from any residential area. Able to be managed through pipeline licensing requirements of Dep't of Minerals and Energy. Factor does not require further EPA evaluation.
	Railway	Ore and fuel are carted on the railway.	No comments received.	Fire risk to humans unlikely to be significantly increased. Factor does not require further EPA evaluation for this component.
Chichester and Karijini National Parks– impact on park purpose and usage	Railway	Railway through Karijini National Park is generally parallel to Hamersley Iron line within excised transport corridor. A railway passing through Millstream-Chichester National Park is inconsistent with purpose of A-class reserves and national parks.	New rail line will affect wilderness values in national parks due to noise and visual impacts (CC, NPNCA). Use of existing Hamersley Iron rail line is preferred (CALM, NPNCA).	Considered to be a relevant environmental factor.

Table 3. Summary of Environmental Factors, EPA Advice and Recommendations.

Relevant Factor/ Component	EPA Environmental Objective	EPA Assessment	EPA Advice
Minesite			
Vegetation communities – impacts from direct disturbance	Maintain the abundance, species diversity, geographic distribution and productivity of vegetation communities	The West Angelas area has a diverse flora for its size because of the presence of a large range of relief and geological types which combine to provide a great diversity of habitats. The Mulga is in good condition because the area has been subject to very little stock grazing. Cracking clays are a particularly important habitat. They represent only a small part of the region and often support diverse Mulga communities and fauna habitat. The conservation value for vegetation associations and species richness at the regional level is rated in the ERMP as high. The vegetation survey report (Trudgen and Casson 1998) stated that none of the vegetation associations described for the orebody A and B study areas "were so unusual that they are of high conservation significance". The main conservation value of the vegetation of these orebody areas was their contribution to the high conservation value of the surrounding area. The Trudgen and Casson (1998) report noted the potential of vegetation associations near the orebodies having moderate conservation value to be affected by mining of the orebodies. CALM has advised that the West Angelas mine area is within a proposed multiple use "Mulgalands" conservation reserve which would adjoin the Karijini National Park. With very careful management, development of the minesite can be accommodated as a multiple use within the wider conservation reserve proposed to adjoin the Karijini National Park (C Muller *pers com* 16/6/98). A mechanism to implement this is for the proponent to develop a "Minesite Environmental Management Plan" based on advice from CALM prior to implementing the proposal.	Having particular regard to: (a) the minesite area having conservation significance for vegetation associations; (b) CALM's advice that, with appropriate management and liaison with CALM, mining can be accommodated within the proposed conservation reserve; and (c) the proponent's commitment to address management of environmental impacts through an EMP, it is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objective for vegetation communities provided that a Minesite Environmental Management Plan is prepared based on advice from CALM. The objective of the plan should be to preserve as many conservation values in the minesite area as possible. The plan should address proponent commitments as well as: (i) the location and design of mine infrastructure, stockpiles, waste dumps and other facilities so as to not significantly impact vegetation associations having conservation value or cracking clay areas; (ii) the maintenance and restoration of original drainage patterns; (iii) restricting the number and size of corridors used for infrastructure and services; (iv) the design and form of stockpiles for maximum harmony with the landscape; (v) the discharge from mine dewatering to natural drainage areas; (vi) eradication of currently identified Ruby Dock infestations and implementation of appropriate weed management procedures; (vii) minimising clearing; and (viii) implementation of a progressive rehabilitation and revegetation plan.

Relevant Factor/ Component	EPA Environmental Objective	EPA Assessment	EPA Advice
Declared Rare and Priority flora – impacts from direct disturbance	Protect Declared Rare and Priority flora, consistent with the provisions of the *Wildlife Conservation Act 1950*	The Declared Rare and Priority flora list for the Pilbara is in a very preliminary state. According to Trudgen and Casson (1998): • the West Angelas survey area has a diverse flora range for its size; • a total of 64 species of conservation interest are known from the West Angelas survey area; • "the West Angelas survey area has moderate or higher value for species of conservation interest"; • the general conservation value of flora on orebodies A and B would be rated as moderate taking into account that "areas with such a flora are moderately widespread in the central part of the Hamersley Ranges"; and • a possible new species, *Cynanchum aff. floribundum* (priority three) was collected from a site adjacent to orebody B.	Having particular regard to: (a) the minesite area contains Declared Rare and Priority flora; and (b) the implementation of recommended procedures for a Minesite Environmental Management Plan can also be used to address the protection of sites where flora species having conservation value exist, it is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objective for Declared Rare and Priority flora provided that the Minesite Environmental Management Plan referred to in section 3.1.1: (i) complies with relevant legislation; (ii) identifies the location of Declared Rare and Priority flora species that will be disturbed by mine development; (iii) assesses the conservation status of each species; and (iv) for those species that are inadequately represented in the conservation estate, describes measures based on advice from CALM to ensure the conservation status of each species is not reduced as a result of the implementation of the proposal.
Specially Protected (Threatened) fauna	Protect Specially Protected (Threatened) fauna, consistent with the provisions of the *Wildlife Conservation Act 1950*	Specially Protected fauna of significance in the area are: • Grey Honeyeater *Conopophila whitei* (now Priority 4, Wildlife Conservation Act) recorded in Mulga habitat in the mine area and Coondewanna Flats; and • Ghost Bat *Macroderma gigas* (Vulnerable, Endangered Species Act) found in caves north of Deposit B and caves previously reported near Deposit E. Impacts to the Grey Honeyeater from developing the minesite are not considered to be significant if, at the regional level, Mulga habitat is preserved. The proposal may affect local populations of Ghost Bats if there are few alternative maternity caves available at the regional level. The EPA notes that measures to protect Specially Protected (Threatened) fauna are a requirement under the Wildlife Conservation Act and notes the proponent's commitments to: • minimise impact to Mulga habitat which is habitat for the Grey Honeyeater; • maintain a minimum barrier of 100 metres between operations and the caves inhabited by Ghost Bats; and • not using barbed wire unless there is a statutory requirement to do so.	Having particular regard to: (a) impacts to Grey Honeyeater populations in the minesite area can be reduced by minimising impacts on Mulga habitats in the vicinity of ore deposits and the connecting railway. Minimising impacts on Mulga habitats is a component of the Minesite Environmental Management Plan referred to in section 3.1.1; and (b) the likelihood of disturbance to the local presence of Ghost Bats from developing the minesite, it is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objective for Specially Protected (Threatened) fauna provided that: (i) the Minesite Environmental Management Plan referred to in section 3.1.1 considers the avoidance of areas likely to be utilised by Ghost Bats in the design of infrastructure such as waste dumps, haul roads and rail lines; (ii) a Ghost Bat Management Plan is developed in consultation with CALM, to ensure that the local ghost bat population remains viable; and (iii) the proponent's commitments are implemented.

Relevant Factor/ Component	EPA Environmental Objective	EPA Assessment	EPA Advice
Surface water - sheet flows	Maintain the integrity, functions and environmental values of drainage systems	Mulga (*Acacia aneura*) has roots which are adapted to taking water from thin surface soils and does not have taproots to access groundwater at depth. Consequently, the distribution of mulga is primarily influenced by soil moisture and the pattern of surface drainage and can be impacted by impedance or diversion of surface drainage. The loss of mulga may result in: • loss of associated flora species; • loss of fauna habitat; • increased soil erosion; and • increased downstream flood levels due to lower levels of moisture retention achieved in mulga groves. The proponent has made a commitment to prepare Drainage Diversion Management Plans to include measures to minimise erosion, sediment transport and turbidity at each new deposit, based on advice from the Water and Rivers Commission.	Having particular regard to: (a) the development of a Minesite Environmental Management Plan referred to in section 3.1.1; and (b) the proponent's commitment to prepare Drainage Diversion Management Plans, it is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objective for surface water provided that: (i) the proponent's commitment is implemented; and (ii) the Drainage Diversion Management Plans are consistent with the objective of the Minesite Environmental Management Plan and therefore also address maintaining surface water flow regimes to preserve mulga communities as far as possible.
Subterranean fauna – impact of groundwater extraction and mine dewatering on aquifer habitat of stygofauna	Maintain the abundance, species diversity and geographic distribution of subterranean fauna	Subterranean fauna includes both troglobites (terrestrial) and stygofauna (aquatic). Both of these are important because of their species richness, evolutionary history and adaptations and the evidence they can provide for continental drift. Hence they are significant in terms of Australian faunal biodiversity. The factor was not identified in the EPA guidelines as a preliminary factor and hence was not addressed in the ERMP. In its submission, the WA Museum has advised that the Pilbara contains significant subterranean faunas in calcrete and alluvial aquifers. These fauna are known to exist to the north, west and east of the mine site in both the Ashburton and Fortescue catchments. The proponent advised during the assessment that sampling of stygofauna in liaison with the WA Museum is under way (D Calvin *pers com* 23/9/98).	Having particular regard to: (a) there appears to be limited information regarding the abundance of stygofauna; (a) advice from the WA Museum that stygofauna may be present in the area; (b) sampling groundwater for the presence of stygofauna could enable the significance of any stygofauna found to be assessed and therefore managed; and (c) sampling is not an onerous task, it is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objective for subterranean fauna, provided that the proponent, based on advice from the WA Museum: (i) samples groundwater at the borefield and below the deposits for the presence of stygofauna; (ii) if stygofauna are identified- • assesses the conservation significance of species found by reference to the Protected Fauna list and to other known collections; • maps the local distribution of species sampled, particularly Protected Fauna, as well as any "new" species; and • if the species distribution is assessed as a significant conservation issue, undertakes further sampling in the region to further identify stygofauna distribution; (iii) reports the results in an EMP; and (iv) prepares and implements a conservation management plan to ensure species survival if stygofauna species of conservation significance are found only in areas affected by the proposal.

Relevant Factor/ Component	EPA Environmental Objective	EPA Assessment	EPA Advice
Groundwater quantity	Maintain the quantity of groundwater so that existing and potential uses are not affected	The water requirement for the proposal is 4 to 6 ML/d. If a desliming plant is required (not included in this proposal), the water requirement will increase to 16 ML/d. Most of the required water is proposed to be sourced from the Turee Creek (B) area where groundwater depth is 40-50 metres below surface. Aquifer capacity is reported in the ERMP to be 8 to 9 ML/d. Local drawdown may be up to 50 metres. After 30 years, drawdown may extend out to three to five kilometres, which may encroach into Karijini National Park. Groundwater will also be extracted due to pit dewatering. Upon completion of mined areas, overburden wastes will be used to cover parts of the mine pit which are below the natural water table. Further groundwater may be lost from the pits in the long term due to capillary action and evaporation if the cover allows this process. The proponent has made commitments to: • prepare a Groundwater Extraction Management Plan which includes monitoring to detect groundwater impacts in the vicinity of Karijini National Park; and • infilling mined-out pits to above the water table (the depth of cover is not quantified).	Having particular regard to the proponent's commitment to prepare a Groundwater Extraction Management Plan based on advice from the Water and Rivers Commission, it is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objective for groundwater quantity provided: (i) the following issues are also addressed and managed in the Groundwater Extraction Management Plan: • the depth at which groundwater is proposed to be extracted; • further groundwater investigations are undertaken to the west of the proposed borefield area to enable more accurate modelling of regional impacts (particularly Paperbark Spring and any other adjacent springs) and assessment of the sustainable yield; • identify emergency water sources closer to the minesite in the event that the borefield is inaccessible for certain times of the year; • the monitoring and management of any impacts of groundwater extraction on the levels of downstream surface pools along Turee Creek; • the impact of proposed groundwater extraction on other current users, and potential users, of the Turee Creek aquifers; • proposed actions in the event that adverse impacts to surface water levels, vegetation or other users of the aquifers are detected; and • the minimisation of water usage; and the Minesite Environmental Management Plan referred to in section 3.1.1 takes into account the level of pit infilling required to prevent evaporation of groundwater brought to the surface by capillary rise in the soil cover.

Relevant Factor/ Component	EPA Environmental Objective	EPA Assessment	EPA Advice
Aboriginal culture and heritage	Demonstrate that the proposal complies with the requirements of *Aboriginal Heritage Act 1972* and ensure that changes to the biological and physical environment resulting from the project do not adversely affect cultural associations with the area	The ERMP reported that there were no areas of Aboriginal ethnographic or archaeological significance in the path of the minesite. In its submission, the Department of Aboriginal Affairs expressed concerns regarding the adequacy of the ethnographic and archaeological surveys undertaken for the proposal. Further more detailed surveys were suggested together with consultation with Aboriginal communities. The proponent advised during the assessment that the company would liaise further with the Department of Aboriginal Affairs to resolve outstanding issues of concern (D Calvin *pers com* 6/7/98).	Having particular regard to the proponent's commitment to liaise with the Department of Aboriginal Affairs, it is the EPA's opinion that the proposal is capable of being managed to meet the EPA's objectives for Aboriginal culture and heritage provided that the proponent's commitments are implemented.

Relevant Factor/ Component	EPA Environmental Objective	EPA Assessment
Railway		
All sections		
Vegetation communities – impacts from direct disturbance Declared Rare and Priority flora – impacts from direct disturbance Specially Protected (Threatened) fauna	Maintain the abundance, species diversity, geographic distribution and productivity of vegetation communities. Protect Declared Rare and Priority flora, consistent with the provisions of the *Wildlife Conservation Act 1950*.	The assessment of proposed railways in the Pilbara against the EPA's environmental objectives needs to recognise that a new railway has the potential to: • impact vegetation communities through direct disturbance, alterations to surface water flows, and/or the spread of weeds; • impact specially protected fauna through direct fatalities ("track kills"), vegetation loss resulting in loss of fauna habitats, disrupting fauna movement, and/or creating corridors for predators; • impact vegetation communities and fauna through the alteration of fire regimes (which includes providing fire breaks); and • impact vegetation communities and fauna through associated disturbance for access roads, gravel/borrow pits and worker accommodation sites. Commitments made or implied by the proponent in the ERMP in regard to the proposed railway include: • using the results of vegetation and flora surveys to assist in minimising impacts to vegetation of moderate to high conservation significance in the final route design; • where the railway parallels existing railways, as a minimum standard, duplicate the existing standard and type of drainage structure already present and elsewhere, determine the size and type of drainage structure based on catchment size with 1 in 20 average recurrence interval for storm events or 1 in 50 average recurrence interval at bridges and major culverts; • maintain stream embankment gradients, stream bed material and riparian vegetation to ensure minimal scouring or change in stream direction; • drainage management techniques in low gradient areas to minimise impacts to mulga from changes to surface hydrology, including installing multiple culverts and spreader banks designed to redistribute outflows in "fill" sections of the track; • rehabilitation of construction camp areas by removing all plant, buildings and other structures, ripping the compacted areas and revegetating; • continuance of existing fire prevention procedures which include appropriate provision of extinguishers on locomotives and grinding machines, fire watch when grinding and avoidance of grinding on days of extreme fire danger; and • implementation of a weed management plan. In discussions with the DEP during the assessment, the proponent has provided the following additional commitments: • making use of existing roads and tracks to access the railway wherever possible; and • ongoing maintenance of spreader banks on the downstream side of culverts in "fill" sections of the track, to ensure the ongoing even distribution of sheet water flows.
Surface water - sheet flows	Maintain the integrity, functions and environmental values of drainage systems.	

Relevant Factor/ Component	EPA Environmental Objective	EPA Assessment	EPA Advice
Coondewanna West route			
		The ERMP states that this route contains very large variations of Mulga stands and areas of grassland, some with scattered Mulga. Collectively, these have very high conservation value for vegetation, particularly as the vegetation is generally in excellent condition. An alternative route from the minesite to the Hamersley Iron railway, which largely followed the Great Northern Highway and circumvented the Coondewanna Flats area has been suggested by CALM. In its submission, CALM advised that: • both the Coondewanna West route and the Mt Robinson alternative have high to very high conservation value in terms of vegetation associations. The Coondewanna West route has a greater diversity of unique associations and the Mt Robinson route has several regionally uncommon associations; • the ERMP's route evaluations did not address the advantages of a new railway adjacent to an existing railway or road in a floodwash area. In this case only negligible additional impacts to existing drainage patterns would be anticipated; • the majority of the Coondewanna West route lies within an area adjoining the Karijini National Park proposed for a multiple use conservation reserve because of the conservation value of the Mulga woodlands; • some Mulga woodlands on the Coondewanna West route have been recommended for addition to the list of Threatened Ecological Communities in WA; • part of the Coondewanna West route comprises a recommended Scientific Reference Area for monitoring long term temporal changes in ecological patterns, and has been proposed for inclusion to Karijini National Park; and • the basis of CALM's alternative proposed route was to keep the new railway within the same corridor as the mine access road and Great Northern Highway.	Having particular regard to: (a) the high conservation value of the Coondewanna Flats flora, particularly for its diverse and extensive Mulga associations which are generally in excellent condition; (b) the level of fauna species richness in the Mulga woodlands and cracking clays that characterise the Coondewanna Flats area. For example, the ERMP reports that the Grey Honeyeater, which is classified as "rare or likely to become extinct... and in need of special protection", has been found nesting in the area; (c) the conservation importance of the Coondewanna Flats is enhanced by the likely loss of similar flora communities and fauna habitat associated with the development of the minesite; (d) the difficulty of predicting and avoiding adverse impacts on Mulga resulting from surface hydrology changes following the construction of a railway embankment through the low gradient Coondewanna Flats. The proposed route has the potential to significantly impact vegetation conservation values; (e) the Mt Robinson route proposed by CALM more closely follows existing transport corridors, notably Great Northern Highway. In such low gradient areas, surface hydrology changes following the construction of a railway embankment alongside existing roads will be much less severe than that following construction of a railway embankment across unmodified terrain; (f) CALM's advice that its Mt Robinson route from the minesite to Great Northern Highway offers up-slope terrain that would allow for a railway embankment design having a lesser impact on surface hydrology (C Muller *pers com* 21 September 1998); and (g) the additional distance of the CALM-preferred route compared to the proponent's preferred route is small (about 8 kilometres) and should not be an onerous imposition on the feasibility of the proposal, it is the EPA's opinion that the proposed Coondewanna West rail route is unable to be managed to meet the EPA vegetation communities and surface water flow objectives. However, a railway constructed along the CALM Mt Robinson route can be managed to meet the EPA's environmental objectives provided that: • the route is finalised in accordance with CALM advice in relation to the protection of significant flora communities and minimising changes to surface hydrology; and • the proponent's commitments described in section 3.2.3 are addressed in a Rail Route Environmental Management Plan and implemented.

Relevant Factor/ Component	EPA Environmental Objective	EPA Assessment	EPA Advice
Mt Leal/Hamersley Parallel routes			
National parks and conservation reserves – impact on park purpose and use	Ensure the purpose and usage of conservation reserves and national parks is not compromised	The proposed route enters the southern border of the Millstream-Chichester National Park within about 100 metres of the existing Hamersley Iron railway and is separated from the Hamersley railway by 100 metres to up to several kilometres. For a substantial proportion of its length, the route is one to five kilometres from the Hamersley line. The Millstream-Chichester National Park covers an area of 199,736 hectares. The park consists of three A-class Reserves (A38333, A30071 and A24392) and is managed by CALM. A draft management plan for the park is in preparation. The existing railway through the Millstream-Chichester National Park is on an 80 metre wide lease granted under an Agreement Act prior to the creation of the national park.	Having particular regard to: (a) the establishment of a national park and/or A-class conservation reserve implies a strong recognition of an area's very high conservation values and a presumption that these values are afforded the highest level of protection; (b) the construction of a railway line through national park or A-class conservation reserves may be seen to compromise these values and is inconsistent with the purpose of an A-class conservation reserve/national park. Such reservation is meant to protect these values and appropriate recreational usage in perpetuity , unless changed by both Houses of Parliament; (c) where there is an existing railway line through a national park, a very strong argument needs to be presented why the construction of any additional line is necessary; (d) in the case of the Marandoo mine and Central Pilbara railway assessment, the EPA was of the view that matters of policy relating to the change of purpose of a national park had been determined by the Parliament's excision from Karijini National Park of the tenement and rail corridor. No such decision has been made for an excision for the proposed rail route through the Millstream-Chichester National Park for this proposal. Until such decisions are made it can only be presumed that the existing purpose and functions of the Millstream-Chichester National Park should be maintained; (e) if a new railway line through a national park is to be approved, it should be located and managed such that the conservation values along the route are not likely to be significantly impacted and the purpose of reservation and usage of the park are not compromised. The ERMP presents little argument or discussion on these matters except to comment on the significance of vegetation. The EPA has been unable to determine an acceptable basis on which the proposed railway line through the Millstream-Chichester National Park can be seen as being consistent with EPA environmental objectives, which are inherent in the national park and reserve designations, it is the EPA's opinion that the construction of a new rail line through the Millstream-Chichester National Park is unable to be managed to meet the EPA's environmental objectives for national parks and A-class conservation reserves. However, the EPA is of the opinion that expanded usage of the existing rail line through the park may be managed to meet EPA environmental objectives. The EPA encourages the proponent to pursue this option. Should the Government decide to approve a new railway line within the Millstream-Chichester National Park, it should be within one kilometre of the existing line to lessen the adverse impacts on the purpose and use of the park. Where the terrain renders this impractical eg. the gorge of the Harding River), the proposed route should be selected in consultation with CALM and demonstrate that significant environmental impacts do not occur.

Relevant Factor/ Component	EPA Environmental Objective	EPA Assessment	EPA Advice
Marandoo Corridor route			
National parks and conservation reserves – impact on park purpose and use	Ensure the purpose and usage of conservation reserves and national parks is not compromised	The proposed railway line route for this section enters the Marandoo Corridor, an excised transport corridor which traverses Karijini National Park, between Marandoo and Homestead Junction. The Marandoo iron ore mine, operated by Hamersley Iron, is located near the centre of the Karijini National Park. A one kilometre wide infrastructure corridor linking the mine to the eastern and western boundaries of the park was excised by Parliament in 1991. The Hamersley railway line meanders within this corridor. Throughout the 52 kilometre Karijini National Park corridor section, the proposed route is generally within 100 to 200 metres of the Hamersley Iron railway except where it diverts around miscellaneous Hamersley Iron leases where separations of up to 600 metres occur. The Karijini National Park is an A-class reserve (A30082) covering an area of 606,597 hectares and is managed by CALM. In its submission on the ERMP, the Department of Resources Development advised that the proponent's proposed railway line through the Marandoo Corridor did not have to be diverted around the Hamersley Iron leases.	Having particular regard to: (a) the establishment of a national park and A-class conservation reserve implies a strong recognition of an area's very high conservation values and a presumption that these values are afforded the highest level of protection. The purpose of the Marandoo Corridor portion the Karijini National Park was changed by the Parliament's excision of that portion to provide a transport corridor; and (b) the EPA recognises that the construction of a new railway line within the corridor is consistent with the purpose of the corridor, it is the EPA's opinion that the proposed railway line through the Marandoo Corridor is able to be managed to meet the EPA's environmental objectives provided that: (i) the proposed railway line lies completely within the Marandoo Corridor (this may require the proponent to cross the Hamersley Iron railway at a number of places); (ii) the route is finalised in accordance with CALM advice in relation to preventing or minimising impacts to surface hydrology, flora and fauna in the Karijini National Park; (iii) the proponent's commitments and assurances described in section 3.2.3 are addressed in a Rail Route Environmental Management Plan and implemented; and (iv) if adjustments to the corridor are contemplated, they should be designed in consultation with CALM such that the resultant corridor does not exceed one kilometre in width.

Relevant Factor/ Component	EPA Environmental Objective	EPA Assessment	EPA Advice
Four Corners Bore/Paraburdoo-Tom Price routes			
		There are no circumstances which require special consideration for these sections. The proponent's commitments are adequate to enable the EPA's environmental objectives to be met.	Having particular regard to: (a) for most of the proposed route between the Karijini, and Millstream-Chichester, National Parks, the railway broadly follows that of an existing railway thereby confining impacts close to already impacted areas; (b) the proponent's commitment to, as a minimum standard, duplicate the existing standard and type of drainage structure already present. This will minimise changes to existing surface hydrology which has already been modified from its natural state by the presence of an existing railway; and (c) these sections of the railway are not on the conservation estate or areas proposed for conservation; it is the EPA's opinion that the proposed railway line between the Karijini and Millstream-Chichester National Parks is able to be managed to meet the EPA's environmental objectives provided that the proponent's commitments and assurances described in section 3.2.3 are addressed in a Rail Route Environmental Management Plan and implemented.
Aboriginal culture and heritage	Demonstrate that the proposal complies with the requirements of *Aboriginal Heritage Act 1972* and ensure that changes to the biological and physical environment resulting from the project do not adversely affect cultural associations with the area	In its submission, the Department of Aboriginal Affairs expressed concerns regarding the adequacy of the ethnographic and archaeological surveys undertaken for the proposal. Further more detailed surveys were suggested together with consultation with Aboriginal communities. The proponent advised during the assessment that the company would liaise further with the Department of Aboriginal Affairs to resolve outstanding issues of concern (D Calvin *pers com* 6/7/98).	Having particular regard to the proponent's commitment to liaise with the Department of Aboriginal Affairs, it is the EPA's opinion that the proposal is capable of being managed to meet the EPA's objectives for Aboriginal culture and heritage provided that the proponent's commitments are implemented.

Relevant Factor/ Component	EPA Environmental Objective	EPA Assessment	EPA Advice
Port			
Marine flora and mangroves	Maintain the abundance, species diversity and geographic distribution of marine flora and mangroves	The new stockpile pad will require reclamation of 44.4 hectares of mudflats including the loss of 10 to 12 small mangrove trees. The areas subject to the greatest impacts from the construction of a new stockpile pad are silty sand habitat and shallow rocky reef habitat. The silty sand intertidal habitat is utilised by species that are mobile or tolerant of daily desiccation. The shallow rocky reef intertidal region comprises exposed rubble at low tide, never exposed and algal covered reef and never exposed and coral covered reef. Total coral cover is less than 10%. The wharf extension will be constructed on piles 250 metres seaward in an area that was disturbed from previous dredging. Channel dredging is required for one kilometre seawards from the new wharf head. The former dredge spoil grounds are proposed to be used for this proposal. The proponent has committed to: • constructing the stockpile extension area by building the external wall first using clean waste rock and then backfilling behind the wall to minimise turbidity generation and impacts on marine flora and fauna; and • preparing and implementing a Dredging Management Plan.	Having particular regard to: (a) direct impacts from dredging will be largely limited to areas which have previously been disturbed; and (b) the proponent's commitments, it is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objective for marine flora and mangroves provided that: (i) dredging takes place outside the coral spawning period (usually around the spring tides near Easter); (ii) the EMP includes a dust management plan that incorporates ambient dust monitoring; and (iii) the proponent's commitments are implemented.
Specially Protected (Threatened) marine fauna	Protect Specially Protected (Threatened) fauna, consistent with the provisions of the *Wildlife Conservation Act 1950*	The ERMP suggests that other mudflats to be used for the stockpile pad are common in the vicinity and hence may be satisfactory alternatives for fauna use to those lost as a result of this proposal. From a survey undertaken for the ERMP, no specially protected fauna were identified as being affected by the proposal.	Having particular regard to: (a) the wharf extension will be constructed on piles in an area that was disturbed from previous dredging; (b) the mudflat areas likely to be lost are widespread in the region; and (c) the areas to be dredged have already been impacted by previous dredging and do not appear to provide a habitat for Specially Protected (Threatened) fauna species, it is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objective for Specially Protected (Threatened) marine fauna provided that the proponent's commitments are implemented.

Relevant Factor/ Component	EPA Environmental Objective	EPA Assessment	EPA Advice
Marine water and sediment quality		The proposal increases the potential for contamination of marine waters from ore handling and ships. Turbidity from dredging may lower oxygen, mobilise contaminants and nutrient in sediments and alter pH thereby impacting fauna. These impacts may potentially affect the operation of a pearl grow-out area for South Sea Pearls operated about one kilometre to the south of Robe River's port operations by Cossack Pearls Pty Ltd. The grow-out area is used continuously throughout the year. Cossack Pearls also operates a pearl hatchery on the shoreline to the southeast of the port where young pearl oysters are grown until they are large enough to be moved to the open water. The hatchery operates continuously between October and July. The DEP advised that the preferred policy framework for managing marine water quality is described in the "Draft Environmental Protection (State Marine Waters) Policy 1998" (EPA 1998). This sets out default environmental values to be protected for coastal waters. The draft Policy contains provisions for exemptions or changes to the default environmental values considering: • existing and possible future uses; • a background assessment of the receiving water quality; • a discharge improvement program designed to minimise the discharge of waste within a specified period of time; and • a monitoring and reporting program.	Having particular regard to: (a) the proponent's existing management measures dealing with land and ship based contaminants entering the marine environment; and (b) the commitment to prepare a Dredging Management Plan, it is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objective for marine water and sediment quality, provided that: (i) an over-riding Marine Management Plan within the framework of the draft Policy is developed, based on advice from the DEP. The Plan should address: • defining the proposed extent (if any) to which environmental values apply to the coastal waters around the proponent's facilities at Cape Lambert, taking into account:- - results of sediment sampling; and - if applicable, any agreements reached with Cossack Pearls; • an ongoing marine monitoring program commencing with baseline studies, which includes control locations, mangroves, adjacent pearl leases and the power station outfall; • water runoff and discharge monitoring from land based facilities; and • indicates any measures required to avoid adverse impacts on nearby commercial pearl hatchery and juvenile pearl oyster growing operations; (ii) the Dredging Management Plan is developed in consultation with the owner of the adjacent pearl hatchery; (iii) a Turbidity Control Management Plan is prepared which addresses the construction of the reclamation area for the stockpile pad in a manner which minimises the generation of turbidity in surrounding waters; and (iv) the proponent's commitments are implemented.

Cracking clays are a particularly important habitat. They represent only a small part of the region and often support diverse Mulga communities and fauna habitat.

The vegetation survey identified:

- a total of 625 native flora taxa from 69 families; and
- 62 vegetation associations,

in the West Angelas Survey area (Trudgen and Casson, 1998).

The ERMP's assessment of conservation values of vegetation was based on:

- regional significance of the West Angelas area within the Hamersley Plateau subdistrict; and
- significance of individual vegetation associations on the basis of occurrence and extent of representation in the conservation estate and floristic richness.

Regional conservation significance

Taking into account the size of the West Angelas area and the above factors, the conservation value for vegetation associations and species richness at the regional level is rated in the ERMP as high.

Vegetation associations with particular conservation value

The vegetation survey report (Trudgen and Casson 1998) stated that none of the vegetation associations described for the orebody A and B study areas "were so unusual that they are of high conservation significance". The main conservation value of the vegetation of these orebody areas was their contribution to the high conservation value of the surrounding area.

The Trudgen and Casson (1998) report noted that mining of the orebodies had the potential to affect vegetation associations near the orebodies having moderate conservation value.

Assessment

The area considered for assessment is considered to be the mines, dumps and associated infrastructure within the Hamersley Plateau subdivision of the Fortescue Botanical District.

The EPA's environmental objective for this factor is to "maintain the abundance, species diversity, geographic distribution and productivity of vegetation communities".

In its submission, Department of Conservation and Land Management (CALM) advised that the West Angelas mine area is within a proposed multiple use "Mulgalands" conservation reserve proposed to adjoin the Karijini National Park (see Fig 4). The location of the access road survey area and proposed road location required clarification to ensure that the proposed road route was adequately represented by the area surveyed.

CALM has also advised that, with very careful management, development of the minesite can be accommodated as a multiple use area within the proposed wider conservation reserve (C Muller *pers com* 16/6/98). A mechanism to implement this is for the proponent to develop a "Minesite Environmental Management Plan" based on advice from CALM prior to implementing the proposal.

The proponent made a commitment in the ERMP to prepare an Environmental Management Program (EMP) which will address, but not be limited to:

- rehabilitation and revegetation of disturbed areas;
- drainage design along the railway at water course crossings and through sheet flow areas (ie Mulga);
- weed management;
- dust management; and
- implementation of DME guidelines for Mining in Arid Environments.

Having particular regard to:

(a) the minesite area having conservation significance for vegetation associations;

(b) CALM's advice that, with appropriate management and liaison with CALM, mining can be accommodated within the proposed conservation reserve; and

(c) the proponent's commitment to address management of environmental impacts through an EMP,

it is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objective for vegetation communities provided that a Minesite Environmental Management Plan is prepared based on advice from CALM. The objective of the plan should be to preserve as many conservation values in the minesite area as possible. The plan should address proponent commitments as well as:

(i) the location and design of mine infrastructure, stockpiles, waste dumps and other facilities so as to not significantly impact vegetation associations having conservation value nor cracking clay areas;

(ii) the maintenance and restoration of original drainage patterns;

(iii) restricting the number and size of corridors used for infrastructure and services;

(iv) the design and form of stockpiles for maximum harmony with the landscape;

(v) the discharge from mine dewatering to natural drainage areas;

(vi) eradication of currently identified Ruby Dock infestations and implementation of appropriate weed management procedures;

(vii) minimising clearing; and

(viii) implementation of a progressive rehabilitation and revegetation plan.

3.1.2 Declared Rare and Priority flora and other species of conservation interest – impacts from direct disturbance

Description

Development of the minesite will result in the direct loss of vegetation and potentially, impacts to Declared Rare and Priority flora.

CALM maintains a list of flora species that are either Declared Rare Flora (DRF) or Priority Flora based on one of four categories. The ERMP states that the Declared Rare and Priority flora list that applies to the Pilbara is in a very preliminary state.

The West Angelas survey area has a diverse flora range for its size.

Trudgen and Casson (1998) stated that a total of 64 species of conservation interest are known from the West Angelas survey area. These consist of:

- one DRF species (*Lepidium catapycnon*);
- 16 priority species;
- eight previously unknown species;
- three species known from elsewhere but new to the records for the Fortescue Botanical District;
- 13 species recognised as distinct but collected previously;
- seven poorly collected or uncommon *Cassia* taxa which are mostly hybrids; and
- 16 other poorly collected or uncommon species.

No DRF or priority flora have been identified in the pipeline corridor or mine area access road.

Two sites of conservation significance near the western end of Deposit A and adjacent to the road between the camp and the base of West Angelas Hill may be potentially impacted by the proposal.

The report of the vegetation survey (Trudgen and Casson 1998) stated that "the West Angelas survey area has moderate or higher value for species of conservation interest". Stands of mulga occur in the area and these are discussed under Section 3.1.4 which deals with surface water and sheet flows.

The vegetation survey placed special emphasis on the vegetation on orebodies A and B since it is clear that vegetation there would be destroyed by mining.

Trudgen and Casson (1998) stated:

- the general conservation value of flora on orebodies A and B would be rated as moderate taking into account that "areas with such a flora are moderately widespread in the central part of the Hamersley Ranges"; and
- a possible new species, *Cynanchum aff. floribundum* (priority three) was collected from a site adjacent to orebody B.

Assessment

The area considered for assessment is considered to be the mines, waste rock dumps and associated infrastructure within the Hamersley Plateau subdivision of the Fortescue Botanical District.

The EPA's environmental objective for this factor is to "protect Declared Rare and Priority flora, consistent with the provisions of the *Wildlife Conservation Act 1950*".

The EPA notes that measures to protect Declared Rare Flora are a requirement under the Wildlife Conservation Act.

Having particular regard to the fact that implementation of recommended procedures for a Minesite Environmental Management Plan can be used to address the protection of sites where Declared Rare and other flora species having conservation value exist, it is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objective for Declared Rare and Priority flora provided that the Minesite Environmental Management Plan referred to in section 3.1.1:

(i) complies with relevant legislation;

(ii) identifies the location of Declared Rare and Priority flora species that will be disturbed by mine development;

(iii) assesses the conservation status of each species; and

(iv) for those species that are inadequately represented in the conservation estate, describes measures, based on advice from CALM, to ensure that the conservation status of each species is not reduced as a result of the implementation of the proposal.

3.1.3 Specially Protected (Threatened) Fauna

Description

Development of the minesite may result in the direct or indirect loss of Specially Protected (Threatened) fauna.

Specially protected fauna in the area were thought to be:

- Grey Honeyeater *Conopophila whitei* (Schedule 1, Wildlife Conservation Act) recorded in Mulga habitat in the mine area and Coondewanna Flats; and
- Ghost Bat *Macroderma gigas* (Vulnerable, Endangered Species Act) found in caves north of Deposit B and caves previously reported near Deposit E.

A check of the listings at the time of writing this report has shown that the Grey Honeyeater has recently (July 1998) been listed as Priority 4 under the Wildlife Conservation Act. This category contains species deemed to be of conservation significance and which require to be monitored but are not considered to be threatened. The ERMP notes that some impacts on the Grey Honeyeater will be unavoidable as a result of destruction and the degradation of habitat at Deposits A and B.

Ghost Bats are listed under Priority 3 of the (Commonwealth) Endangered Species Act but not under corresponding State legislation. This category lists species with several poorly known populations, some of which are on conservation lands. Impacts to the Ghost Bat take the form of destruction or disturbance of roosting or maternity caves or entrapment on barbed wire fences. During the biological survey conducted in 1997, four Ghost Bats were recorded from a cave near Deposit B and eight were observed roosting in a cave on the northern flank of the West Angelas Hill. A survey of 60 caves undertaken after the release of the ERMP found evidence of ghost bat presence in six caves near Deposits B and F, and in the adit on Deposit B (Ecologia, 1998b). One female Ghost Bat was captured in a large cave on the boundary of Deposit F.

The proponent considers that a 100 metres barrier between mining operations and caves will be adequate to preserve caves.

Assessment

The area considered for assessment is considered to be the mines, dumps and associated infrastructure within the Hamersley Plateau subdivision of the Fortescue Botanical District.

The EPA's environmental objective for this factor is to "protect Specially Protected (Threatened) fauna, consistent with the provisions of the *Wildlife Conservation Act 1950*".

Impacts to the Grey Honeyeater from developing the minesite are not considered to be significant if, at the regional level, adequate Mulga habitat is preserved.

The proposal may affect the ability of Ghost Bats to use caves suitable for maternity purposes. This may be from direct destruction of the caves or from disturbance arising from arising from noise, vibration or other forms of disturbance associated with mining operations. The effect on local populations of Ghost Bats may be significant if there are only a few alternative caves available at the regional level.

The EPA notes that measures to protect Specially Protected (Threatened) fauna are a requirement under the Wildlife Conservation Act.

The proponent has made commitments to:

- minimise impact to Mulga habitat which is habitat for the Grey Honeyeater;
- maintain a minimum barrier of 100 metres between operations and the caves inhabited by Ghost Bats; and
- not use barbed wire unless there is a statutory requirement to do so.

Having particular regard to:

(a) that impacts on Grey Honeyeater populations in the minesite area can be reduced by minimising impacts on Mulga habitats in the vicinity of ore deposits and the connecting railway. (Minimising impacts on Mulga habitats is a component of the Minesite Environmental Management Plan referred to in section 3.1.1); and

(b) the likelihood of significant disturbance to the local presence of Ghost Bats from developing the minesite,

it is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objective for Specially Protected (Threatened) fauna provided that:

(i) a Ghost Bat Management Plan is developed in consultation with CALM which addresses:

- areas likely to be utilised by Ghost Bats in the design of minesite infrastructure such as waste dumps, haul roads and rail lines; and
- verification procedures for ensuring that the local ghost bat population remains viable; and

(ii) the proponent's commitments are implemented.

3.1.4 Surface water - sheet flows

Description

Development of the minesite will disturb vegetation and cause changes to surface drainage patterns.

Mulga (*Acacia aneura*) has roots which are adapted to taking water from thin surface soils and does not have taproots to access groundwater at depth. Consequently, the distribution of mulga is primarily influenced by soil moisture and the pattern of surface drainage. Mulga can be significantly impacted by impediments to or diversion of surface drainage, both direct and indirect.

The loss of mulga may result in:

- loss of associated flora species;
- loss of fauna habitat;
- increased soil erosion; and
- increased downstream flood levels from reduction in levels of mature, retained mulga stands.

Assessment

The area considered for assessment is considered to be the mines, dumps and associated infrastructure within the Hamersley Plateau subdivision of the Fortescue Botanical District.

The EPA's environmental objective for this factor is to "maintain the integrity, functions and environmental values of drainage systems".

The proponent has made a commitment to prepare Drainage Diversion Management Plans to include measures to minimise erosion, sediment transport and turbidity at each new deposit, based on advice from the Water and Rivers Commission and CALM.

Having particular regard to:

(a) the development of a Minesite Environmental Management Plan referred to in section 3.1.1; and

(b) the proponent's commitment to prepare Drainage Diversion Management Plans,

it is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objective for surface water - sheet flows, provided that:

(i) the proponent's commitment is implemented; and

(ii) the Drainage Diversion Management Plans are consistent with the objective of the Minesite Environmental Management Plan and therefore also address maintaining, as far as possible, surface water flow regimes to preserve mulga communities.

3.1.5 Subterranean fauna – impact of groundwater extraction and mine dewatering on aquifer habitat of stygofauna.

Description

The extraction of groundwater from the borefield and for pit dewatering may impact on subterranean fauna.

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

The factor was not specifically identified in the EPA guidelines as a preliminary factor and was not addressed in the ERMP. A subsequent recently completed survey of water bores by Robe has indicated the presence of stygofauna in shear zones in Jeerinah Formation dolerite rocks near the minesite but not at the borefield. However the absence of fauna in boreholes at Turee Creek B borefield is not conclusively proven because sampling of the bores was undertaken after casing and packing had been carried out. This filters out the larger forms of stygofauna and prevents them from entering the bores. A station bore 8km west of the borefield (Pastoral Bore) was sampled and found to contain stygofauna.

Assessment

The areas considered for assessment are the areas within the influence of groundwater extraction at the borefield and the minesite.

The EPA's environmental objective for this factor is to "maintain the abundance, species diversity and geographic distribution of subterranean fauna".

In its submission, the WA Museum has advised that the Pilbara contains significant subterranean fauna in calcrete and alluvial aquifers. These fauna are known to exist to the north, west and east of the mine site in both the Ashburton and Fortescue catchments.

In response to submissions, the proponent has stated that in the absence of calcrete substrates, extensive stygofauna communities are not predicted to occur in the borefield area.

The EPA notes that measures to protect Specially Protected (Threatened) fauna are a requirement under the Wildlife Conservation Act.

The proponent advised during the assessment that sampling of stygofauna in liaison with the WA Museum is under way (D Calvin *pers com* 23/9/98). This recent survey sampling work has indicated that stygofauna were collected from bores in shear zones in massive dolerite rocks. Accordingly the proponent has proposed commitments to ensure that impacts on stygofauna present in the West Angelas project area will be reduced and these are outlined in Schedule 2 of Appendix 1.

Having particular regard to:

(a) the limited information regarding the abundance of stygofauna in the area;

(b) advice from the WA Museum that stygofauna may be present in the area;

(c) recent surveys showing the presence of stygofauna close to the minesite;

(d) the commitment to sampling groundwater for the presence of stygofauna to enable the significance of any stygofauna found to be assessed and therefore managed;

(e) the proponent's other commitments,

it is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objective for subterranean fauna, provided that the proponent, based on advice from the WA Museum:

(i) samples groundwater at the borefield and below the deposits for the presence of stygofauna;

(ii) if stygofauna are identified-

- assesses the conservation significance of species found by reference to the Protected Fauna list and to other known collections;
- maps the local distribution of species sampled, particularly Protected Fauna, as well as any "new" species; and
- if the species distribution is assessed as a significant conservation issue, undertakes further sampling in the region to further identify stygofauna distribution;

(iii) reports the results in an EMP; and

(iv) prepares and implements a conservation management plan to ensure species survival if stygofauna species of conservation significance are found only in areas to be affected by the proposal.

3.1.6 Groundwater quantity

Description

The proposal will use groundwater, which may have impacts on other groundwater users and vegetation.

The water requirement for the proposal is 4 to 6 megalitres per day (ML/d). If a desliming plant is required (not included in this proposal), the water requirement will increase to 16 ML/d.

Most of the required water is proposed to be sourced from the Turee Creek (B) area where groundwater depth is 40-50 metres below surface (Figure 7). Aquifer capacity is reported in the ERMP to be 8 to 9 ML/d. Local drawdown may be up to 50 metres. After 30 years, drawdown may extend out to three to five kilometres, which may encroach into Karijini National Park.

The groundwater is potable with concentrations of total dissolved solids ranging from 210 to 700 milligrams per litre (AGC Woodward-Clyde 1997).

Groundwater will also be extracted by pit dewatering. Upon completion of mined areas, overburden wastes will be used to fill parts of the mine pit to a level which is above the natural water table. Further groundwater may be lost from the pits in the long term due to capillary action and evaporation if the cover allows this process.

Assessment

The areas considered for assessment are the areas within the influence of groundwater extraction and pit dewatering.

The EPA's environmental objective for this factor is to "maintain the quantity of groundwater so that existing and potential uses are not affected".

The Water and Rivers Commission has queried the depth at which groundwater is proposed to be extracted and the effect this may have on downstream surface pools along Turee Creek and other existing and potential users of the aquifer (Alan Wright *pers com* 9/6/98).

The EPA notes that extraction of groundwater will be subject to the controls of the *Rights in Water and Irrigation Act 1914*.

The proponent has made commitments to:

- prepare a Groundwater Extraction Management Plan which includes monitoring to detect groundwater impacts in the vicinity of Karijini National Park; and
- infilling mined-out pits to above the water table (the depth of cover is not quantified).

Having particular regard to the proponent's commitment to prepare a Groundwater Extraction Management Plan based on advice from the Water and Rivers Commission, it is the EPA's

opinion that the proposal can be managed to meet the EPA's environmental objective for groundwater quantity provided:

(i) the following issues are also addressed and managed in the Groundwater Extraction Management Plan:

- the depth from which groundwater is proposed to be extracted;
- further groundwater investigations are undertaken to the west of the proposed borefield area to enable more accurate modelling of regional impacts (particularly Paperbark Spring and any other adjacent springs) and assessment of the sustainable yield;
- identifies emergency water sources closer to the minesite in the event that the borefield is inaccessible for certain times of the year;
- the monitoring and management of any impacts of groundwater extraction on the levels of downstream surface pools along Turee Creek;
- the impact of proposed groundwater extraction on other current users of the Turee Creek aquifers;
- proposed actions in the event that adverse impacts to surface water levels, vegetation or other users of the aquifers are detected; and
- the minimisation of water usage; and

(ii) the Minesite Environmental Management Plan referred to in section 3.1.1 takes into account the level of pit infilling required to prevent evaporation of groundwater brought to the surface by capillary rise in the soil cover and to enable vegetation to re-establish.

3.1.7 Aboriginal culture and heritage

Description

Development of the minesite has the potential to disturb any Aboriginal ethnographic or archaeological sites which occur there.

The ERMP reported that there were no areas of Aboriginal ethnographic or archaeological significance in the path of the minesite.

Assessment

The area considered for assessment is considered to be the mines, dumps and associated infrastructure within the Hamersley Plateau subdivision of the Fortescue Botanical District.

The EPA objectives for this factor are to:

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

In its submission, the Department of Aboriginal Affairs expressed concerns regarding the adequacy of the ethnographic and archaeological surveys undertaken for the proposal. Additional, more detailed surveys were suggested, together with consultation with Aboriginal communities.

The proponent advised during the assessment that the company would liaise further with the Department of Aboriginal Affairs to resolve outstanding issues of concern (D Calvin *pers com* 6/7/98).

The EPA notes the proponent's requirement to comply with the *Aboriginal Heritage Act 1972* and considers that there needs to be adequate consultation between potentially affected local aboriginal community representatives, the proponent and the WA Museum's Department of

Aboriginal Sites prior to ground disturbing activities being undertaken. The EPA has recommended a condition to this effect (see Condition 11).

Having particular regard to the proponent's commitment to liaise with the Department of Aboriginal Affairs and the recommended condition, it is the EPA's opinion that the proposal is capable of being managed to meet the EPA's objectives for Aboriginal culture and heritage provided that the proponent's commitments are implemented.

3.2 Railway

3.2.1 Railway sections

Rail transport is required to carry iron ore from the minesite to the proponent's port facilities at Cape Lambert. The ERMP has proposed the construction of a rail line from the minesite at West Angelas to the Robe Pannawonica-Cape Lambert railway and separately assessed the environmental impacts and alternative routes for the sections of this railway. It nominated preferred routes, starting from the south (Figure 3), as follows:

Section	Title of Preferred Route in ERMP
1. Coondewanna Flats	Coondewanna West
2. Karijini	Marandoo Corridor
3. Hamersley Station Flats	Four Corners Bore
4. Hamersley Station Flats to Lower Chichester Ra.	Paraburdoo-Tom Price alignment
5. Lower Chichester	Mt Leal
6. Upper Chichester	Hamersley Parallel (Western)

3.2.2 Assessment approach

The areas considered for assessment are specific for each section of the railway. The relevant biophysical environmental factors common to all sections of the railway are vegetation communities, Declared Rare and Priority flora, Specially Protected (Threatened) fauna and surface water.

The EPA's environmental objectives for these factors in turn are:

- "to maintain the abundance, species diversity, geographic distribution and productivity of vegetation communities";
- "to protect Declared Rare and Priority flora, consistent with the provisions of the Wildlife Conservation Act";
- "to protect Specially Protected (Threatened) fauna, consistent with the provisions of the Wildlife Conservation Act"; and
- "to maintain the integrity, functions and environmental values of drainage systems".

The assessment of proposed railways in the Pilbara against the EPA's environmental objectives needs to recognise that a new railway has the potential to:

- impact vegetation communities through:-
  - direct disturbance,
  - alterations to surface water flows, and/or
  - the spread of weeds;

- impact specially protected fauna through:-
  - direct fatalities ("track kills"),
  - vegetation loss resulting in loss of fauna habitats,
  - disrupting fauna movement, and/or
  - creating corridors for predators;
- impact vegetation communities and fauna through the alteration of fire regimes (which includes positive influences by providing fire breaks); and
- impact vegetation communities and fauna through associated disturbance for access roads, gravel/borrow pits and worker accommodation sites.

Due to the high degree of interrelationship between these impacts, the assessment of each section of the railway simultaneously addresses the above relevant environmental factors.

Aboriginal heritage is a factor which is also relevant to all sections and is addressed separately following the assessment of the biophysical environmental factors for each section of the proposed rail alignment.

The proposed railway passes through a national park. Where this is the case the EPA has considered options as a hierarchy, in decreasing order of preference: (a) using the existing line within the park; (b) outside the park; (c) close to the existing line within the park (inside a 1km rail corridor); and lastly (d) a new alignment through the park which does not closely follow the existing railway.

3.2.3 Proponent commitments for biophysical impacts for the rail route

Commitments made by the proponent in the ERMP in regard to the proposed railway include:

- using the results of vegetation and flora surveys to assist in minimising impacts to vegetation of moderate to high conservation significance in the final route design;
- where the railway parallels existing railways, as a minimum standard, duplicate the existing standard and type of drainage structure already present and elsewhere, determine the size and type of drainage structure based on catchment size with 1 in 20 average recurrence interval for storm events or 1 in 50 average recurrence interval at bridges and major culverts;
- maintain stream embankment gradients, stream bed material and riparian vegetation to ensure minimal scouring or change in stream direction;
- use drainage management techniques in low gradient areas to minimise impacts to mulga from changes to surface hydrology, including installing multiple culverts and spreader banks designed to redistribute outflows in "fill" sections of the track;
- rehabilitation of construction camp areas by removing all plant, buildings and other structures, ripping the compacted areas and revegetating;
- continuance of existing fire prevention procedures which include appropriate provision of extinguishers on locomotives and grinding machines, fire watch when grinding and avoidance of grinding on days of extreme fire danger; and
- implementation of a weed management plan.

In discussions with the DEP during the assessment, the proponent has provided the following additional commitments (D Calvin *pers com* 6 July 1998):

- making use of existing roads and tracks to access the railway wherever possible; and
- ongoing maintenance of spreader banks on the downstream side of culverts in "fill" sections of the track, to ensure the ongoing even distribution of sheet water flows.

In addition to these the EPA considers that a programme for monitoring the effects of changes to drainage caused by the railway on Mulga health and distribution is needed over the long operational timeframe of the proposal.

3.2.4 Coondewanna Flats Section

Description

The proposed rail route across this section is referred to as the "Coondewanna West" route in the ERMP (see Figure 4). The route passes to the north of West Angelas Hill, looping slightly west around Coondewanna Flats then heads north west towards Packsaddle. The route then heads west north west to meet the rail formation constructed by Hamersley Iron between Marandoo and Homestead Junction.

The Coondewanna West route is approximately 37 kilometres long and passes through a series of valley plains and dissected stony hills. The valley plains have Beard's (1975) mulga formation (*Acacia aneura* low woodland) while the hills have his *Eucalyptus brevifolia-Triodia wiseana* association. The railway is largely within the mulga formation of the valley plains, at one point running close to the eastern end of a large claypan. Realignments to this route have been proposed by Robe and discussed with CALM officers.

The ERMP states that this route contains very large variations of Mulga stands and areas of grasslands, some with scattered Mulga. Collectively, these have very high conservation value for vegetation, particularly as the vegetation is generally in excellent condition.

An alternative route from the minesite to the Hamersley Iron railway, which largely followed the Great Northern Highway and circumvented the Coondewanna Flats area has been suggested by CALM. This is referred to as the "CALM Mt Robinson route" (Figure 4). The ERMP evaluated a shorter derivative of CALM's proposed route, referred to as the "Mt Robinson route". The Coondewanna West route was selected by the proponent because of its shorter length, resulting in lower operating and capital costs.

Iron Ore deposits in BHP's Mining Area C lease, which lie to the west of the Coondewanna Flats, may be mined in coming decades. These deposits, known as Alligators, Parallel Ridge and Boundary Ridge (see Figure 3), could be accessed from the western side of Coondewanna Flats. Robe has recently received a letter from BHP Iron Ore which supports the shared use of its proposed Coondewanna West rail route and which refers to a draft Heads of Agreement between the two companies to provide for sharing of the railway at some time in the future if these deposits are mined and if the railway is on this alignment.

Assessment

The area considered for assessment of the Coondewanna West route is the Hamersley Plateau physiographic unit of Beard (1975).

The biophysical environmental factors that are relevant and corresponding EPA environmental objectives that relate to this section are described in Section 3.2.2 above.

During the assessment, the proponent submitted two variations to the Coondewanna West route. The first contained different options for the five kilometre portion of the alignment running east to west, starting at about eight kilometres along the route from the minesite. The second variation was to relocate the portion of the alignment running southwest to northeast further to the west. Neither variation was considered to be sufficiently different to materially affect the assessment of the Coondewanna West route as described in the ERMP.

In its submission, CALM advised that:

- both the Coondewanna West route and the Mt Robinson alternative have high to very high conservation value in terms of vegetation associations. The Coondewanna West route has a greater diversity of unique associations whereas the Mt Robinson route has several regionally uncommon associations;

- the ERMP's route evaluations did not address the advantages of a new railway adjacent to an existing railway or road in a floodwash area. In this case only negligible additional impacts to existing drainage patterns would be anticipated;
- some Mulga woodlands on the Coondewanna West route have been recommended for addition to the list of Threatened Ecological Communities in WA (V English *pers com* in CALM submission);
- part of the Coondewanna West route comprises a recommended Scientific Reference Area for monitoring long term temporal changes in ecological patterns (Dunlop and Porter 1985), and has been proposed for inclusion in Karijini National Park; and
- the basis of CALM's alternative proposed route was to keep the new railway within the same corridor as the mine access road and Great Northern Highway.

CALM officers subsequently inspected Robe's modified Coondewanna West route with company personnel. Despite the potential to reduce environmental impacts should the proposed realignments prove to be feasible, CALM's preferred route remains the CALM Mt Robinson route. CALM wrote in a letter dated 9th December 1998 to the EPA: "For the Coondewanna West route to be accepted, it should be clearly demonstrated that the environmental costs are clearly outweighed by other factors. To date no detailed assessment of the CALM route has been undertaken (by Robe). It is our view that this is necessary to permit a proper comparison and assessment of the costs and benefits of these two options."

Having particular regard to:

(a) the high conservation value of the Coondewanna Flats flora, particularly for its diverse and extensive Mulga associations which are generally in excellent condition;

(b) the level of fauna species richness in the Mulga woodlands and cracking clays that characterise the Coondewanna Flats area (for example, the ERMP reports that the Grey Honeyeater, which is classified as "rare or likely to become extinct... and in need of special protection", has been found nesting in the area);

(c) the conservation importance of the Coondewanna Flats is enhanced by the likely loss of similar flora communities and fauna habitat associated with the development of the minesite;

(d) the difficulty of predicting and avoiding adverse impacts on Mulga resulting from surface hydrology changes following the construction of a railway embankment through the low gradient Coondewanna Flats. The proposed route has the potential to significantly impact vegetation conservation values;

(e) the Mt Robinson route proposed by CALM more closely follows existing transport corridors, notably Great Northern Highway. In such low gradient areas, surface hydrology changes following the construction of a railway embankment alongside existing roads will be much less severe than that following construction of a railway embankment across unmodified terrain;

(f) CALM's advice that its Mt Robinson route from the minesite to Great Northern Highway offers up-slope terrain that would allow for a railway embankment design having a lesser impact on surface hydrology (C Muller *pers com* 21 September 1998);

(g) the additional distance of the CALM-preferred route compared to the proponent's preferred route is small (about 8 kilometres out of a total length of 340km) and should not be an onerous imposition on the feasibility of the proposal; and

(h) the fact that there has been no detailed comparison of the environmental benefits and impacts of the modified Coondewanna West route with the CALM Mt Robinson route available for the EPA to assess;

it is the EPA's opinion that the Coondewanna West rail route and its modified derivative do not meet the EPA environmental objectives for vegetation communities and surface water - sheet flows.

However, it is the EPA's view that a railway constructed along the CALM Mt Robinson route can be managed to meet the EPA's environmental objectives provided that:

- the route is finalised in accordance with CALM advice in relation to the protection of significant flora communities and minimising changes to surface hydrology; and
- the proponent's commitments and assurances described in section 3.2.3 are addressed in a Rail Route Environmental Management Plan and are implemented.

The EPA aim is to minimise adverse environmental effects to the Coondewanna Flats by seeking to optimise the rail route. It believes that CALM's Mt Robinson route best achieves this aim.

3.2.5 Millstream-Chichester National Park Sections

Description

The proposed rail route across Millstream-Chichester National Park is described in the ERMP as two sections:

Section	Title of Preferred Route in ERMP
Lower Chichester	Mt Leal
Upper Chichester	Hamersley Parallel (Western)

The ERMP proposed the Mt Leal route through the Lower Chichester section of the Millstream-Chichester National Park, however, during the assessment, the proponent advised that the preferred route through this section is now adjacent to the Existing Hamersley Iron route (see Figure 3). The assessment is therefore based on the revised preferred route (see Figure 5).

The length of the Existing Hamersley Iron route through the Millstream-Chichester National Park is approximately 46 kilometres. The ERMP shows the route crossing the southern border of the Millstream-Chichester National Park adjacent to the existing Hamersley Iron railway and remaining within one kilometre of the Hamersley railway until about six kilometres north of Camp Curlewis. From that point to the gorge of the Harding River, the route is one to five kilometres from the Hamersley line. The proposed route is then largely within one kilometre of the Hamersley line to the point where the proposed route parallels the Cape Lambert line and joins it near the northern boundary of the national park.

The Millstream-Chichester National Park covers an area of 199,736 hectares. The park consists of three A-class Reserves (A38333, A30071 and A24392) which are vested in the National Parks and Nature Conservation Authority and are managed by CALM. A draft management plan for the park is in preparation.

The existing railway through the Millstream-Chichester National Park is on an 80-metre wide lease granted under an Agreement Act prior to the creation of the national park.

Assessment

The area considered for assessment of the existing Hamersley Iron and Hamersley Parallel (Western) rail routes is the Millstream-Chichester National Park.

The additional environmental factor (refer to Section 3.2.2 for other factors) that is relevant to this section of the rail route is national parks and conservation reserves – impact on park purpose and use. The EPA's environmental objective for this factor is to "ensure the purpose and usage of conservation reserves and national parks is not compromised".

Having particular regard to:

(a) the establishment of a national park and/or A-class conservation reserve is the highest recognition given by Government of an area's very high conservation, scientific, heritage and recreation values and a presumption that these values should be afforded the highest level of protection. Such reservation is meant to protect these values and appropriate recreational usage in perpetuity, unless changed by both Houses of Parliament;

(b) the construction of a railway line through national park or A-class conservation reserves may be seen to compromise these values and is inconsistent with the purpose of an A-class conservation reserve/national park;

(c) where there is an existing railway line through a national park, a very strong argument needs to be presented as to why the construction of any additional line is necessary;

(d) in the case of the Marandoo mine and Central Pilbara railway assessment, the EPA is of the view that matters of policy relating to the change of purpose of a national park had been determined by the Parliament's excision from Karijini National Park of the tenement and rail corridor. No such decision has been made for an excision for the proposed rail route through the Millstream-Chichester National Park. Until such decision is made it can only be presumed that the existing purpose and functions of the Millstream-Chichester National Park should be maintained; and

(e) a new railway line through a national park would only be acceptable where it has been shown that the conservation values along the route are not significantly impacted and the purpose of reservation and usage of the park are not compromised. The ERMP presents little argument or discussion on these matters except to comment on the significance of vegetation. The EPA has been unable to determine an acceptable basis on which the proposed railway line through the Millstream-Chichester National Park can be seen as being consistent with EPA environmental objectives, which are inherent in the national park and nature reserve designations;

(f) the NP&NCA has written to the EPA to advise of its concerns with the proposal for a new railway through the park. This letter appears in Appendix 4;

it is the EPA's opinion that the construction of a new rail line through the Millstream-Chichester National Park is unable to be managed to meet the EPA's environmental objectives for national parks and A-class conservation reserves.

However, the EPA is of the opinion that expanded usage of the existing rail line through the park may be managed to meet EPA environmental objectives. The EPA encourages the proponent to pursue this option.

If the Government decides, after considering broader issues, to approve a new railway line within the Millstream-Chichester National Park, it should be within one kilometre of the existing line to lessen the engineering/adverse impacts on the purpose and use of the park. Where the terrain renders this impractical (eg. the gorge of the Harding River), the proposed route should be selected in consultation with CALM and demonstrate that significant environmental impacts do not occur.

The EPA's preference is for there to be no new rail line through the park (refer to the EPA's stated hierarchy in Section 3.2.2). However, if the Government decides that a new railway can be constructed within the park, the EPA is strongly of the view that such approval should be conditional on future access being provided to other users, if needed, to obviate the need for any additional railways through the park.

Comments pertaining to this factor are also made in Section 6.

3.2.6 Karijini Section

Description

The proposed railway line route for this section enters the Marandoo Corridor, an excised transport corridor which traverses Karijini National Park, between Marandoo and Homestead Junction. The Marandoo iron ore mine, operated by Hamersley Iron, is located near the centre of the Karijini National Park. A one kilometre wide infrastructure corridor linking the mine to the eastern and western boundaries of the park was excised by Parliament in 1991.

The Hamersley railway line meanders within this corridor.

The proposed line is parallel to the existing Hamersley Iron formation initially on the southern side, crossing the Hamersley Iron line by an overpass located approximately 20 kilometres northwest of the Juna Downs station (see Figure 8). The line then runs parallel to the existing Hamersley Iron Marandoo line to the Western boundary of the national park. The Cherry Creek system is crossed between the overpass and Marandoo.

Throughout the 52 kilometre Karijini National Park corridor section, the proposed route is generally within 100 to 200 metres of the Hamersley Iron railway except where it diverts around miscellaneous Hamersley Iron leases where separations of up to 600 metres occur.

The Karijini National Park is an A-class reserve (A30082) covering an area of 606,597 hectares vested in the NP&NCA and is managed by CALM.

Assessment

The area considered for assessment of the Marandoo Corridor route is the Corridor and the adjacent Karijini National Park.

The EPA's environmental objectives relevant to the railway proposed through the Marandoo Corridor section are those described in Section 3.2.2. An additional factor is relevant for Karijini National Park – impact on park purpose and use. The EPA's environmental objective for this factor is to "ensure the purpose and usage of conservation reserves and national parks is not compromised".

In its submission on the ERMP, the Department of Resources Development advised that the proponent's proposed railway line through the Marandoo Corridor did not have to be diverted around the Hamersley Iron leases.

Having particular regard to:

(a) as discussed in section 3.2.5, the establishment of a national park and A-class conservation reserve implies a strong recognition of an area's very high conservation values and a presumption that these values are afforded the highest level of protection. The purpose of the Marandoo Corridor portion the Karijini National Park was changed by the Parliament's excision of that portion to provide a transport corridor; and

(b) the EPA recognises that the construction of a new railway line within the corridor is consistent with the purpose of the corridor,

it is the EPA's opinion that the proposed railway line through the Marandoo Corridor is able to be managed to meet the EPA's environmental objectives provided that:

(i) the railway is wholly within the transport corridor;

(ii) the route is finalised in accordance with CALM advice and NP&NCA's concerns (refer to letter in Appendix 4) in relation to preventing or minimising impacts to surface hydrology, flora and fauna in the Karijini National Park; and

(iii) the proponent's commitments and assurances described in section 3.2.3 are addressed in a Rail Route Environmental Management Plan and implemented.

3.2.7 Hamersley Station Flats to the Lower Chichester ranges Sections

Description

The sections of the proposed railway between the Karijini, and Millstream-Chichester, National Parks are:

Section	Title of Preferred Route in ERMP
Hamersley Station Flats	Four Corners Bore
Hamersley Station Flats to the Lower Chichester ranges	Paraburdoo-Tom Price alignment

The Four Corners Bore route commences from west of Mount Stephenson (Figure 3) where the proposed railway line leaves the Marandoo spur line and strikes north. The route passes to the north of Four Corners Bore, before deviating northwest to meet up with the Hamersley Iron Paraburdoo-Dampier railway approximately seven kilometres east of Satellite Spring.

The Hamersley Station Flats to the Lower Chichester ranges route parallels the Paraburdoo-Dampier railway to the north for approximately 60 kilometres. Most of this section is parallel to the Hamersley Iron railway within 100 to 200 metres except for about 40 kilometres at the northern end (near Mount Leal) where the rail is located between 400 to 800 metres from the Hamersley Iron railway.

Assessment

The area considered for assessment of the proposed railway between the Karijini and Millstream-Chichester National Parks is the Fortescue Botanical District.

The EPA's environmental objectives for the railway across these sections are those described in Section 3.2.2.

Having particular regard to:

(a) the proposed rail route between the Karijini, and Millstream-Chichester National Parks broadly follows that of an existing railway thereby confining impacts close to already affected areas for most of its length;

(b) the proponent's commitment to, as a minimum standard, duplicate the existing standard and type of drainage structure already present. This will minimise changes to existing surface hydrology which has already been modified from its natural state by the presence of an existing railway; and

(c) these sections of the railway are not on the conservation estate or areas proposed for conservation;

it is the EPA's opinion that the proposed railway line between the Karijini and Millstream-Chichester National Parks is able to be managed to meet the EPA's environmental objectives provided that the proponent's commitments and assurances described in section 3.2.3 are addressed in a Rail Route Environmental Management Plan and implemented.

3.2.8 Aboriginal culture and heritage

Description

Construction of the railway has the potential to disturb any Aboriginal ethnographic or archaeological sites.

The ERMP reported that there were no areas of Aboriginal ethnographic or archaeological significance in the path of the railway.

Assessment

The EPA's objectives for this factor are to:

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

In its submission, the Department of Aboriginal Affairs expressed concerns regarding the adequacy of the ethnographic and archaeological surveys undertaken for the proposal. Further more detailed surveys were suggested together with consultation with Aboriginal communities.

The proponent advised during the assessment that the company would liaise further with the Department of Aboriginal Affairs to resolve outstanding issues of concern (D Calvin *pers com* 6/7/98).

The EPA notes the proponent's requirement to comply with the *Aboriginal Heritage Act 1972* and considers that there needs to be adequate consultation between potentially affected local aboriginal community representatives, the proponent and the WA Museum's Department of Aboriginal Sites prior to ground disturbing activities being undertaken. The EPA has recommended a condition to this effect, to the requirements of the Department of Environmental Protection on advice of the Department of Aboriginal Affairs.

Having particular regard to the proponent's commitment to liaise with the Department of Aboriginal Affairs and the EPA's recommended condition, it is the EPA's opinion that the proposal is capable of being managed to meet the EPA's objectives for Aboriginal culture and heritage provided that the proponent's commitments and assurances are implemented.

3.3 Port

3.3.1 Marine water and sediment quality

Description

The proposal increases the potential for contamination of marine waters from ore handling and ships. Extra shipping may increase accidental discharges, discharge of sewage waste, ballast waters, engine coolant waters, bilge waters, washdown waters and TBT contamination.

Turbidity from dredging may lower oxygen, mobilise contaminants and nutrient in sediments and alter pH, thereby affecting fauna.

These impacts may potentially affect the operation of a pearl grow-out area for South Sea Pearls operated about one kilometre to the south of Robe River's port operations by Cossack Pearls Pty Ltd (Figure 6). The grow-out area is used continuously throughout the year.

Cossack Pearls also operates a pearl hatchery on the shoreline to the southeast of the port where young pearl oysters are grown until they are large enough to be moved to the open water. The hatchery operates continuously between October and July (Enzer Marine Environmental Consulting 1998).

Assessment

The area considered for assessment is considered to be the marine environment in the vicinity of the Cape Lambert wharf.

The EPA's environmental objectives in regard to this environmental factor are to:

- "maintain or improve the quality of marine water consistent with the draft WA Guidelines for Fresh and Marine Waters (EPA, 1993)"; and
- "maintain or improve marine water and sediment quality consistent with Environmental Quality Objectives (EQOs) and Environmental Quality Criteria (EQCs) defined in the Southern Metropolitan Coastal Waters Study (1996)".

The DEP advised that the preferred policy framework for managing marine water quality is described in the "Draft Environmental Protection (State Marine Waters) Policy 1998" (EPA 1998). This sets out default environmental values to be protected for coastal waters. The draft Policy contains provisions for exemptions or changes to the default environmental values considering:

- existing and possible future uses;
- a background assessment of the receiving water quality;
- a discharge improvement program designed to minimise the discharge of waste within a specified period of time; and
- a monitoring and reporting program.

Dredging in the vicinity of the existing wharf may mobilise tributyltin (TBT) in the marine sediments.

The EPA notes that:

- dredging needs to be carried out in accordance with the (Commonwealth) *Environment Protection (Sea Dumping) Act 1981*, which is managed by Environment Australia; and
- port operations require a licence for the discharge of wastes (including effluents) into the environmental under the Environmental Protection Act.

Having particular regard to

(a) the proponent's existing management measures dealing with land and ship based contaminants entering the marine environment; and

(b) the commitment to prepare a Dredging Management Plan,

it is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objective for marine water and sediment quality, provided that:

(i) a Marine Management Plan within the framework of the draft State Marine Waters Policy is developed, based on advice from the DEP. The Plan should address:

- defining the proposed extent (if any) to which environmental values apply to the coastal waters around the proponent's facilities at Cape Lambert, taking into account:-
  - results of sediment sampling; and
  - if applicable, any agreements reached with Cossack Pearls;
- an ongoing marine monitoring program commencing with baseline studies, which includes control locations, mangroves, adjacent pearl leases and the power station outfall;
- water runoff and discharge monitoring from land based facilities; and
- indicates any measures required to avoid adverse impacts on nearby commercial pearl hatchery and juvenile pearl oyster growing operations;

(ii) the Dredging Management Plan is developed in consultation with the owner of the adjacent pearl hatchery;

(iii) the proponent's commitments are implemented.

3.3.2 Marine flora and mangroves

Description

The proposal includes reclaiming land for a new product stockpile pad, extension to the existing wharf facility and dredging at Cape Lambert, which may potentially impact marine flora and mangroves.

Stockpile pad

The new stockpile pad will require reclamation of 44.4 hectares of mudflats including the loss of 10 to 12 small mangrove trees.

The handling and stockpiling of the Marra Mamba ore that will be mined from West Angelas has the potential to lead to the generation of airborne dust. This may affect nearby mangroves and the marine environment.

The marine environment at Cape Lambert is essentially a calcarenite-based tidal mudflat. Figure 6 illustrates local marine habitats.

The areas subject to the greatest impacts from the construction of a new stockpile pad are silty sand habitat and shallow rocky reef habitat.

The silty sand intertidal habitat is utilised by species that are mobile or tolerant to daily desiccation.

The shallow rocky reef intertidal region comprises of exposed rubble at low tide, never exposed and algal covered reef, and never exposed and coral covered reef. Total coral cover is less than 10%.

Wharf extension

The wharf extension will be constructed on piles 250 metres seaward in an area that was disturbed by previous dredging. The ERMP states that impacts on the underlying sandy mud habitat from driving the piles to support the wharf are expected to be minimal.

Channel dredging

Channel dredging is required for one kilometre seawards from the new wharf head. This will cause loss of sandy mud habitat in water more than eight metres deep (spring low tide). From a survey undertaken for the ERMP, the area to be dredged is dominated by species adapted for turbid environments.

The former dredge spoil grounds, proposed to be used for this proposal, contain more shallow water species including sea-cucumbers, sea-anenomes and corals.

Dredging will increase turbidity and affect light penetration, potentially impacting algae and coral in the vicinity of the dredged areas and spoil grounds.

Assessment

The area considered for assessment is considered to be the marine environment in the vicinity of the Cape Lambert wharf.

The EPA's environmental objective for this factor is to "maintain the abundance, species diversity and geographic distribution of marine flora and mangroves".

The EPA notes that:

- dredging needs to be carried out in accordance with the (Commonwealth) *Environment Protection (Sea Dumping) Act 1981*, which is managed by Environment Australia; and
- port operations require a licence for the discharge of wastes (including dust) into the environment under Part V of the Environmental Protection Act.

The proponent has committed to:

- constructing the stockpile extension area by building the external wall first using clean waste rock and then backfilling behind the wall to minimise turbidity generation and impacts on marine flora and fauna;
- preparing and implementing a Dredging Management Plan.

Having particular regard to:

(a) direct impacts from dredging will be largely limited to areas which have previously been disturbed; and

(b) the proponent's commitments,

it is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objective for marine flora and mangroves provided that:

(i) dredging takes place outside the coral spawning period (usually around the spring tides near Easter);

(ii) the Marine Management Plan requires a dust management plan that incorporates ambient dust monitoring in the nearby mangroves; and

(iii) the proponent's commitments are implemented.

3.3.3 Specially Protected (Threatened) marine fauna

Description

Stockpile pad

The ERMP lists 47 bird species falling within CAMBA, JAMBA and CALM declared, special and priority lists, which are expected to be found or have been observed at Cape Lambert. Most of the species rely heavily on the mudflats and beach of the silty sand habitats and the rocks of the rocky shore habitat and hence may be directly affected by the construction of the stockpile pad.

Marine fauna present on the silty sand intertidal habitat includes sea-anenomes, sea-cucumbers, annelid tube worms, gastropod molluscs and bivalve molluscs. Fish species are composed almost exclusively of those that feed on the incoming tide. Other fauna recorded in this habitat included Green Turtles, Hawksbill Turtles and wading birds.

The assessment of possible impacts on these species was based on a marine survey undertaken in early September 1997, anecdotal information and the assumption that the long gentle slope of the beach and steep foredunes would make the area unsuitable for turtle breeding.

The ERMP suggests that other mudflats are common in the vicinity and hence may be satisfactory alternatives for fauna use to those lost as a result of this proposal.

Wharf extension and channel dredging

From a survey undertaken for the ERMP, the area to be dredged for the wharf extension is dominated by turbid environment specialists including gorgonians and sea-whips, hydroids, sponges, bryozoans, crinoids and ascidians.

Assessment

The area considered for assessment is considered to be the marine environment in the vicinity of the Cape Lambert.

The EPA's environmental objective for this factor is to "protect Specially Protected (Threatened) fauna, consistent with the provisions of the *Wildlife Conservation Act 1950*".

The EPA notes that dredging needs to be carried out in accordance with the (Commonwealth) *Environment Protection (Sea Dumping) Act 1981*, which is managed by Environment Australia.

The EPA notes that dredging needs to be carried out in accordance with the (Commonwealth) *Environment Protection (Sea Dumping) Act 1981*, which is managed by Environment Australia.

The proponent's commitments are described in section 3.3.2.

Having particular regard to:

(a) the wharf extension will be constructed on piles in an area that was disturbed from previous dredging;

(b) the mudflat areas likely to be lost are widespread in the region; and

(c) the areas to be dredged have already been affected by previous dredging and do not appear to provide a habitat for Specially Protected (Threatened) fauna species,

it is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objective for Specially Protected (Threatened) Marine fauna provided that the proponent's commitments are implemented.

4. Conditions and commitments

Section 44 of the Environmental Protection Act 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. They do however, 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 that they are enforceable, 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 those relating to the proponent's commitments.

4.1 Proponent's commitments

Robe River has made changes to its commitments to reflect discussions with the DEP which have been part of the assessment process. The proponent's commitments as set out in the ERMP 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 considers that certain components of the proposal described in the ERMP should be excluded from the Minister's approval. These components are:

- development of Deposits C to H, because insufficient information exists for the EPA to assess them;
- the railway line along the Coondewanna West route (see section 3.2.4); and
- the railway line anywhere within the Millstream-Chichester National Park (see section 3.2.5).

Table 4. Summary of proponent's commitments.

This table indicates the proponent's commitments in Section 11 of the ERMP.

Commitment (Who/What)	Objective (Why)	Action (How/Where)	Timing (When)	Whose Advice	Measurement/ Compliance Criteria
The stockpile extension area will be built by constructing the external wall first using clean waste rock and then backfilling behind the wall.	To minimise turbidity generation and impacts on marine flora and fauna.	Cape Lambert.	Construction phase.	DEP	Inspection
A dredging management plan will be prepared.	To ensure impacts on marine flora and fauna are minimised.	Cape Lambert.	Prior to commencement of dredging operations.	DEP	Dredging plan developed and implemented.
Where railway parallels existing railways, as a minimum standard, duplicate the type of drainage structure and elsewhere determine the size and type of drainage structure based on catchment size with 1 in 20 average or 1 in 50 average recurrence interval for storm events, stream and embankment gradients, stream bed material and riparian vegetation to ensure minimal scouring or change in stream direction.	To minimise changes to watercourse hydrology.	Along the railway.	Pre-construction.	WRC	Plans approved by WRC and culverts build to plans.
Drainage Diversion Management Plans will be prepared.	To minimise erosion, sediment transport and turbidity.	At each new deposit	Prior to commencement of mining-related earthworks for each Deposit.	WRC	Drainage Diversion Management Plans developed and implemented.
A Groundwater Extraction Management Plan to monitor regional groundwater drawdown will be developed. The Plan will include monitoring to detect ground and surface water impacts in and around Karijini National Park.	To ensure vegetation is not adversely impacted.	Around the Turee Creek (B) borefield.	Prior to the commencement of pumping.	WRC and CALM	Reporting and actions in accordance with Groundwater Extraction Management Plan.
A Greenhouse Management Plan will be prepared.	To document minimisation of greenhouse gases.	For the West Angelas Project.	Following construction.	DOME and DEP	Quality assurance reporting.
Mining pits constructed below the water table will be progressively backfilled with excavated materials.	To ensure no changes to groundwater quality through evaporation.	In pits mined below the water table.	During mining operations.	WRC and DEP	

Commitment (Who/What)	Objective (Why)	Action (How/Where)	Timing (When)	Whose Advice	Measurement/ Compliance Criteria
Robe River Mining Pty Ltd will allow other mining companies to widen cuttings and fill adjacent to the existing alignment in national parks so as to utilise the existing alignment, provided there is no cost or interference to Robe's rail operations.	To maintain a service corridor through national parks		Life of project	DRD	
An Environmental management Plan will be prepared which will address, but not be limited to: • rehabilitation and revegetation of disturbed areas • drainage design along the railway at water course crossings and through sheet flow areas (ie Mulga) • weed management • dust management • implementation of DME guidelines for Mining in Arid Environments, Asbestos management in Mining and Environmental management of Quarries • measures to prevent contamination of ground and surface waters • an overview of timing for implementation of commitments, and • reporting requirements (including those for Greenhouse Challenge Program) and other environmental actions and programs.	To ensure the environment is protected by consolidating environmental management requirements into one document.	To ensure the environment is protected by consolidating environmental management requirements into one document.	Prior to construction.	DEP, DRD	Annual and triennial reporting.

In addition the proponent has committed to the following with respect to management of potential impacts to stygofauna:

1. In collaboration with the Museum of WA the proponent will continue to assist with:
   - sampling and identification of stygofauna species within areas where groundwater drawdown from abstraction and mine dewatering is predicted;
   - assessment of the conservation significance of any species found;
   - mapping of the local distribution of species sampled;
   - undertaking further sampling of the full extent of the West Angelas Jeerinah Formation if species disrtribution is found to be a significant issue.
2. Should further research indicate that stygofauna species present are of significant conservation value bores for use as production and standby bores for the mine area in the Jeerinah Formation will be avoided as far as possible.
3. Bores for Deposit A will be used during the construction phase (including but not limited to WAAPB 1 and WAAPB2).
4. The proponent will monitor production and dewatering bores for stygofauna abundance and water levels where stygofauna are present, throughout the life of the raine. If any bores in Jeerinah Formation are used, drawdown and fauna abundance monitoring will be performed on bores WB 32, WB 41, WB 51, WB 54 and WB 58.
5. If a significant drop in stygofauna abundance is noted in conjunction with water table depression, pumping rates will be reassessed or stopped.
6. Where stygofauna have been found to exhibit a significant drop in fauna diversity and/or abundance due to water extraction, alternative bores should be utilised at a distance where drawdown produced does not extend into bores containing stygofauna.
7. Workshops, stores and fuel depots will be constructed in accordance with management issues and Department of Minerals and Energy guidelines for the prevention of pollution to groundwater, with self contained drainage and storage and treatment systems for potential conatminants.
8. Mine staff shall be briefed on environmental issues and management recommendations as contained in the proponent's report titled "West Angelas Stygofauna Assessment Survey", dated November 1998.
9. Monitoring of stygofauna abundance and water table levels will be performed at the Pastoral Bore once Turee Creek B borefield is operational.
10. Should the proposed borefield expansion go ahead, further survey and monitoring work will be carried out in the expanded borefield prior to identifying production bores. A monitoring programme will be implemented where stygofauna are found, as per the mine area.

FLORA AND FAUNA DATABASE

The proponent commits to provide data on flora and fauna surveys carried out in the region of interest associated with the West Angelas mine proposal in a form that can be incorporated into a regional database with information from other companies and government agencies.

For the remainder of the proposal, the EPA has developed a set of conditions which the EPA recommends should be imposed if the proposal is approved, but these are subject to the Minister's consideration in accordance with recommendation 5 in section 7. These conditions are presented in Appendix 1. Matters addressed in the conditions include:

(a) the proponent shall fulfil the commitments set out as a schedule to the recommended conditions;

(b) the proponent shall prepare and implement an Environmental Management Plan and other Plans which address, but are not limited to, groundwater extraction, minesite management, weed management, protection of Ghost Bats, marine management, greenhouse gas emissions, rail route environmental management and decommissioning and rehabilitation;

(c) further work in relation to the assessment of impacts to subterranean fauna;

(d) in order to manage the relevant environmental factors and EPA's environmental 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:

1. An environmental policy and corporate commitment to it;
2. Mechanisms and processes to ensure:
    - planning to meet environmental requirements;
    - implementation and operation of actions to meet environmental requirements;
    - measurement and evaluation of environmental performance; and
3. A mechanism for continuous review and improvement of environmental outcomes.

In addition the proponent has committed to the following with respect to management of potential impacts to stygofauna:

5. Other advice

The EPA understands that there are numerous mineral deposits in the Pilbara that may become economically viable to develop over the next few decades.

Access corridors

The EPA believes that the Government should give consideration to the rationalisation of future rail, road and other corridors in the Pilbara and to the means to ensure that the environmental impacts of future cumulative access proposals are acceptable. The Central Pilbara Mineral Province Study could be an effective vehicle for consideration of these issues.

The EPA strongly prefers that new railway lines do not go through national parks or conservation reserves. If however, approval for such lines is given, then approval should be conditional upon access to those lines being available to others, to reduce the need for additional lines in the future.

Proposed consevation reserves

Proposed reserves, such as the Rangelands Mulga Reserve planned to adjoin the Karijini National Park, should be progressed so that the broader issues relating to proposed access corridors, cumulative groundwater usage and future developments in the Pilbara can be considered in the light of factors arising from the location of these reserved areas.

Vegetation and fauna

An adequate database of significant vegetation associations in the region is not available. It is understood that a large number of vegetation surveys have been carried out in the region to date but the results of these are dispersed amongst different mining companies and Government agencies.

Similarly, the assessment of developments in the Pilbara is also hampered by the absence of consolidated information on the regional distributions of terrestrial fauna and subterranean fauna. Robe has committed to making available to government the data collected during surveys commissioned for this proposal.

The EPA supports the initiation of a project by the DEP and CALM to consolidate vegetation and fauna data for the Pilbara to facilitate the cumulative impact assessment of future proposals and the protection of vegetation associations and fauna habitat.

Groundwater usage

Mineral developments are large users of groundwater. Proposed developments in close proximity may utilise common, or connected, aquifers. The extraction of groundwater may lead to impacts on vegetation, existing water features and the available supply for other users. The EPA therefore strongly believes that a coordinated regional approach led by WRC for managing groundwatesr resources in the Pilbara should be initiated.

6. Conclusions

The EPA has considered the proposal by Robe River Mining Co. Pty. Ltd and concluded that, whilst the proposal is largely able to meet the EPA's environmental objectives, some portions of the proposed rail line are unable to do so.

The over-riding environmental issue which has arisen during the assessment of this proposal is the proposed construction of a new railway line, particularly where the proposed route crosses national parks or areas of high conservation value.

Millstream-Chichester National Park Sections

Use and purpose of national parks

The EPA's view is that national parks have been recognised and dedicated by Government for their special values and a new railway should not normally be located in a national park outside the area which has been designated by the Government or is currently used for railway purposes. The EPA's strong preference is for the shared use of the existing Hamersley railway or for a new line to be located outside the national park. The next preferred option is for a new railway line to be located on the same embankment, or close (inside a one kilometre nominal rail corridor) to the existing Hamersley railway. By far the least preferred alignment option is for a new railway line to be located greater than one kilometre away from the existing line (outside a one kilometre nominal rail corridor) within the national park.

Environmental values

Irrespective of which railway route is proposed, the environmental values that may be affected need to be clearly identified. The proposed Mt Leal route was considered unacceptable because of potential impacts to the wilderness values in the Millstream-Chichester National Park. The proponent has advised that this option will not be implemented and its preference is now for a rail route close to the Hamersley line in the southern part of the national park.

For the Hamersley Parallel Western Route (in the northern part of the park), advice from the Department of Conservation and Land Management (CALM) indicates that there may be an opportunity to rationalise the location of the existing and proposed railway lines and the

proposed Mt Tom Price Road into one new corridor to reduce the overall impacts on environmental values.

It is the EPA's view that the construction of a new rail line through the Millstream-Chichester National Park cannot be managed to meet the EPA's environmental objectives for national parks and A-class conservation reserves.

However, it is the EPA's view that expanded usage of the existing rail line through the park may be managed to meet EPA environmental objectives. The EPA encourages the proponent to pursue this option.

Should the Government decide to approve a new railway line within the Millstream-Chichester National Park, it should be within one kilometre of the existing line to lessen the adverse impacts on the purpose and use of the park. If however, approval for such a line is given, the approval should be conditional upon access to the line being available to others, to reduce the need for additional lines in the future.

At the time of this assessment, insufficient information was available on the specific alignment, environmental values, or management proposed along a rail route through the national park that would fall wholly within one kilometre of the existing line. The EPA is hence unable to provide firm advice on the acceptability of a specific route. The proponent would need to consult closely with CALM and EPA on these specific details if a new rail route in the Millstream-Chichester National Park is to meet environmental objectives.

Where the terrain renders the construction of the rail line within 1km of the existing line to be impractical (eg. the gorge of the Harding River), the proposed route should be selected in consultation with CALM and demonstrate, to the satisfaction of the EPA, that significant environmental impacts will not occur. The EPA is of the view that this is by far the least preferred environmental outcome but it does recognise that, in terms of engineering feasibility, it may be the only practical option.

Coondewanna Flats Section

The EPA is concerned that rail routes through Coondewanna Flats may compromise environmental values associated with significant mulga vegetation associations, through disturbance to surface hydrology.

The EPA considers that the risks of substantial impacts are much more likely for the Coondewanna West route than for other routes. Consequently, the Coondewanna West route is not environmentally acceptable. Modifications to the alignment of this route are understood to be under consideration by Robe. These realignments could result in reduced environmental impacts but no detailed comparison of this Modified Coondewanna West route with the CALM Mt Robinson route has been provided to the EPA for assessment.

The alternative route to the east of Coondewanna Flats proposed by CALM is strongly preferred because it substantially avoids impacts on sensitive vegetation communities and could be located largely in areas already disturbed by the Great Northern Highway. It is considered from field inspections and advice from CALM that this route could be made environmentally acceptable.

The proponent's Mt Robinson route option, while being less undesirable than the proposed Coondewanna West route, may compromise significant vegetation associations in the northern area of Coondewanna Flats by disturbance to local hydrology and is hence regarded as being environmentally unacceptable.

Karijini Section

The EPA considered that the Marandoo Corridor through the Karijini National Park has been created by Government specifically to cater for rail traffic. A new line would be environmentally acceptable provided it was entirely within this existing one kilometre corridor. The construction of a new railway line completely within the existing corridor could be difficult but the proponent has advised that this is feasible. If construction within the corridor is found not to be feasible and as a result the Government considers adjusting the corridor, then advice

should be sought from CALM and the maximum width should not exceed one kilometre, as is currently the case.

Other Railway Sections

The proposed railway alignment can otherwise be managed to meet the EPA's environmental objectives.

Other Proposal Components

The components of the project comprising mining of Deposits A and B, the borefield and the port expansion can be managed to meet the EPA's environmental objectives. Insufficient information has been provided on the environment and management of Deposits C to H to determine whether the EPA's environmental objectives could be met there. Hence development of these deposits has not been assessed as part of this proposal.

Other Advice

The EPA believes that the Government should give consideration to the rationalisation of future rail, road and other corridors in the Pilbara and to the means to ensure that the cumulative environmental impacts of future cumulative access proposals are acceptable.

Development of conservation reserves in the Pilbara region should be progressed so that the broader cumulative issues relating to proposed access corridors, groundwater usage and future developments in the Pilbara can be considered in the light of factors arising from the location of known conservation reserves.

The assessment of developments in the Pilbara is hampered by the absence of consolidated information on the regional distributions of terrestrial fauna, subterranean fauna and an adequate database of significant vegetation associations in the region. It is understood that a large number of vegetation surveys have been carried out in the region to date, but the results of these remain dispersed among different mining companies and Government agencies.

Mineral developments are large users of groundwater. Proposed developments may utilise common or connected aquifers. The extraction of groundwater may lead to impacts on vegetation, existing water features and the supply available for other users.

In providing advice on this proposal, the EPA considers that its implementation wholly as proposed by the proponent would not be environmentally acceptable. Regarding the Other Advice provided in Section 5, the EPA has concluded:

- that Government should give consideration to the rationalisation of rail and infrastructure corridors in the Pilbara through the Central Pilbara Mineral Province Study, and to the means to ensure that the cumulative environmental impacts of future cumulative access proposals are acceptable;

- that a project to consolidate vegetation and fauna data for the Pilbara to facilitate assessment of future proposals should be initiated and coordinated by the DEP and CALM; and

that a coordinated regional approach led by the Water and Rivers Commission for managing groundwater resources in the Pilbara should be developed.

7. Recommendations

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

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

2. The EPA recommends that the Minister notes the EPA has concluded that Deposits A and B of the West Angelas mine, Cape Lambert port extension and the railway line, except where it passes through the Millstream-Chichester National Park and across Coondewanna Flats, can be managed to meet the EPA's environmental objectives, provided there is satisfactory implementation by the proponent of the recommended conditions and exclusions set out in Section 4 and set out in detail in Appendix 1, including the proponent's commitments;

3. The EPA recommends that the Minister notes that for subsequent mining of Deposits C to H within the project area, the EPA would require additional details on the environment there and the management proposed, to be referred to the EPA to enable the EPA to provide advice on the environmental effects of the proposals;

4. The EPA recommends that the Minister considers the EPA's strong preference for use of the existing Hamersley Iron line or for the location of the railway outside national parks, and notes that it is the EPA's opinion that the construction of a new rail line through the Millstream-Chichester National Park is inconsistent with the EPA's environmental objectives which are inherent in the designation of national parks and A-class conservation reserves;

5. The EPA recommends that the Minister notes that should the Government decide, after considering broader issues, to approve a new railway line within the Millstream-Chichester National Park, it should be within one kilometre of the existing line to lessen the adverse impacts on the purpose and use of the park. Where the terrain renders this impractical (eg. the gorge of the Harding River), the proposed route should be selected in consultation with CALM and demonstrate to the satisfaction of the EPA that significant environmental impacts do not occur;

6. The EPA recommends that the Minister notes that the EPA has recommended conditions consistent with the position of a new railway not being constructed within a national park (see Recommendation 2). However, it further recommends that the Minister be aware that an alternative condition in relation to a railway line within the Millstream-Chichester National Park has been included in brackets in Condition 10 dependent on the Minister's decision in Recommendation 5.

7. The EPA recommends that the Minister notes that the Mt Leal and Coondewanna West sections of the route do not meet EPA environmental objectives and are therefore not environmentally acceptable;

8. The EPA recommends that the Minister imposes conditions as set out in Appendix 1, but noting that the final wording will depend upon the decision taken by the Minister on Recommendation 5;

9. The EPA recommends that the Minister notes the Other Advice in Section 5 and takes appropriate action to ensure those agencies responsible (being DEP, CALM and WRC) are aware of this advice.

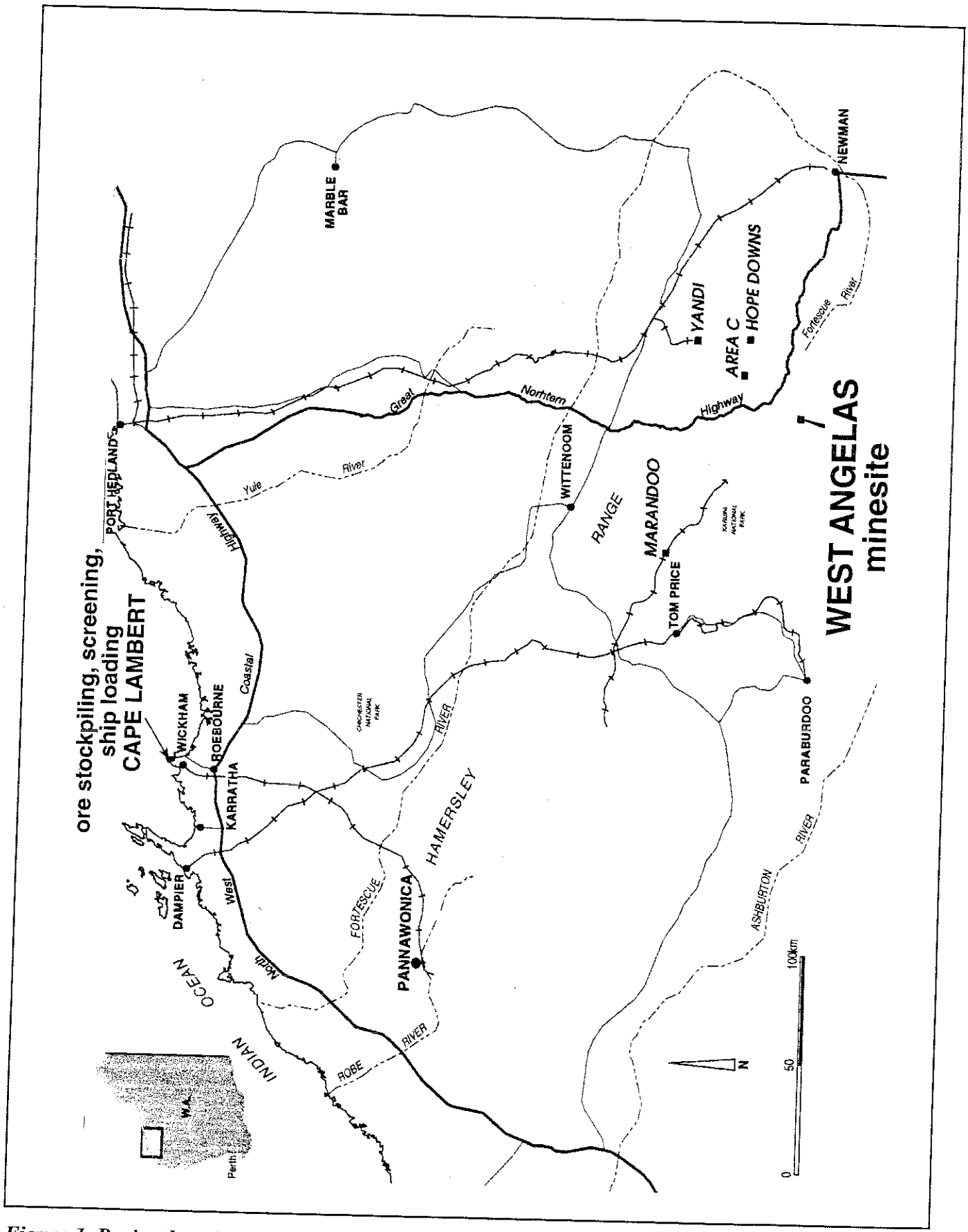

Figure 1. Project location showing mine site, port and existing railways.

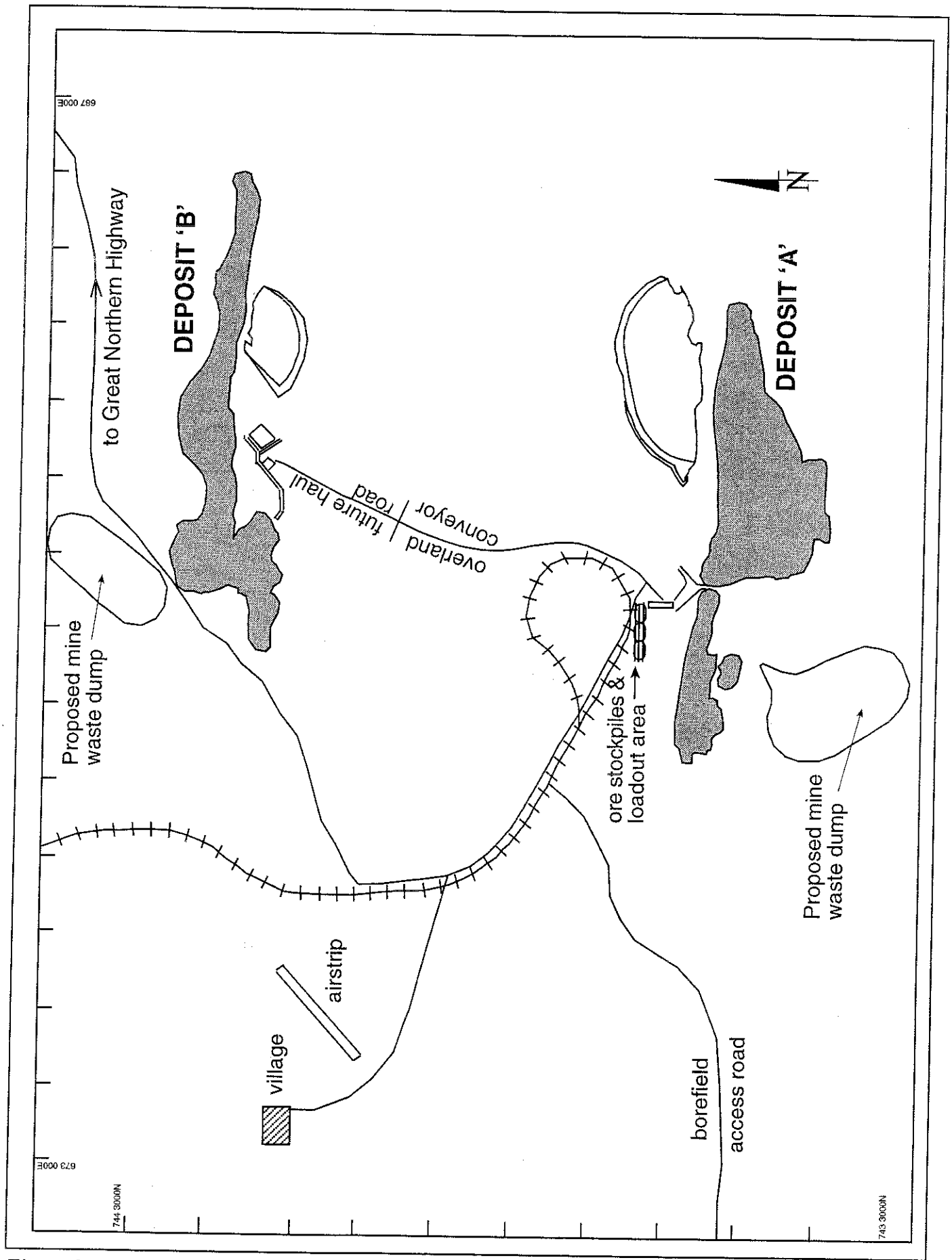

Figure 2. Main mine components.

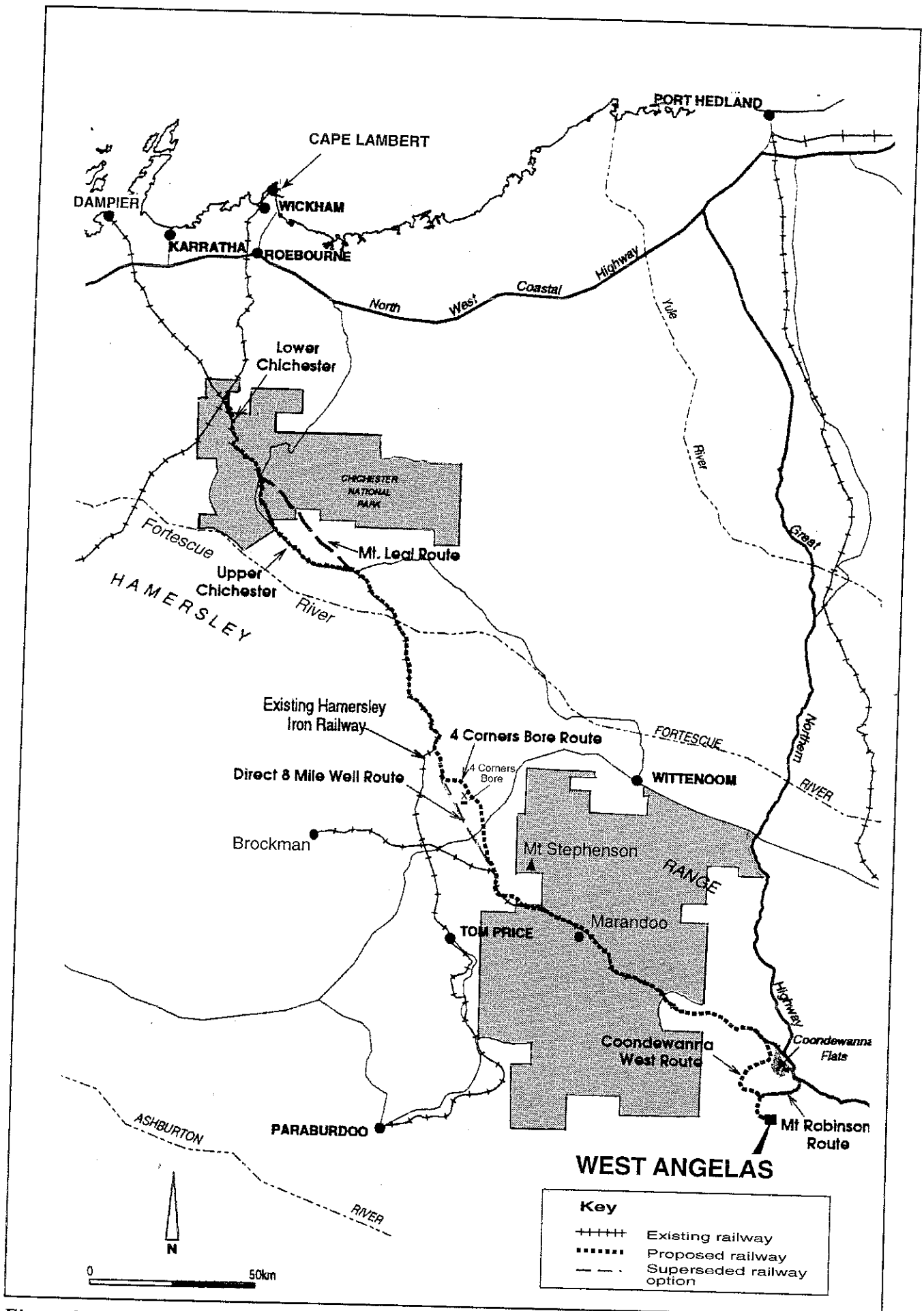

Figure 3. Rail route options considered.

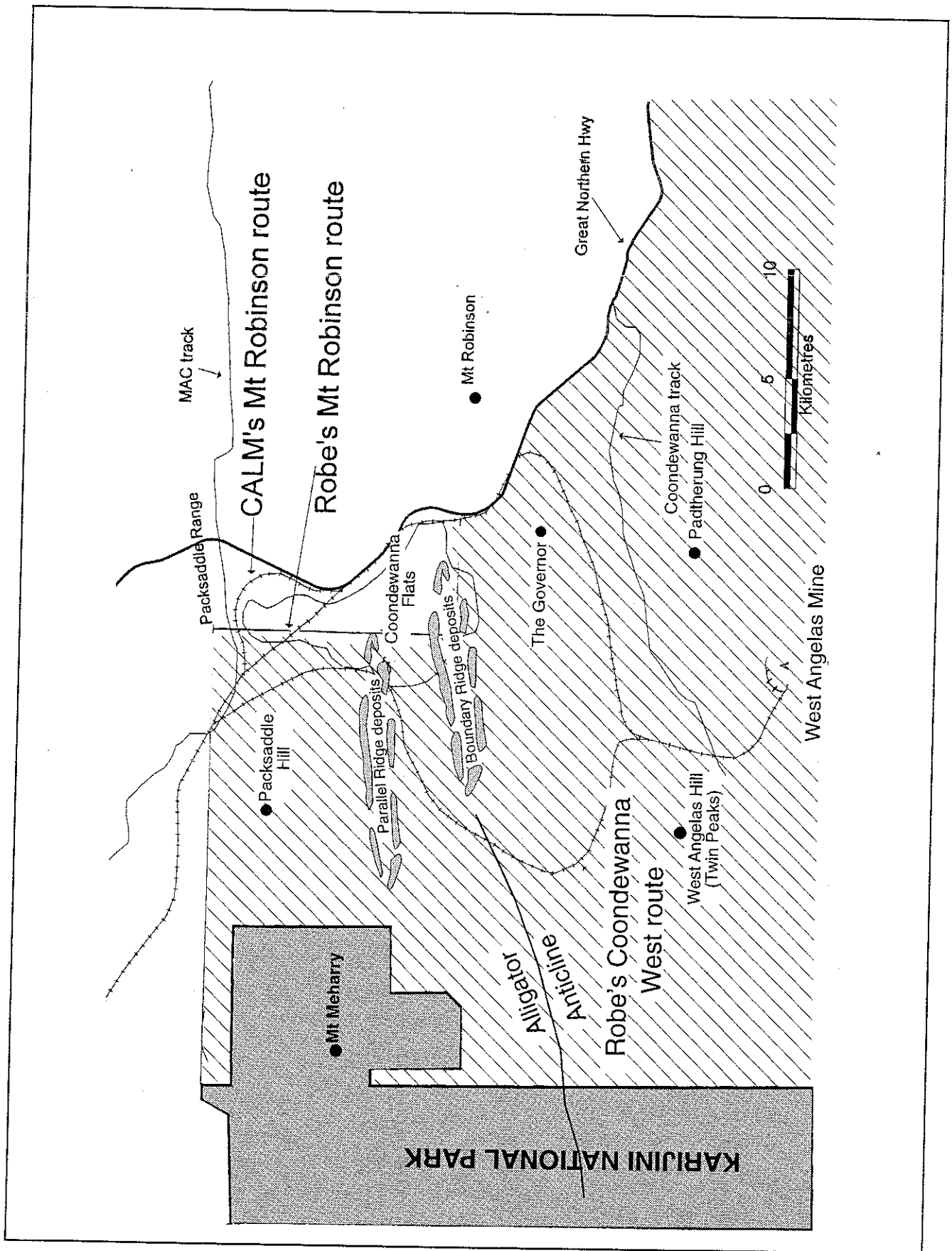

Figure 4. Coondewanna Flats sector, showing rail alignment options and schematic of BHP iron deposits in the area (Source: Department of Conservation & Land Management and BHP Iron Ore (respectively).

Appendix 2

List of submitters

List of organisations and individuals who made submissions

State and Local Government Agencies:

- Aboriginal Affairs Department
- Department of Conservation and Land Management
- Department of Land Administration
- Department of Resources Development
- Main Roads Department
- National Parks and Nature Conservation Authority
- Shire of Ashburton
- Shire of Roebourne
- Western Australian Museum
- Western Australian Tourism Commission
- Water and Rivers Commission

Organisations:

- Conservation Council of Western Australia

Public:

- Cossack Pearls Pty Ltd

Appendix 3

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Standards Australia 1997, AS/NZS ISO 14004:1997, Environmental management systems – General guidelines on principles, systems and supporting techniques.

Thackway, R. and Cresswell, I.D. 1995, An Interim Biogeographic Regionalisation for Australia: A Framework for Setting Priorities in The National Reserves System Cooperative Program. Australian Nature Conservation Agency, Canberra.

Trudgen, M.E. and Casson, N. 1998, Flora and Vegetation Surveys of Orebody A and Orebody B in the West Angela Hill area and area surrounding them, and of rail route options considered to link them to the existing Robe River Iron Associates rail line. Unpublished Report Prepared for Robe River Iron Associates, Volume 1, March 1998.

Van Leeuwin, S.J., Muller, C., Bromilow, B. and Lipple, S. 1998, Conservation Values of Three Proposed Additions to the Hamersley Range Conservation Estate. CALM Science, in prep.

Appendix 4

Letter from NP&NCA to EPA

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National Parks and
Nature Conservation Authority

Mr Bernard Bowen
Chairman
Environmental Protection Authority
8th Floor, Westralia Square
141 St Georges Terrace
PERTH WA 6000

(1) Copy for Warren Tacey / (2) Discuss for RS / Doug Betts. (3) Copy 9 Dec 1998 certification

Dear Bernard

ROBE RIVER WEST ANGELAS IRON ORE PROJECT

Thank you for your letter of 27 November 1998 enclosing a copy of your letter to Robe River Mining Co Pty Ltd regarding the railway route for the West Angelas project.

The National Parks and Nature Conservation Authority (NPNCA) would like to reiterate its previous comments in relation to the proposal.

The NPNCA's preference is for Robe River to either use the same railway as Hamersley Iron or utilise the same embankment for the railway alignments through Karijini and Millstream-Chichester National Parks. The NPNCA would like the railway route to parallel the existing Hamersley Iron railway alignment as closely as possible. Common use of the present service road would also be preferred. The Authority does not support a proposed route that would involve another infrastructure corridor. The Authority also stresses the need to keep infrastructure corridors to the minimum width.

It is important that all possible routes through the Millstream-Chichester National Park are explored and considered. The NPNCA is not convinced that all alternatives have been fully considered and assessed.

The Authority is concerned about the potential impacts on areas of Mulga on both the Coondewanna flats, southeast of Karijini National Park, and within some areas of the Karijini National Park. The current rail alignment shows some Mulga death resulting from drainage interference.

The existing Hamersley Iron rail is already having effects on surface hydrology and a route that is not parallel to the existing rail would have significant additional impacts. An adjacent line would not significantly add to the existing surface hydrology disturbance.

I understand that the Department of Conservation and Land Management (CALM) has provided some comments to you in relation to the advice you are seeking on environmental impacts within the Millstream Chichester National Park and on the Coondewanna Flats. The NPNCA supports the comments made by CALM in its letter of 9 December 1998.

Yours sincerely

Tom Day
CHAIRMAN

24December 1998

cc. Peter Murphy, Department of Resources Development
cc. Daryl Calvin, Robe River Mining

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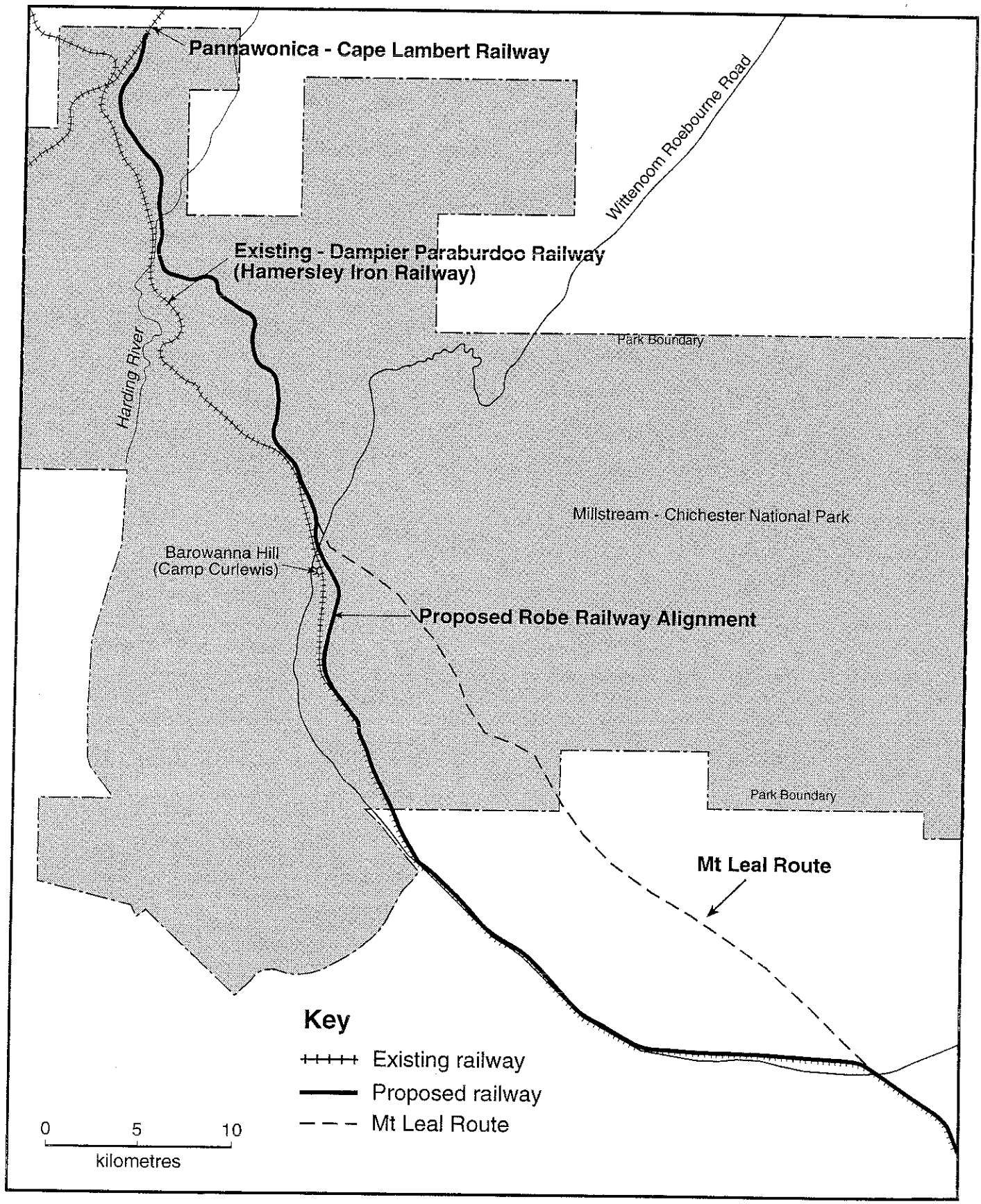

Figure 5. Existing and proposed railway routes through Millstream-Chichester National Park.

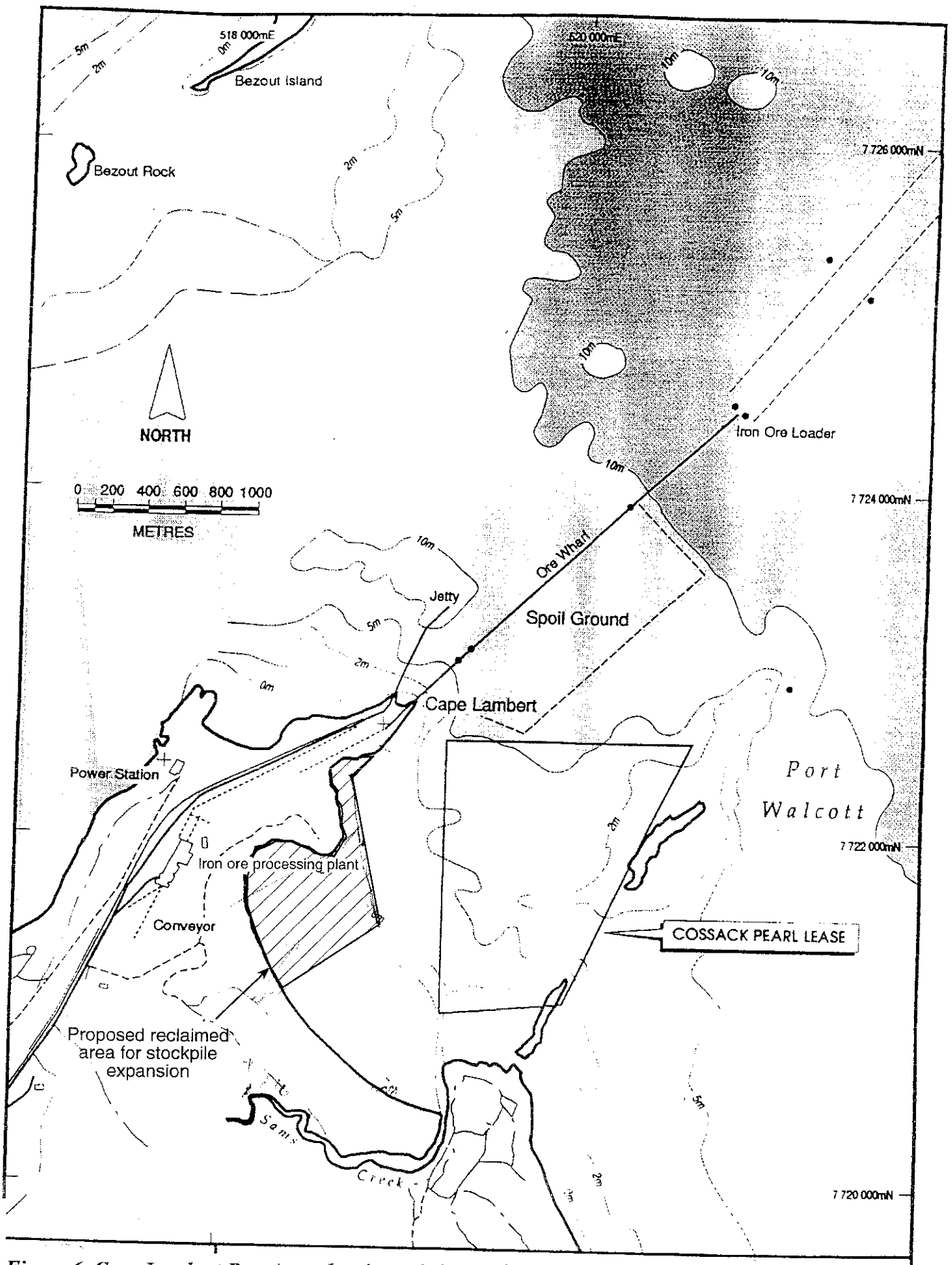

Figure 6. Cape Lambert Port Area showing existing and proposed facilities (Map by Enzer Marine Environmental Consulting)

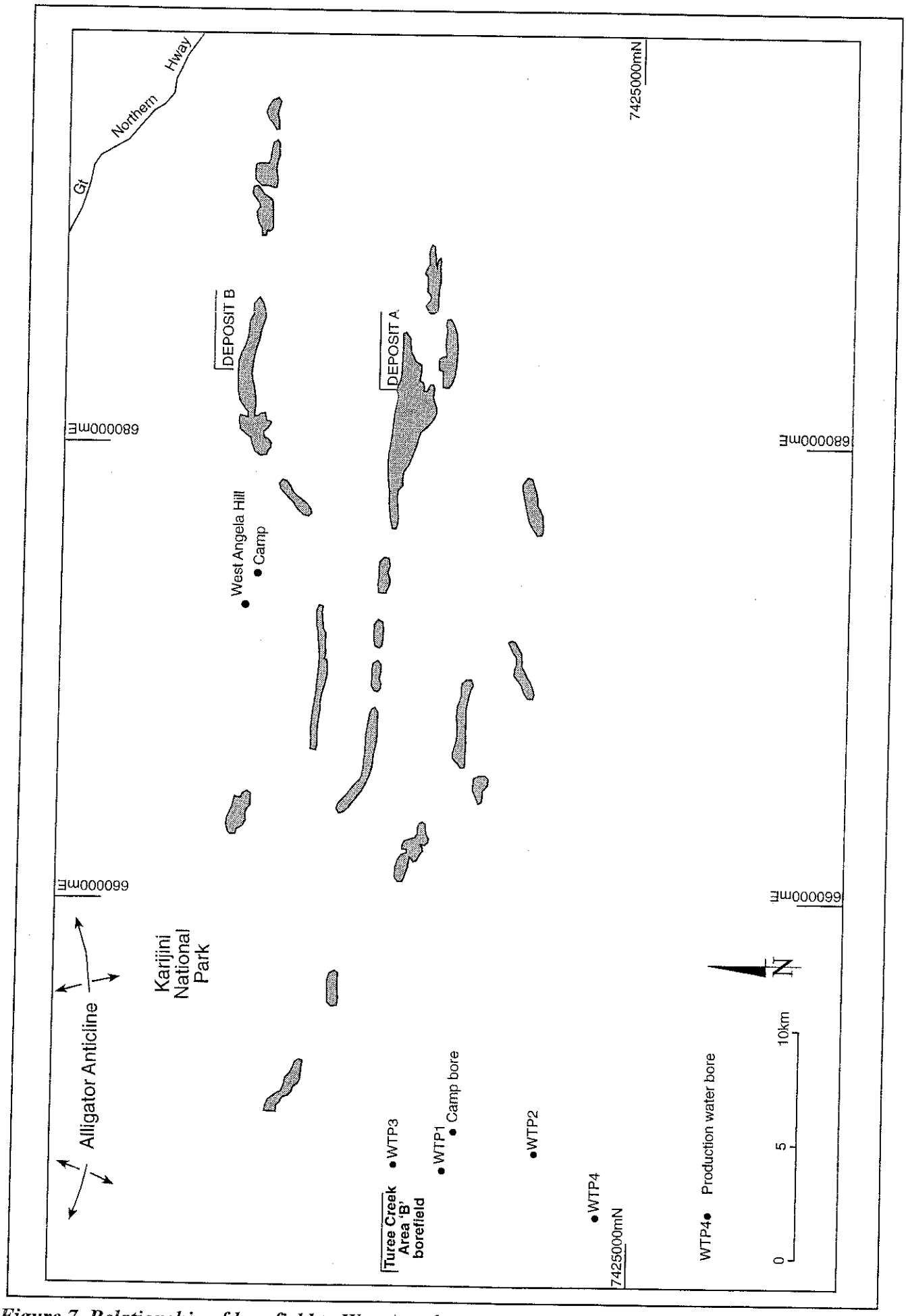

Figure 7. Relationship of borefield to West Angelas ore deposits.

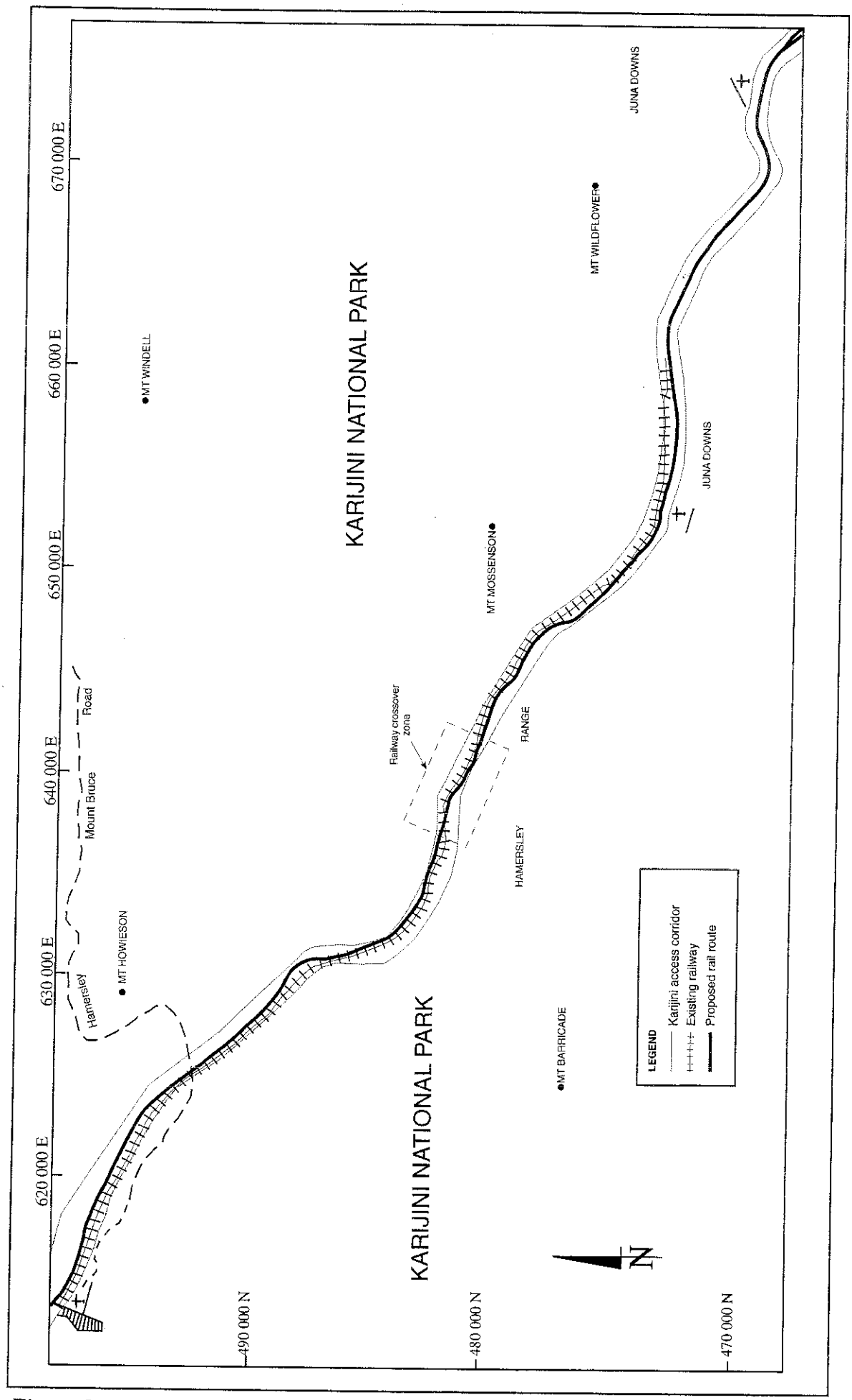

Figure 8. Proposed rail route through Karijini Access corridor.

Appendix 1

Recommended environmental conditions and proponent's consolidated commitments

Statement No.

RECOMMENDED CONDITIONS

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

WEST ANGELAS IRON ORE PROJECT -
SHIRES OF EAST PILBARA, ASHBURTON AND ROEBOURNE

Proposal:	The development of an iron ore mine at Deposits 'A' and 'B', and ore processing operation at West Angelas, 130 km west of Newman; construction of a rail line and expansion of port facilities at Cape Lambert, as documented in schedule 1 of this statement.
Proponent:	Robe River Mining Co. Pty. Ltd. (ACN: 007 066 766)
Proponent Address:	9th Floor, 12-14 St George's Terrace, PERTH WA 6000
Assessment Number:	1144

Report of the Environmental Protection Authority: Bulletin 924

The proposal to which the above report of the Environmental Protection Authority relates, excluding:

- the proposed 46km gas pipeline from West Angelas minesite to the Goldfields Gas Transmission Pipeline at the Boonanchi Wells valve station, as this component is no longer proposed;
- the proposed railway line along the Coondewanna West route; and
- the railway line, as proposed in the proponent's document, through the Millstream-Chichester National Park (see Condition 12-1),

(but NB: depending on the decision of the Minister pursuant to Sections 3.2.4, 3.2.5 and Recommendation 5 of this report);

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.

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

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

2 Proponent Commitments

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

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

3 Environmental Management System

3-1 In order to manage the environmental impacts of the project and fulfil the requirements of the conditions and procedures in this statement, prior to construction 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.

3-2 The proponent shall implement the environmental management system referred to in condition 3-1.

4 Environmental Management Program

4-1 Prior to commencement of ground-disturbing activities, the proponent shall prepare an Environmental Management Program to the requirements of the Environmental Protection Authority.

This Program shall:

1. document consultations with agencies and groups involved in the development of the program;

2. address the report on the assessment of subterranean fauna as proposed in the proponent's commitments; and

3. address proposed dust controls for ore handling operations at Cape Lambert,

and shall include the following Plans:

1. Groundwater Extraction Management Plan (See condition 5);

2. Minesite Environmental Management Plan (See condition 6);

3. Weed Management Plan (See condition 7);

4. Marine Management Plan (See condition 8);

5. Greenhouse Gas Emissions Management Plan (See condition 9);

6. Rail Route Environmental Management Plan (See condition 10), and

7. Ghost Bat Management Plan (See condition 12);

8. Decommissioning and Rehabilitation Management Plan (See condition 13).

4-2 The proponent shall implement the Environmental Management Program required by condition 4-1.

4-3 The proponent shall make the Environmental Management Program required by condition 4-1 publicly available, to the requirements of the Environmental Protection Authority.

5 Groundwater Extraction Management Plan

5-1 Prior to commencement of construction of the borefield, the proponent shall prepare a Groundwater Extraction Management Plan to achieve the following objectives:

- determine the levels and extent of groundwater drawdown from the borefield and mine dewatering over the life of the project;
- determine the sustainable yield of groundwater supply;
- ensure that groundwater extraction does not significantly affect surface water bodies;
- ensure that groundwater extraction does not significantly affect other users;

- ensure that groundwater extraction does not significantly affect vegetation; and
- ensure that water usage is minimised.

This Plan shall be prepared to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection, the Water and Rivers Commission and the Department of Conservation and Land Management, and shall include:

1. the depth and description of the aquifer from which groundwater is proposed to be extracted;
2. the undertaking of further groundwater investigations to the west of the proposed borefield area to enable more accurate modelling of regional impacts (particularly Paperbark Spring and any other adjacent springs) and determination of the sustainable yield;
3. identification of emergency water sources closer to the minesite in the event that the borefield is inaccessible at certain times of the year;
4. the monitoring and management of any impacts of groundwater extraction on the levels of downstream surface pools along Turee Creek;
5. the impact of proposed groundwater extraction on other users, and potential users, of the Turee Creek aquifers; and
6. proposed actions in the event that adverse impacts on surface water levels, vegetation or other users of the aquifers are detected.

5-2 The proponent shall implement the Groundwater Extraction Management Plan required by condition 5-1.

5-3 The proponent shall make the Groundwater Extraction Management Plan required by condition 5-1 publicly available, to the requirements of the Environmental Protection Authority.

6 Minesite Environmental Management Plan

6-1 Prior to commencement of ground-disturbing activities, the proponent shall prepare a Minesite Environmental Management Plan to protect environmental values that may be affected by implementation of the proposal, to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection and the Department of Conservation and Land Management.

This Plan shall address:

1. the protection of vegetation associations having conservation value;
2. the maintenance of the conservation status of those species that are inadequately represented in the conservation estate;

3. the protection of Declared Rare and Priority flora;

4. the minimisation of clearing;

5. the location and design of mine infrastructure, stockpiles, waste dumps and other facilities so as-

   - not to significantly affect vegetation associations, including Declared Rare and Priority flora species and cracking clay areas having conservation value; and
   - to maintain corridors for faunal movements, as far as practicable,;

6. minimising the number and size of corridors used for infrastructure and services;

7. the maintenance and restoration of original drainage patterns;

8. minimising the size and number of stockpiles by maximising the amount of excavated material returned to the pits;

9. the design and form of stockpiles for maximum harmony with the landscape;

10. the discharge from mine dewatering to natural drainage areas;

11. the level of pit infilling required to prevent evaporation of groundwater brought to the surface by capillary rise in the soil cover as detailed in the proponent's commitment number 7;

12. the implementation of a progressive rehabilitation and revegetation plan;

13. implementation of the Department of Minerals and Energy guidelines for Mining in Arid Environments; and

14. the implementation of a Ghost Bat management plan.

6-2 The proponent shall implement the Minesite Environmental Management Plan required by condition 6-1.

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

7 Weed Management Plan

7-1 Prior to commencement of ground-disturbing activities, the proponent shall prepare a Weed Management Plan to eradicate existing infestations or future outbreaks of Ruby Dock in the minesite area and prevent the spread of weeds particularly Bindens bipinnata, Cenchrus ciliaris (Buffel grass) and Rumex acetosa (Ruby Dock), during the construction and operation of the minesite and sections of the railway within Millstream-Chichester National Park and the Access Corridor through Karijini National

Park, to the requirements of the Environmental Protection Authority on advice of the Department of Conservation and Land Management.

7-2 The proponent shall implement the Weed Management Plan required by condition 7-1.

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

8 Marine Management Plan (Cape Lambert)

8-1 Prior to commencement of dredging, the proponent shall prepare a Marine Management Plan to protect environmental values for, and commercial pearl operations in the coastal waters around the port at Cape Lambert that may be affected by implementation of the proposal, to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection and Fisheries WA.

This Plan shall:

1. be consistent with the most recent version of the "Draft Environmental Protection (State Marine Waters) Policy 1998" and subsequently the final policy when issued; the Western Australian Water Quality Guidelines for Fresh and Marine Waters (EPA Bulletin 711, 1993); and address the Interim Ocean Disposal Guidelines (ANZECC 1998);
2. define the extent to which environmental values apply to the coastal waters around the proponent's facilities at Cape Lambert, taking into account:

    - results of sediment sampling; and
    - any agreements reached with Cossack Pearls;

and shall address:

3. marine monitoring, commencing with baseline studies, which include control locations, mangroves and the adjacent pearl lease;

4. water runoff and discharge from land based facilities;

5. measures required to avoid adverse impacts on any nearby commercial pearl hatchery or pearl grow-out operations; and

6. consultation with owners of the pearl hatchery and pearl grow-out operations.

Note: This Plan will incorporate Dredging Management Plans required under the (Commonwealth) Environment Protection (Sea Dumping) Act 1981.

8-2 The proponent shall implement the Marine Management Plan required by condition 8-1.

8-3 The proponent shall make the Marine Management Plan required by condition 8-1 publicly available, to the requirements of the Environmental Protection Authority.

9 Greenhouse Gas Emissions Management Plan

9-1 Prior to commissioning, the proponent shall prepare a Greenhouse Gas Emissions Management Plan for this proposal to ensure that "greenhouse gas" emissions meet the requirements consistent with "Minimising Greenhouse Gas Emissions, Guidance for the Assessment of Environmental Factors, No. 12" published by the Environmental Protection Authority, to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection.

This Plan shall include:

1. calculation of the "greenhouse gas" emissions associated with the proposal, as indicated in "Minimising Greenhouse Gas Emissions.." referred to above;

2. specific measures to minimise the "greenhouse gas" emissions associated with the proposal;

3. monitoring of "greenhouse gas" emissions;

4. estimation of the "greenhouse gas" efficiency of the project (per unit of product and/or other agreed performance indicators) and comparison with the efficiencies of other comparable projects producing a similar product; and

5. estimated global emission credit (greenhouse gas offsets) achieved through implementation of the proposal, if any.

9-2 The proponent shall implement the Greenhouse Gas Emissions Management Plan required by condition 9-1.

Note: The proponent has entered the Commonwealth Government's "Greenhouse Challenge" voluntary co-operative agreement program.

[Components of the agreement program include:

1. an inventory of emissions;

2. opportunities for abating "greenhouse gas" emissions in the organisation;

3. a "greenhouse gas" mitigation action plan;

4. regular monitoring and reporting of performance; and

5. independent performance verification.]

10 Rail Route Environmental Management Plan

10-1 Prior to commencement of construction of the rail formation, the proponent shall prepare a Rail Route Environmental Management Plan to minimise adverse environmental impacts of

the railway and its formation, to the requirements of the Minister for the Environment on advice from the Environmental Protection Authority and the Department of Conservation and Land Management.

This Plan shall include:

[1. determination of any alternative routes.
(1) In the event that a route traverses the Millstream-Chichester National Park it shall lie not more than one kilometre from the existing Hamersley Iron Tom Price-to-Dampier railway, except where it can be demonstrated that the terrain renders this impractical;

(2) in the case of the sector of railway in the vicinity of Coondewanna Flats, the route shall follow the "CALM Mt Robinson" route except if it can be demonstrated that an alternative route, such as the "Coondewanna West" route, will provide an environmentally acceptable shared alignment for future iron ore mine developments which do not form part of this proposal;]

2. a report of a detailed vegetation and fauna survey;

3. topographical information;

4. a report on a survey of surface water resources;

5. a visual amenity study;

6. a statement that the Aboriginal Heritage Act has been complied with for determination of archaeological and ethnographic sites;

7. measures to minimise adverse environmental impacts of the railway and its formation, in particular drainage shadow impacts, and ongoing monitoring and amelioration of any drainage shadow impacts; and

8. provisions for breaching the formation following decommissioning, subject to the requirements of the Iron Ore (Robe River) Agreement Act 1964-1987.

10-2 The proponent shall implement the Rail Route Environmental Management Plan including any acceptable alternative route referred to and required by condition 10-1, to the requirements of the Minister for the Environment.

10-3 The proponent shall make the Rail Route Environmental Management Plan required by condition 10-1 publicly available, to the requirements of the Environmental Protection Authority.

11 Aboriginal Sites and Areas of Cultural Significance

11-1 Prior to ground-disturbing activities, the proponent shall consult adequately with both the Western Australian Museum's Department of Aboriginal Sites and potentially

affected local aboriginal community representatives, to determine whether such activities are likely to disturb known aboriginal sites or areas of cultural significance, to the requirements of the Department of Environmental Protection on advice of the Department of Aboriginal Affairs.

11-2 The proponent shall conduct operations in a manner that is consistent with the discussions referred to in condition 11-1.

12 Ghost Bat Management Plan

12-1 Prior to commencement of ground disturbing activities, the proponent shall prepare a Ghost Bat Management Plan to protect Ghost Bat *Macrodermas gigas* populations that may be affected by implementation of the proposal, to the requirements of the Environmental Protection Authority on advice of the Department of Conservation and Land Management.

This Plan shall address:

1 avoidance of areas likely to be utilised by Ghost Bats in the design of infrastructure such as waste dumps, haul roads and rail lines; and

2 verification procedures for ensuring that the local Ghost Bat population is not sifnificantly affected.

12-2 The proponent shall implement the Ghost Bat Management Plan required by condition 8-1.

12-3 The proponent shall make the Ghost Bat Management Plan required by condition 8-1 publicly available, to the requirements of the Environmental Protection Authority.

13 Decommissioning and Rehabilitation Management Plan

13-1 At least six months prior to decommissioning, the proponent shall prepare a Decommissioning and Rehabilitation Management Plan to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection, the Department of Conservation and Land Management, the Department of Minerals and Energy and the Water and Rivers Commission.

The objectives of this plan are:

- to render the minesite areas safe and stable; and
- to encourage the re-establishment of self-sustaining ecosystems.

This Plan shall address:

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

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

3. groundwater levels in mine pits; and

4. identification and remediation of contaminated areas, including provision of evidence of notification to relevant statutory authorities.

13-2 The proponent shall implement the Decommissioning and Rehabilitation Management Plan required by condition 13-1 until such time as the Minister for the Environment, *on* advice of the Environmental Protection Authority, determines that decommissioning and rehabilitation are complete.

13-3 The proponent shall make the Decommissioning and Rehabilitation Management Plan required by condition 13-1 publicly available, to the requirements of the Environmental Protection Authority.

14 Performance Review

14-1 Each six years following the commencement of construction, the proponent shall submit a Performance Review to the Department of Environmental Protection:

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

relevant to the following:

1. environmental objectives reported on in Environmental Protection Authority Bulletin 924;

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

3. environmental management system environmental management targets;

4. environmental management programs and plans; and/or

5. environmental performance indicators;

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

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

15 Proponent

15-1 The proponent for the time being nominated by the Minister for the Environment under section 38(6) or (7) of the Environmental Protection Act 1986 is responsible for the implementation of the proposal until such time as the Minister for the Environment has exercised the Minister's power under section 38(7) of the Act to revoke the nomination of that proponent and nominate another person in respect of the proposal.

15-2 Any request for the exercise of that power of the Minister referred to in condition 15-1 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.

15-3 The proponent shall notify the Department of Environmental Protection of any change of proponent contact name and address within 30 days of such change.

16 Commencement

16-1 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.

16-2 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.

16-3 The proponent shall make application to the Minister for the Environment for any extension of approval for the substantial commencement of the proposal beyond five years from the date of this statement at least six months prior to the expiration of the five year period referred to in conditions 16-1 and 16-2.

16-4 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.

17 Compliance Auditing

17-1 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.

17-2 Unless otherwise specified, the Chief Executive Officer of the Department of Environmental Protection is responsible for assessing compliance with the conditions, procedures and commitments contained in this statement and for issuing formal clearances.

17-3 Where compliance with any condition, procedure or commitment 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 the minesite and port components of this project under the provisions of Part V of the Environmental Protection Act.

Schedule 1

The Proposal

Note: The proposal as summarised in this schedule differs in several respects from the original proposal described in the Environmental Review and Management Programme (dated March 1998). The description in this schedule relates to the significant infrastructure items submitted in the proposal which have been accepted by the Environmental Protection Authority.

The proposal consists of four main components:

- an iron ore mining and processing operation at West Angelas, 130 kilometres west of Newman;
- borefield at Turee Creek about 30 kilometres west of the minesite;
- the construction of a rail line; and
- expansion of port facilities at Cape Lambert.

Mining and Processing

Iron ore is to be mined from two Deposits, "A" and "B", using conventional open pit methods. These utilise large rotary drill rigs, blasting and hydraulic excavators. The ore production rate is expected to be 7 million tonnes in the first year of operation, increasing to approximately 20 million tonnes per year thereafter. The anticipated project life is about 29 years.

Facilities at Deposit "A" include:

- primary crushing of ore and overland conveyor of primary crushed ore to plant;
- secondary crushing, screening and separation into lump and fines products;
- product stockpiling common to Deposit "A" and "B"; and
- train load-out common to Deposit "A" and "B" lump and fines.

Facilities at Deposit "B" include:

- primary crushing of ore and overland conveyor for primary crushed ore to plant.

Support infrastructure for the mine operation will include:

- a private access road to the West Angelas minesite off Great Northern Highway;
- heavy vehicle and plant maintenance workshop;
- fuelling and fuel storage facilities;
- vehicle washdown areas;
- accommodation village approximately 9 kilometres west of the processing plant;
- airstrip; and
- diesel fuelled power station. Fuel will be delivered on trains from Cape Lambert and stored in bulk storage tanks. The power station will consist of eleven 800kW, 6.6kV continuously rated diesel-driven generators sized to meet a maximum demand of 7200kW. This provides one standby machine and one machine out of service at any time. The station will be fully automated and capable of running unattended and interfaced with the plant control system.

(Note: The overhead transmission line option from Newman, identified in the Environmental Review and Management Programme and the subsequently proposed gas turbine power station on the site, which would have required the construction of a 46 kilometre pipeline from the Goldfields Gas Transmission natural gas pipeline, have been withdrawn by the proponent and are not part of the proposal).

Borefield

The water supply requirement during operation is 4 to 6 megalitres per day (ML/d). The borefield is located at Turee Creek approximately 30 kilometres west of the mine site. Investigations indicate that 8 ML/d may be obtained from the Turee Creek (B) aquifer. The pipeline from the borefield may be above or below ground.

Railway

A single standard gauge railway line will be constructed. The construction will involve:

- temporary and permanent access roads;
- borrow pits to source fill material;
- one or two quarries to provide stone for ballast and concrete aggregates; and
- construction camps.

Port Expansion

The existing ore outloading facilities at Cape Lambert will be expanded. An additional stockpile pad will be constructed as a northern extension into the sea, parallelling the existing facility. This will require the construction of a new sea wall and the reclamation of approximately 44.4 hectares of land.

The existing wharf will be extended approximately 250 metres seaward. Dredging will be required for deepening and widening the departure channel on both sides of the wharf for approximately one kilometre seaward from the new wharf head.

Other associated facilities to be constructed are:

- a rotary ore car dumper;
- a tertiary screening facility;
- new shiploader;
- power substations; and
- new rail and plant control and maintenance facilities.

Table 1: key characteristics of the proposal, as modified during the environmental assessment process, are summarised as follows:

Component	Proposal Characteristic	Description
Minesite	Mining rate	Approximately 20Mt/a
	Measured resource: Deposits "A" & "B"	458Mt & 236Mt
	Life of project	27-30 years
	Mine pit area: Deposits "A" & "B"	Approximately 460ha, 335ha
	Maximum pit depth Deposits "A" & "B"	Approximately 250m, 180m
	Depth to water table: * Deposit "A" * Deposit "B"	Approximately 102m (Fig 5.2 ERMP) 114m (Fig 5.3 ERMP)
	Area of overburden storage: * Deposit "A" * Deposit "B"	Approximately 850ha 600ha
	Dewatering requirements	Required to access ore below water table
	Dewatering discharge	Normally to process plant and dust control
	Area of disturbance	4031ha (camps, infrastructure, Deposits "A" and "B" and overburden waste dumps)
	Airstrip (runway)	Approximately 2.3km
	Diesel fuelled power station	Maximum demand 7200kW
	Water pipeline (above ground)	Approximately 30km
	Location of mine accommodation village	Approximately 9km north-west of minesite
	Workforce (entire project): * Construction * Operation	 Approximately 1200 Approximately 450
	Water supply source * Construction * Operation	Turee Creek B Borefield and minesite bores Approximately 2ML/day Approximately 4-6ML/day
Railway Locations	Train movements (170 cars per train)	22 /week
	Section	Route
	Coondewanna Flats	"CALM Mt Robinson" route, unless modified according to the requirements of condition 12-1
	Karijini	Marandoo Corridor
	Hamersley Station Flats	Four Corners Bore
	Hamersley Station Flats to Lower Chichester Ranges	Dampier-Tom Price alignment
	Millstream-Chichester National Park	Hamersley Parallel route, as modified according to the requirements of condition 12-1
Port	Ship Loading	15-20Mt/a
	Ships	397/a
	Reclamation for port stockpile	44.4ha
	Wharf extension	250m
	Dredging volume	Approximately 590,000m^3
All	Greenhouse gases (CO_2)	approx. 0.140Mt/a

Definitions of units:

"/a" means per annum

"km" means kilometres;

"ML/day"' means million litres per day;

"Mt/a" means million tonnes per annum;

"m^3" means cubic metres.

"ha" means hectares (1 ha = 10,000 square metres)

"m" means metres;

"Mt" means million tonnes.

"ERMP" means Environmental Review and Management Programme

Schedule 2

Proponent's Consolidated Environmental Management Commitments

December 1998

WEST ANGELAS IRON ORE PROJECT - SHIRES OF EAST PILBARA, ASHBURTON, ROEBOURNE

(1144)

Robe River Mining Co. Pty. Ltd.

This table indicates the proponent's consolidated and modified commitments.

	Commitment (Who/What)	Objective (Why)	Action (How/Where)	Timing (When)	Whose advice	Measurement /Compliance criteria
1	Turbidity from construction of the Cape Lambert stockpile extension area will be kept below defined criteria.	To minimise turbidity generation and impacts on marine flora and fauna.	The proponent will prepare a stockpile marine extension management plan based upon constructing the external wall first using clean waste rock and then backfilling behind the wall, to the southeast of the existing stockpiles.	Prior to construction phase.	DEP	Management plan developed and implemented.
2	Maintain existing natural drainage lines where practical and minimise potential for erosion.	To minimise changes to watercourse hydrology.	The size and type of drainage structure will be determined using design methods appropriate to the region and the relevant catchments. Major crossings, being those having a 50 year design flow of >500 cubic metres a second using the RORB method, or equivalent, will be designed for no less than a normal 30 year recurrence interval. Minor crossings will be designed for no less than a nominal 20 year recurrence interval and culverts with existing waterway alignments to ensure minimal scouring or change of drainage system direction.	Pre-construction.	WRC	Plans approved by WRC and culverts built to plans.
3	Drainage Diversion Management Plans will be prepared for the minesite deposits and infrastructure.	To minimise erosion, sediment transport and turbidity.	The Plan will include, but not be limited to consideration of: • potential impacts to Mulga woodlands or other vegetation associations of conservation significance (e.g. cracking clays); • detailed engineering, topographic and hydrological assessments; • strategies to mitigate impacts; • monitoring programmes to assess impacts; and • a description of remedial actions available.	Prior to commencement of mining-related earthworks for each deposit.	WRC, CALM	Approved drainage diversion management plans developed and implemented.

	Commitment (Who/What)	Objective (Why)	Action (How/Where)	Timing (When)	Whose advice	Measurement /Compliance criteria
4	Aquifers exposed by mining will be protected from salinisation.	To ensure no significant changes to groundwater quality through evaporation.	Mining pits constructed below the watertable will be backfilled with excavated materials.	During mining operations.	WRC & DEP	Annual Performance and Compliance report.
5	The proponent will allow other mining companies to use the rail corridor.	To reduce the need for multiple service corridors through national parks.	By permitting other companies to widen cuttings and fill adjacent to the existing alignment in national ps so as to utilise the existing alignment, provided there is no cost or interference to Robe's rail operations. Along the rail alignment within national parks.	Life of project.	DRD	Provide documentation demonstrating permission given if application is made by a third party.
6	An Environmental Management Plan will be prepared and implemented and which would include but not be limited to consideration of: • cracking clay communities; • Mulga communities; • flora and fauna with special management needs; • rehabilitation; • drainage design along the railway; • fire and dust management; • implementation of relevant *aspects of* DME guidelines; • timing for implementation of commitments;	To ensure the environment is protected by consolidating environmental management requirements into one concise document.	Continue to update existing environmental management systems which would include, but not be limited to consideration of: • prevention of impacts to cracking clay communities in the minesite area by isolation from disturbance (e.g using environmental exclusion zones) and preventing the incursion of environmental weeds; • prevention of impacts to significant association of Mulga over Chenopodiaceous shrubs and hummock grasses (6adb25, site 892A), particularly by avoiding changes to surface hydrology; • management of flora and fauna species of conservation value which need special management; • rehabilitation and revegetation of disturbed areas with particular attention to incorporating species of conservation and scientific significance and locally collected seed; • drainage design along the railway at watercourse crossings and through sheet flow areas (i.e. mulga); • weed management including the minesite and railways; • fire management;	Prior to construction.	DEP	Annual Performance and Compliance report.

	Commitment (Who/What)	Objective (Why)	Action (How/Where)	Timing (When)	Whose advice	Measurement /Compliance criteria
	• reporting.		• dust management, implementation of Department of Minerals and Energy guidelines for Mining in Arid Environments, Asbestos Management in Mining, and Environmental Management of Quarries; • measures to prevent contamination of groundwater and surface waters; • an overview of timing for implementation of commitments; and • reporting requirements (including those for the Greenhouse Challenge Programme, and those noted in Section 10.2 above).			
7	Additional surveys will be undertaken to address flora, fauna and groundwater.	To minimise flora and fauna impacts associated with specific proposals.	An environmental assessment will be undertaken of: • flora and fauna along the pipeline from the borefield to the minesite area; • proposed water supply points, to ensure access tracks and associated activities do not have any adverse impact on significant flora and fauna populations; • flora at the locations of any communication repeater stations located outside corridors of biological assessment (eg on hilltops of Hamersley Ranges); • flora and fauna at quarry sites (ballast and aggregate supply) on Four Corners Bore Route; • significant areas of flora and vegetation along the proposed rail route through the Marandoo Corridor; • flora and fauna of areas where surveys have been inadequate along the rail route when the rail route alignment is pegged; and • flora and fauna along the West Angelas Minesite access road.	Prior to construction	CALM	Reports agreed to by CALM

	Commitment (Who/What)	Objective (Why)	Action (How/Where)	Timing (When)	Whose advice	Measurement /Compliance criteria
8	Assist WA Museum	to minimise and manage impacts to stygofauna around the minesite and the borefield	• sampling and identification of stygofauna species within areas where groundwater drawdown from abstraction and mine dewatering is predicted; • assessment of the conservation significance of any species found; • mapping of the local distribution of species sampled; • undertaking further sampling of the full extent of the West Angelas Jeerinah Formation if species distribution is found to be a significant issue	prior to mine dewatering and prior to groundwater abstraction from the Turee Creek B Borefield	WA Museum CALMD EP	sample results from bores provided to WA Museum, CALM and DEP
9	Bores for production and standby use in the Jeerinah Formation dolerite rocks	if further research indicates that stygofauna species present are of significant conserva-tion value	production and standby bores will be avoided as far as possible where proposed for Jeerinah Formation dolerite rock shear zones	when results from further research become available	WRC, WA Museum CALM, DEP	the number of operational water bores in the Jeerinah Formation dolerite rock shear zones
10	Bores to provide water for the construction phase	there have been no stygofauna found from bore sampling in this area	bores (including WAAPB 1 and WAAPB 2) to supply water for the construction phase will be sited in Deposit A if possible	construction phase	WA Museum CALM, DEP	water bores for construction sited only in Deposit A or where no stygofauna are present
11	Monitor production and dewatering bores for stygofauna abundance and water levels	to ensure that subterranean conditions for the protection of stygofauna are met	where stygofauna are present	throughout the life of the mine	WRC, WA Museum CALM, DEP	monitoring data to show that stygofauna in bores with populations of stygofauna are protected

	Commitment (Who/What)	Objective (Why)	Action (How/Where)	Timing (When)	Whose advice	Measurement /Compliance criteria
12	Drawdown and fauna abundance monitoring will be performed	to enable populations of stygofauna known in the named bores to be monitored for their protection	on bores WB 32, WB 41, WB 51, WB 54, and WB 58	throughout the life of the mine	WA Museum CALM, DEP	results from the monitoring of the named bores
13	Pumping rates will be re-assessed or stopped	to ensure that subterranean conditions for the protection of stygofauna are met	from water bores used for water production or dewatering	if a significant drop in stygofauna abundance is noted in conjunction with water table depression	WRC, WA Museum CALM, DEP	timely response to results of monitoring resulting in an altered regime for the protection of stygofauna species abundance
14	Alternative bores will be utilised at a distance	to ensure that subterranean conditions for the protection of stygofauna are met	where water production and related drawdown does not extend into bores containing stygofauna	when stygofauna have been found to exhibit a significant drop in fauna diversity and/or abundance due to water extraction	WRC, WA Museum CALM, DEP	water levels in bores containing stygofauna not depressed as a result of drawdown from production or dewatering bores
15	Workshops, stores and fuel depots	to prevent pollution to groundwater	will be constructed to comply with DME guidelines for the prevention of pollution to groundwater, with self-contained drainage, storage and treatment systems	construction phase	DME, DEP	all spills are collected and treated so that none enters the ground
16	Monitoring of stygofauna abundance and water table levels	to ensure that stygofauna present in the bore are protected	at the Pastoral Bore, approximately 8km west of the Turee Creek B borefield	when Turee Creek B borefield is operational	WRC, DEP, WA Museum CALM	water levels remain unaffected by water production from Turee Creek B borefield

	Commitment (Who/What)	Objective (Why)	Action (How/Where)	Timing (When)	Whose advice	Measurement /Compliance criteria
17	Further survey and monitoring will be carried out	to ensure that production bores do not have stygofauna populations and are not near enough to other bores where stygofauna may be affected	in the expanded borefield	prior to identifying production bores	WRC, DEP, WA Museum CALM	data from further surveys made available to agencies show that no stygofauna present in proposed production bores
18	Monitoring programme will be implemented (as for the mine area as described above)	to ensure that stygofauna present in the expanded borefield are protected	where stygofauna are found in the expanded borefield	prior to production from an expanded borefield	WRC, DEP, WA Museum CALM	data from the monitoring programme show results indicating no significant loss of stygofauna abundance or drawdown in water levels
19	Mine staff briefed	to ensure that aims and strategies to protect stygofauna are understood	environmental issues and management recommendations relevant to the protection of stygofauna	prior to construction phase	WA Museum CALM, DME, DEP	approved staff induction procedures
20	Flora and fauna survey data provided to government agencies in a compatible format	to enable government to consolidate data in a GIS for regional use	from the region of interest associated with the West Angelas mine proposal (including the rail route)	prior to construction and when further surveys are carried out	DEP	survey data are able to be accessed and used