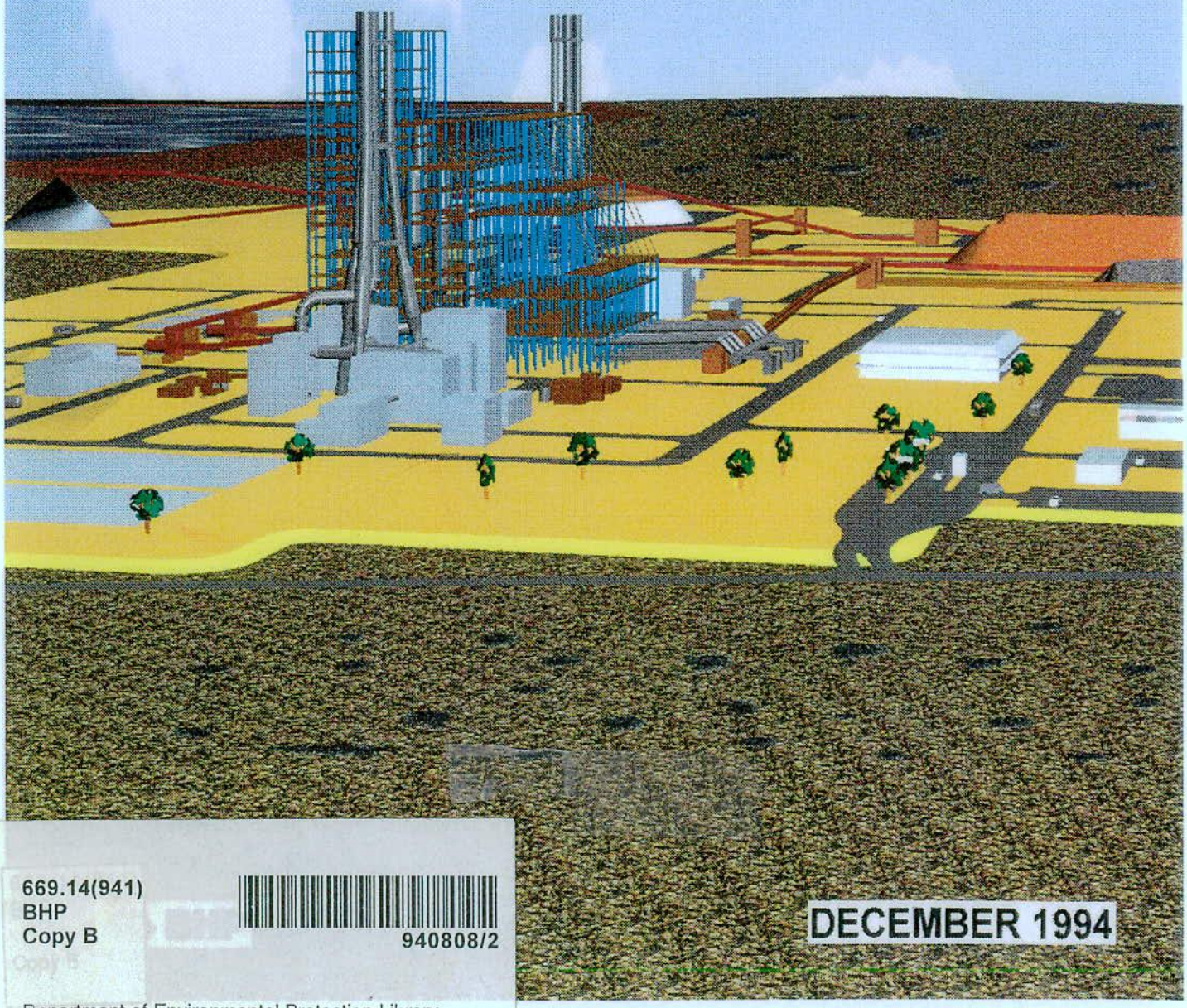
BHP Direct Reduced Iron Pty Ltd

HOT BRIQUETTED IRON PROJECT

CONSULTATIVE ENVIRONMENTAL REVIEW



DECEMBER 1994

INVITATION

The Environmental Protection Authority (EPA) invites people to make submissions on this proposal.

The Consultative Environmental Review (CER) for the proposed Direct Reduced Iron Project has been prepared in accordance with Western Australian Government procedures. The report will be available for public comment for five weeks from Monday 12 December 1994.

Comments from government agencies and from the public will assist the EPA to prepare an assessment report in which it will make recommendations to Government.

Following receipt of comments from government agencies and the public, the EPA will discuss the issues raised with the proponent and may ask for further information. The EPA will then prepare its assessment report with recommendations to government, taking into account the issues raised by the public submissions.

Why write a submission?

A submission is a way to provide information, express your opinion and put forward your suggested course of action including any alternative approach. It is useful if you indicate any suggestions you have to improve the proposal. All submissions received will be acknowledged.

Developing a submission

You may agree or disagree with, or comment on, the general issues discussed in the CER or with specific proposals. It helps if you give reasons for your conclusions, supported by relevant data. You may make an important contribution by suggesting ways to make the proposal more environmentally acceptable.

When making comments on specific proposals in the CER:

- Clearly state your point of view;
- Indicate the source of your information or argument if this is applicable; and
- Suggest recommendations, safeguards or alternatives.

Points to keep in mind

By keeping the following points in mind, you will make it easier for your submission to be analysed.

Attempt to list points so that the issues raised are clear. A summary of your submission is helpful. Refer each point to the appropriate section, chapter or recommendation in the CER. If you discuss sections of the CER, keep them distinct and separate, so there is no confusion as to which section you are discussing.

Attach any factual information you wish to provide and give details of its source.

Make sure that your information is accurate. Please indicate whether your submission can be quoted, in full or in part, by the EPA in its assessment report.

Remember to include:

Your name;
Your address; and
The date of your submission.

The Closing Date for Submission is: Monday 16 January 1995

Submissions should be addressed to:

The Chairman
Environmental Protection Authority
9th Floor "Westralia Square"
141 St George's Terrace
PERTH WA 6000
Attention: Ms Xuan Nguyen

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EXECUTIVE SUMMARY

THE PROPOSAL

BHP Direct Reduced Iron Pty Ltd (BHP DRI) proposes to build and operate a nominal 2 Mtpa (max. 3 Mtpa) Hot Briquetted Iron (HBI) plant approximately 7.5 km south-west of Port Hedland. The project will add value to iron ore mined by BHP Iron Ore and diversify and improve the economic viability of mining and processing of raw materials for export overseas.

The major elements of the project are:

- modification to the existing Finucane Island infrastructure including stockpiles, shiploader and wharf;
- an overland conveyor with a single continuous belt having the dual function of transporting iron ore from the new Finucane Island stockpiles to the HBI plant (7 km) on the lower strand and returning briquettes to Finucane Island on the upper strand;
- a HBI plant producing briquettes through the reduction of iron ore to metallic iron using natural gas;
- a concentrator, located adjacent to the HBI plant, to beneficiate (improve) the iron ore fines prior to use in the direct reduction process;
- a natural gas pipeline and power transmission line running between the Pilbara Energy Pty Ltd power station and the HBI plant, a distance of 5 km; and
- a seawater intake and distribution system. Seawater, for use in the cooling water system, will be pumped to the HBI plant through a pipeline running adjacent to the conveyor. A parallel pipe will return used cooling water to the ocean.

The cost of the project will be in excess of $750 M.

Construction of the project is scheduled to start in mid 1995 with commissioning scheduled for early 1997.

BHP DRI propose to negotiate an agreement with the Western Australian Government, to be ratified by Parliament, which will cover the development and operation of this project.

NEED FOR THE PROPOSAL

BHP Minerals Pty Ltd and other BHP Iron Ore companies currently have as part of their Agreements with the State Government a requirement to investigate the establishment of further processing of iron ore in the State.

Although ore beneficiation plants have been established at Newman and Finucane Island, sintering and steel making have historically demonstrated to be uneconomic due mainly to high energy costs. With deregulation of the WA gas industry and development of technology to produce HBI directly from iron ore fines, further processing of iron ore now appears potentially viable.

The primary use of HBI is as a scrap steel supplement feed for electric arc furnaces.

EVALUATION OF ALTERNATIVES

As part of the project development process a number of alternatives were considered with respect to technology, site selection, energy supply, water supply, brine disposal and stockpile location.

This assessment led to the selection of direct reduction as the preferred technology. The process selected allows high grade iron ore fines to be utilised directly without the need for a pellet plant. In addition, environmental impacts are reduced since the process does not produce slags which require off-site disposal and does not require the stockpiling and use of coal.

Nelson Point, Finucane Island, Newman and Boodarie Hill were assessed for location of the HBI plant and concentrator. On the basis of this assessment which included environmental issues, energy supply, proximity to ports, availability of feed stock and geotechnical considerations, the Boodarie Hill site was selected.

Fresh water supply alternatives considered for the project included the existing Water Authority supply system, the development of a new fresh or brackish water borefield and desalination using thermal or reverse osmosis. On the basis of availability and security of supply, development timing, environmental issues and costs, the existing Water Authority system was preferred.

Seawater was selected for cooling at the HBI plant due to the availability of supply. This reduced the reliance on the Water Authority System and reduced costs that would have been borne through purchase or production of fresh water.

Two options were considered for disposal of salt water cooling system brine. These were to either discharge to the harbour or disposal to

Cargill Salt for use as a feed in the salt production operation. On the basis of cost/benefit and the assessment that harbour disposal would not adversely impact the environment, harbour disposal was preferred.

Various stockpile locations were assessed against a range of environmental, economic and materials handling issues.

POTENTIAL ENVIRONMENTAL IMPACTS AND THEIR MANAGEMENT

The potential environmental issues relating to the project have been identified. Where appropriate, the existing environment relating to each issue is described and the mitigation or management of the impacts discussed.

Flora and Fauna

No flora or fauna species which have been declared as Rare under the *Wildlife Conservation* Act 1950 - 1980 are located in the project area.

Surface Water

The HBI plant and concentrator will be located within the catchment of South West Creek and are located on the fringe of the 1:100 year ARI flood plain of the creek.

Overland flow will be directed around the site.

Run-off water will be channelled into sediment traps prior to being released to natural drainage systems.

Groundwater

Groundwater at the HBI plant site is non-potable, ranging up to 52,000 mg/L total dissolved solids.

The material proposed for storage in the residue impoundment is comprised of low grade iron ore and gangue. Seepage from the impoundment will be negligible and benign, due to the low permeability of the solar dried residue and impoundment floor sub strata.

Marine

The principal potential impact that the project will have on the harbour will be due to the discharge of brine from the HBI plant cooling water system adjacent to the Finucane Island wharf.

Two methods of brine discharge are currently being evaluated. These are, discharge just below the water surface via a series of diffusers and

discharge to the bottom of the harbour. Currently surface discharge is preferred but neither method is expected to cause any significant environmental impact.

Atmospheric Emissions

The air dispersion model AUSPLUME was used to assess the impact on air quality of cumulative airborne emissions from the HBI plant and Pilbara Energy Pty Ltd power station.

Modelling demonstrated that predicted emission of NO_2, SO_2, H_2S and particulates are all below accepted EPA standards. Modelling also indicated that the HBI plant will utilise less than 10 % of the available airshed capacity.

Noise

Modelling of cumulative noise emissions for the HBI plant, concentrator, conveyor and Pilbara Energy Pty Ltd power station was undertaken based on a worst case assessment.

Noise emission levels impacting on Port Hedland, South Hedland and Wedgefield will not exceed the permissible environmental noise level under normal operating conditions.

SOCIAL CONDITIONS AND COMMUNITY CONSULTATION

Workforce

No significant impacts associated with the project workforce are expected.

The construction workforce (approx. 700 personnel) will be housed in an upgraded construction camp at Wedgefield or in a temporary camp which will be established adjacent to the HBI plant. The operations workforce (approx. 250 personnel) will be housed in existing accommodation in Port Hedland, with any additional housing requirements being dictated by market forces. The maintenance workforce (approx. 200 personnel) will be housed at the upgraded Wedgefield construction camp.

Economic Impacts

This project will be a significant contributor to the economy of the region through the creation of business and employment opportunities associated with construction and supply aspects of the project and ongoing operation of the plant. Benefits will be realised through payments to local contractors with multiplier effects extending to the local communities.

Aboriginal Heritage

A preliminary Aboriginal Heritage Survey of the project area has identified no sites of cultural significance which may be impacted by the project. However, several middens were identified which have the potential to be impacted by construction of the conveyor and pipeline.

Once final design is complete, a final survey will be undertaken to identify any sites that may be impacted. No sites will be disturbed without prior approval from the Minister for Aboriginal Affairs.

Community Consultation

A community consultation and awareness programme was initiated in August 1994 to ensure that the community and other interest groups are fully informed about the project. A full colour information brochure has been prepared and distributed and a free standing display erected in the foyer of the Port Hedland Town Council.

RISKS AND HAZARDS

A qualitative risk and hazard assessment has been conducted and appropriate control measures identified to ensure that the hazards are either minimised or eliminated.

PROPONENT COMMITMENTS

A number of commitments have been developed by BHP DRI to reduce the potential impacts of the project. These cover the pre-construction, construction and post construction phases of the project and will be implemented to the satisfaction of the relevant authorities.

1.0 INTRODUCTION

1.1 BACKGROUND, STATUS AND TIMING OF THE PROJECT

BHP Direct Reduced Iron Pty Ltd proposes to build and operate a Hot Briquetted Iron (HBI) plant of nominal 2 Mtpa capacity (max. 3 Mtpa). This document describes the project from the planning stage through to operation and discusses the environmental and social issues and how they will be managed.

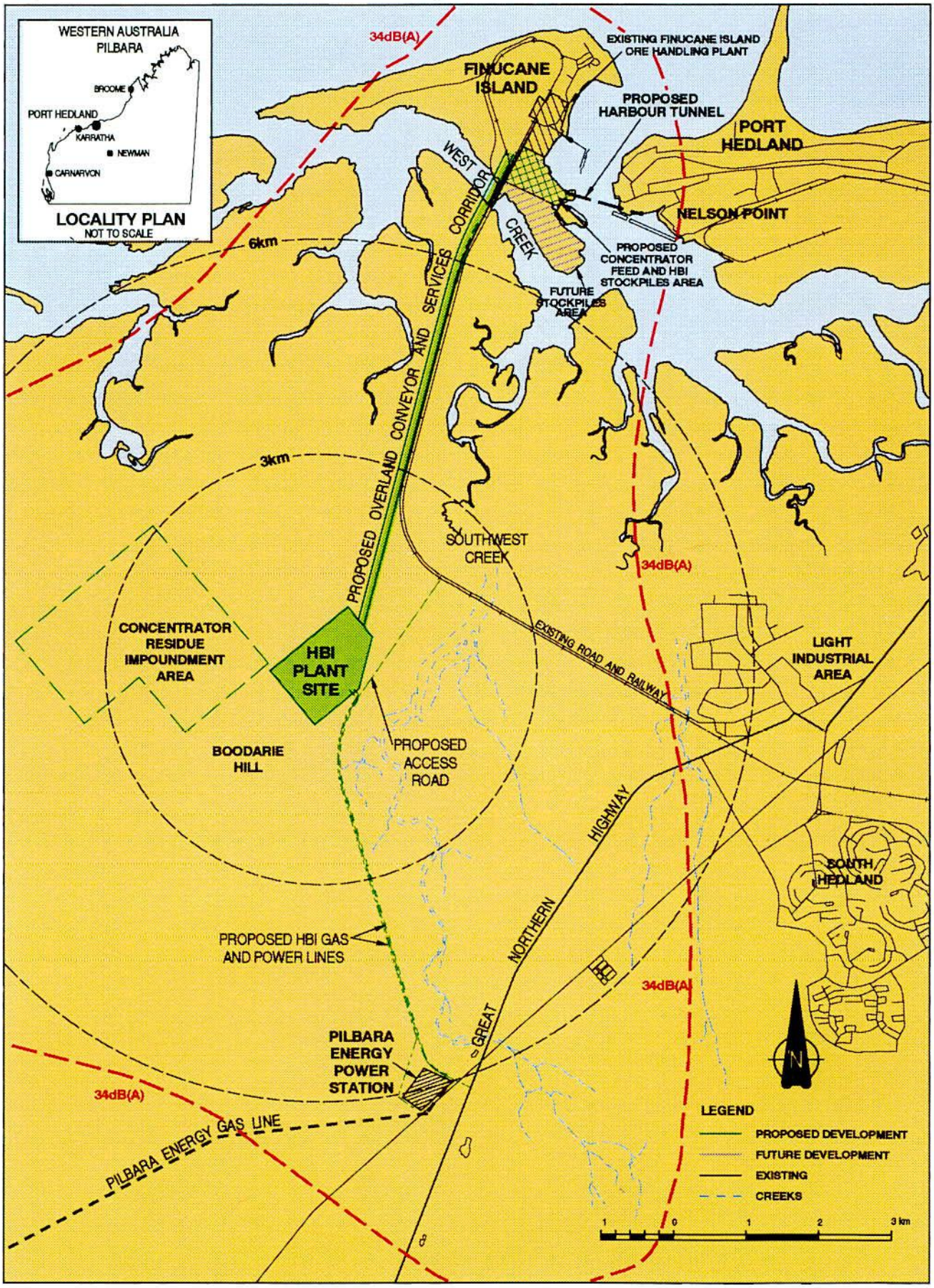
The purpose of the project is to provide a downstream processing facility for iron ore extracted from the north west of Western Australia by BHP Iron Ore. The project will add value to the raw materials mined by BHP Iron Ore and diversify and improve the economic viability of mining and processing of raw materials principally for export overseas.

The project will provide an additional consumer for natural gas from gas fields presently in operation and to be developed in the north-west. The project site selection takes into consideration the proximity to abundant supplies of natural gas and mineral resources, the established port of Port Hedland which is close to Asian markets, and the existing community support services of Port Hedland and South Hedland.

The preferred site for the HBI plant and concentrator is approximately 7.5 km south west of Port Hedland (Figure 1.1).

Subject to obtaining necessary approvals, it is planned to commence construction in mid 1995 with commissioning scheduled to start in early 1997. Consultation has occurred with all interested parties including State and Local Government Authorities, landholders, Aboriginal and community interest groups. Information gathered during this consultation assisted in definition of the preferred location of the HBI plant and concentrator, alignment of the overland conveyor, gas pipeline and transmission line corridors, and other infrastructure facilities required for the project.

PROPOSED HOT BRIQUETTED IRON PROJECT



SITE AND INFRASTRUCTURE RELATIONSHIPS AND 34dB(A) NOISE BUFFER

BHP

FIGURE 1.1

1.2 THE PROPONENT

The proponent for the project is BHP Direct Reduced Iron Pty Ltd (BHP DRI), a 100 % owned subsidiary of The Broken Hill Proprietary Company Limited.

Head office for BHP DRI is located at:

200 St Georges Terrace
Perth WA 6000.

BHP DRI is responsible for the planning, design, construction and eventual ongoing operation of the plant and its associated facilities.

1.3 HISTORY OF BHP AT PORT HEDLAND

BHP's involvement in Port Hedland started in the mid 1960's when the two joint venturers, Mt Goldsworthy Mining Associates and the Mt Newman Joint Venture, commenced iron ore export operations. Port developments that were initiated at this time to accommodate the fledgling industry included the dredging of an expanded approach channel and turning basin, land reclamation and the construction of wharves for loading iron ore. The first shipment of iron ore from Mt Goldsworthy Mining Associates occurred in 1966 and from the Mt Newman Joint Venture in 1969. By 1984 the port was the largest in Australia in terms of tonnage of shipping handled per year.

In 1985/86 development dredging of the approaches to, and within, the harbour took place. The costs of dredging, the upgrading of navigation aids and the deepening of berths was met by the Mt Newman Joint Venture.

Currently BHP Iron Ore companies manage the Nelson Point (Port Hedland) processing and port facilities, handling ore from mines at Mt Whaleback, Jimblebar, and Yandi, and the Finucane Island facilities (also at Port Hedland) handling ore from Nimingarra and Yarrie. The ports handle more than 50 Mtpa of crushed lump and fines and have a combined stockyard capacity of 8 Mt. The Companies supply ore to 14 countries including Japan, South Korea, Taiwan and China as well as to BHP's Australian Steelworks.

1.4 ENVIRONMENTAL RESPONSIBILITY

BHP Iron Ore has a long term commitment to Port Hedland and, as a result of its philosophy towards responsible development, has initiated a number of recent projects which have the objectives of increasing the knowledge of the local environment, providing information that will be useful in quantifying present and future

impacts of its activities on the local environment and allowing improved mitigation of these impacts. Of note are the following:

- Port Hedland Harbour Environmental Study which was initiated in 1992 with the objective of collating all information available on the harbour and initiating a monitoring programme which will allow any future impacts on the harbour to be qualified and minimised;

- installation of dust monitoring and control systems at Nelson Point and Finucane Island to assess and reduce fugitive dust emissions originating from the ore stockpiles and other dust sources on the site;

- initiation of a programme during 1993 to rehabilitate East Creek;

- initiation of a programme to improve storm and washdown water management on the Nelson Point site with the objective of reducing fresh water demand; and

- upgrading of waste oil and oily water management procedures.

1.5 RELEVANT LEGISLATION AND THE APPROVAL PROCESS

BHP DRI proposes to negotiate an agreement with the Western Australian Government, to be ratified by Parliament, which will cover the development and operation of this project. The agreement will comply with all relevant laws and regulations.

1.5.1 Environmental Impact Assessment

The Environmental Protection Authority (EPA) examined the BHP DRI proposal in August 1994 and elected to formally assess the project at the level of a Consultative Environmental Review (CER). Guidelines for the preparation of the CER were issued by the EPA in September 1994 and are reproduced in Appendix A.

This document has been prepared in accordance with the guidelines provided by the EPA. It is being released for public review for a period of five weeks. During this period government agencies, private organisations and the public are invited to make submissions to the EPA. The EPA will evaluate the CER, the submissions received and the proponent's response to those submissions, and make recommendations to the Minister for the Environment on the acceptability of the proposal and the conditions which should apply if the development is to proceed. The public may appeal the EPA Report and Recommendations to the Minister. Only after the

Minister has set Environmental Conditions may other authorities give approvals and allow construction to commence.

The environmental assessment process for this proposal is shown in Figure 1.2.

1.5.2 Relevant Legislation and Policies

The development and operation of the project will be subject to a variety of Local, State and Commonwealth legislation, including:

- *Environmental Protection* Act 1986 (Amended 1994);
- *Mines Regulation* Act 1946;
- *Mining* Act 1978;
- *Conservation and Land Management* Act 1984;
- *Aboriginal Heritage* Act 1972;
- *Water Authority* Act 1984;
- *Explosives and Dangerous Goods* Act 1961 - 1986; and
- *Dangerous Goods Regulations* 1992.

1.6 STRUCTURE OF THIS DOCUMENT

This document has been structured to allow the key environmental and social issues arising from the project to be identified and assessed, and to detail proposals for the mitigation and management of those impacts.

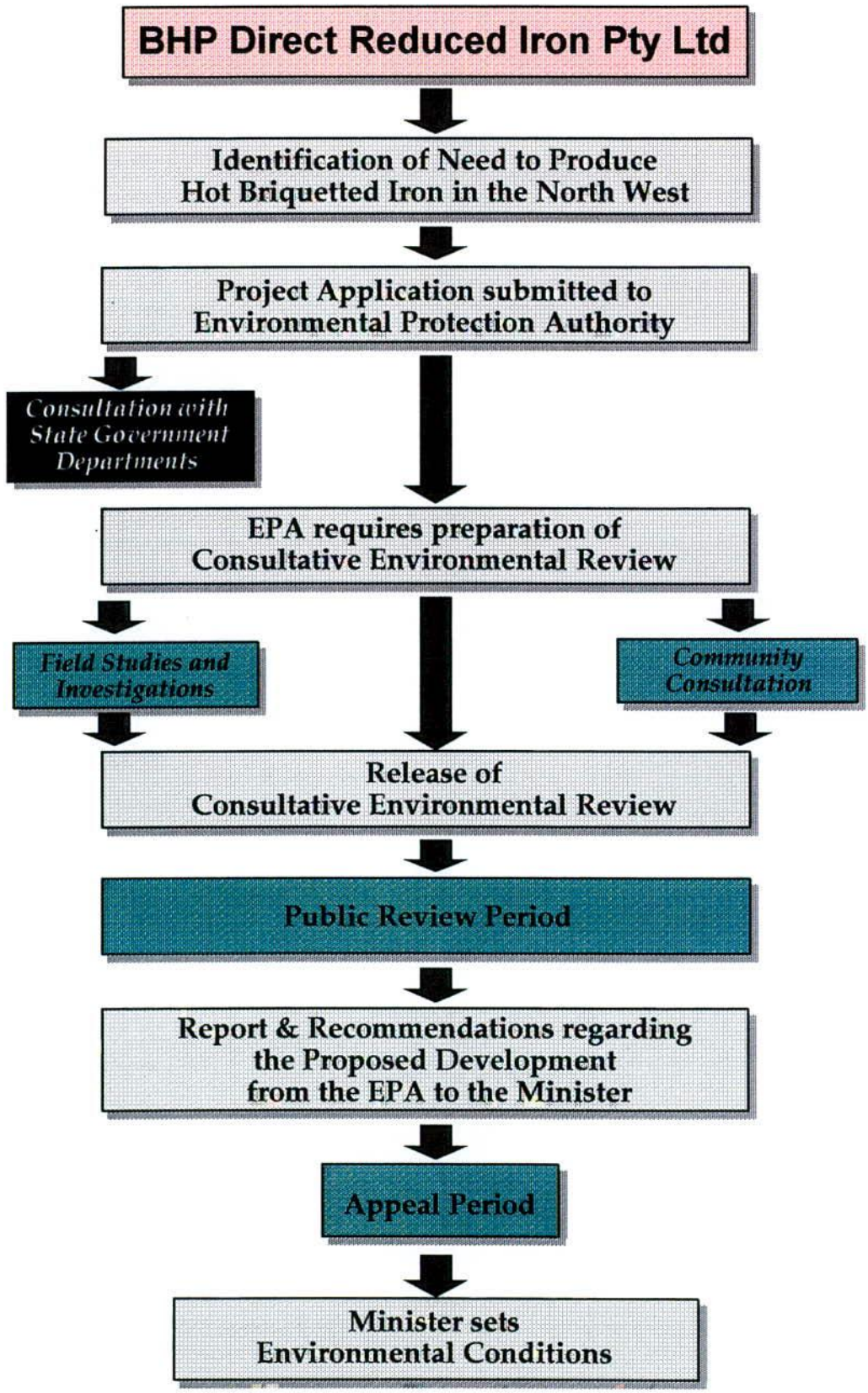
Descriptions of the physical, biological and social environments are focused on the areas likely to be impacted and, where necessary, these descriptions are placed in a local and regional context.

Section 2.0 of this CER details the need for the project and Section 3.0 outlines the alternatives considered for technology, location, energy supply, water supply and waste disposal for the project.

Section 4.0 describes the proposal in detail whilst Section 5.0 outlines the potential environmental impacts and their management. The social conditions and the process of community consultation which is in progress is described in Section 6.0 and a risks and hazards assessment is provided in Section 7.0. A list of Proponents commitments is provided in Section 8.0.

Specialist documents covering the areas of flora, fauna, noise, hydrology and atmospheric emissions have been provided to the DEP. The essential information of relevance to the HBI project is summarised in the CER.

PROPOSED HOT BRIQUETTED IRON PROJECT



ENVIRONMENTAL ASSESSMENT PROCESS

BHP

FIGURE 1.2

2.0 NEED FOR THE PROJECT

2.1 BACKGROUND

BHP Minerals Pty Ltd and other BHP Iron Ore companies have had as part of their Agreements with the State Government the requirement to investigate the establishment of further processing of iron ore.

Over the many years that iron ore has been mined by BHP, several alternative further processing options have been assessed. These included:

- ore beneficiation (1979, 1988);
- sintering (1982, 1988, 1991);
- conventional steelmaking using a blast furnace (1987, 1989);
- direct reduced iron using MIDREX and Iron Carbide technology (1988); and
- COREX smelt reduction (1988).

Although ore beneficiation plants have been established at BHP Iron Ore operations at Newman and Finucane Island (Port Hedland) to upgrade the ore, sintering and steelmaking proved uneconomic mainly due to high energy costs and the remoteness of the plants from the customer (transport is a major cost).

With the deregulation of the gas industry in Western Australia and the proximity of the developing Asian market to Port Hedland, further processing of iron ore has become potentially viable.

During 1993 and 1994, BHP reassessed the various iron and steel making technologies and assessed product type acceptability in the international market place.

The availability of technology to produce HBI directly from iron ore fines has led to the current proposal to develop a HBI plant at Port Hedland.

HBI is a scrap steel supplement feed for electric arc furnaces.

2.2 BENEFITS TO THE NATION, STATE AND LOCAL REGION

The purpose of the project is to provide feed for an emerging market and the growing demand from electric arc furnaces. Through meeting this demand, iron ore fines will be processed to a stage of

higher value consequently increasing the returns from the minerals mined in Western Australia.

2.2.1 National Benefits

Australia's balance of payments will potentially improve through the production of a value-added mineral that would otherwise be exported in its unprocessed form and at a much lower return from overseas consumers.

2.2.2 Benefits to Western Australia

The benefits to Western Australia will include:

- increased royalties from the sale of additional iron ore;
- increased employment and training opportunities;
- encouragement in the growth of ancillary industries in WA;
- increased usage of natural gas derived from the gasfields in the State and indirect value-adding to that natural resource tapped locally;
- a presence in the international market, taking advantage of the State's proximity to the South East Asian iron and steel industry where an increasing number of manufacturers use electric arc furnace technology and import a large component of their raw materials (scrap, HBI); and
- additional infrastructure development.

2.2.3 Benefits to the Local Region

Benefits to the Local Region will include:

- provision of direct business, employment and training opportunities for the communities in the Pilbara during the construction, operation and maintenance phases; and
- economic multiplier effects to other local businesses.

2.3 THE 'NO-PROJECT' OPTION

The 'no-project' option would result in iron ore exports remaining status quo and a likely decline in the price of fines due to the absence of further processing and value-adding.

This option would result in the compounding of a number of undesirable issues which have been recognised in Australia's minerals extraction industry, namely;

- loss of employment and training opportunities to overseas HBI suppliers and downstream processors;
- the inability to improve export earnings from the natural resources extracted;
- inflexibility and inability to exploit Australia's close proximity to arc furnace technology users in the South East Asian iron and steel industry; and
- loss of a new industry together with the associated developments and ancillary industries that would flourish in support.

3.0 EVALUATION OF ALTERNATIVES

3.1 INTRODUCTION

As part of the project development process a number of alternatives were considered with respect to the technology, siting of the HBI plant, energy supply, water supply, brine disposal and stockpile locations. These alternatives are discussed below.

3.2 ALTERNATIVE TECHNOLOGY

A number of alternative technologies were assessed in determining the most appropriate process for the production of direct reduced iron.

For each process, evaluation of product type and acceptability in the market place led to the selection of fine ore direct reduction as the preferred technology. Unlike other reduction technologies such as MIDREX, the process selected allows high grade iron ore fines to be utilised directly without the need for a pellet plant. This results in a reduction in operating costs and consequently increases the competitiveness of the product.

In addition, environmental impacts are reduced since the process does not produce slags which require off-site disposal and does not require the stockpiling and use of coal as is required in COREX and conventional steel making.

3.3 ALTERNATIVE SITES

Four sites were assessed for the location of the HBI plant (Figure 1.1). These were:

- Nelson Point;
- Finucane Island;
- Boodarie Hill; and
- Newman.

The sites were considered against a variety of criteria which included:

- geotechnical - selection of the Nelson Point and Finucane Island sites would involve considerable additional expense in ground stabilisation;
- availability of infrastructure;

- energy and gas supply - the Boodarie Hill site is the closest site to the proposed Pilbara Energy Pty Ltd power station;
- proximity to ports - the Hedland sites are all close to an existing port;
- water supply; and
- environmental - the Boodarie Hill site is a greenfields site located close to an industrial park proposed by the Western Australian Government and remote from residential areas. There is also adequate capacity for possible future expansion.

On the basis of the assessment, the Boodarie Hill site was selected as the preferred site for the HBI plant.

Newman was also considered as a potential site for the concentrator. However, selection of this site would place restrictions on the project since only Newman fines could be processed without additional rail infrastructure being constructed.

3.4 ENERGY SUPPLY ALTERNATIVES

Natural gas is essential in the process and is the lowest cost energy source available to the project. The proposed HBI plant will make use of natural gas supplied via Pilbara Energy Pty Ltd.

3.5 WATER SUPPLY ALTERNATIVES

3.5.1 Fresh Water Resources in the Region

Groundwater is the most viable fresh water source in the region.

Fresh water (potable) is supplied to the Port Hedland area by the Water Authority of Western Australia (Water Authority) from borefields located in the Yule and De Grey River catchments. These aquifers presently have an identified unused capacity.

Undeveloped fresh groundwater resources have been identified in the West Canning Basin by the Water Authority and the groundwater section of the Department of Minerals and Energy. These resources are located about 120 km east of Port Hedland.

While these reserves of groundwater exist, there is no surface water in the area which is viable for development.

3.5.2 Seawater Resources

Seawater resources for process cooling in the HBI plant can be supplied from the harbour at Finucane Island, approximately 7 km north of the site.

3.5.3 Water Quality Requirements

The project has requirements for water for a range of purposes. The water needs of the project, the required water quality and the preferred water sources are summarised in Table 3.1:

Table 3.1 Water Quality Requirements

Facility/Area	Water Quality Required	Selected Option: Proposed Source
HBI Plant		
Process cooling water	Options include: • fresh water with evaporative cooling • desalinated sea or brackish water with evaporative cooling • fresh water with indirect seawater cooling	Fresh water: from existing Water Authority sources Seawater: pumped from Finucane Island
Machinery cooling water	Very high quality required for machinery protection	Boiler quality water: produced by deionising fresh water from existing Water Authority sources
Process steam production	Boiler quality required	Boiler quality water: produced by deionising fresh water from existing Water Authority sources
Concentrator		
Process	Fresh water required for product quality	Fresh water: from existing Water Authority sources and generated in the HBI plant
Residue Disposal	Options include fresh, brackish and seawater	Fresh water: from existing Water Authority sources
Other		
Drinking	Fresh	Fresh water: from existing Water Authority sources
Ablution	Fresh	Fresh water: from existing Water Authority sources
Washdown	Fresh	Fresh water: from existing Water Authority sources

...cont'd

Table 3.1 Water Quality Requirements (cont'd)

Facility/Area	Water Quality Required	Selected Option: Proposed Source
Landscape Irrigation	Fresh	Fresh water: from existing Water Authority sources
Dust Suppression	Fresh for product quality at stockpiles	Fresh water: from existing Water Authority sources

3.5.4 Water Supply Alternatives

A range of fresh water supply alternatives were considered for the project including:

- use of fresh water from the existing Water Authority borefields (Yule/De Grey) via a connection to the water distribution system at Port Hedland;
- production of fresh water from seawater using either thermal desalination or reverse osmosis treatment;
- development of a new fresh water borefield (West Canning Basin approximately 120 km east of Port Hedland); and
- development of a brackish water borefield (approximately 90 km east of Port Hedland) with treatment at the project site using either thermal desalination or reverse osmosis to provide the fresh water requirements.

Factors considered in the evaluation included availability and security of supply, development timing, environmental issues and costs.

Taking into account the above factors and the project water quality requirements in Table 3.1, the following water sources are proposed for the nominal 2 Mtpa HBI plant:

- fresh water from the existing Water Authority system.

  Negotiations are proceeding between the proponent and the Water Authority on the terms and conditions of a water supply Agreement (Section 3.5.5); and

- Seawater pumped from Finucane Island.

  Advice has been sought from the Port Hedland Port Authority on the requirements for a seawater intake in the harbour.

3.5.5 Water Authority Supply

The existing BHP Iron Ore operations in Port Hedland at Nelson Point and Finucane Island are supplied by the Water Authority under the Mt Newman and Goldsworthy Agreements respectively.

Based on a capital contribution to the Water Authority, the Agreements specify maximum annual and peak daily allocations and consumption charges.

Approximately half the existing combined allocation is used. It is proposed to use some of the remaining allocation for the project. No expansion to existing or new freshwater borefields are required for the projects estimated water demand.

Should the project expand in the future, the alternative water supply options (Section 3.5.4) would be re-evaluated to meet the additional requirements.

3.5.6 Water Conservation

A significant objective is to reduce the demand for fresh water from the existing developed sources to a practical minimum by using alternative sources where viable and by the adoption of water conservation practices for the project.

The measures proposed to reduce demand on the region's fresh water resources are summarised in Table 3.2 below:

Table 3.2 Fresh Water Conservation

Facility/Area	Fresh Water Conservation Measures
HBI Plant	
Process cooling water	A hybrid system of recirculating fresh water in contact with the process and seawater heat exchangers to cool the fresh water has resulted in a fresh water reduction of about 3 Mm^3pa.
Process modifications	Change in Benfield operation to modify the process from a net consumer of fresh water to one where condensate is recycled as boiler quality water, reducing fresh water demand by about 0.8 Mm^3pa.
Concentrator	
Residue Disposal	Fresh water demand decreased by reducing the moisture content of residue slurry to a practical minimum.
Other	Collection and recycling of fresh water from wash down etc.

With a view to further savings in fresh water, the use of seawater for residue disposal was considered. However, to satisfy product quality requirements, seawater cannot be introduced into the ore processing

area of the concentrator thus minimising the potential for fresh water savings.

The use of fresh water for residue disposal has an added advantage in that it will eliminate salinity problems thus simplifying rehabilitation of the residue impoundment area.

Air cooling was considered as an alternative to fresh water (boiler quality)/seawater cooling at the HBI plant. Completed investigations indicate that air cooling is not technically or economically viable. However, this aspect is noted for further investigations during detailed design.

Details of the proposed water supply systems are discussed in Section 4.6.

3.6 BRINE DISPOSAL ALTERNATIVES (COOLING WATER BLOWDOWN)

3.6.1 Overview

With an objective of reducing the demand for fresh water from the Water Authority supply system to a practical minimum, it is proposed to use a hybrid water cooling system at the HBI plant (refer Section 4.6).

In summary, the system incorporates:

- A primary cooling water circuit for machinery, gas and process cooling. Demineralised water is used to remove excess heat.
- A secondary cooling water circuit using seawater. The seawater is used to remove heat from the primary cooling water circuit via demineralised water - seawater heat exchangers.

Water in the primary and secondary cooling circuits does not come into direct contact.

Cooling of the seawater is achieved by evaporation from cooling towers, resulting in an increase in the salinity of the water used to a brine (blowdown) up to four times the salinity of the raw seawater feed.

It is proposed to produce boiler quality water for the HBI plant by treating fresh water in a demineralisation plant. The demineralisation plant produces a saline waste stream during regeneration cycles.

It is estimated that approximately 4,000 m^3 per day of brine will require disposal from the HBI plant cooling system and

demineralisation plant at a temperature about 4°C above the receiving seawater. Future expansion of the plant may result in the discharge volume doubling.

Following a preliminary review of potential options for brine disposal, which included the option of discharging directly to South West Creek, two alternatives were selected for more detailed assessment. Factors considered included environmental issues, costs, security and risks. The alternatives are discussed below.

3.6.2 Disposal to Port Hedland Harbour

The first option is to dispose of brine off the Finucane Island wharf to Port Hedland harbour.

Facilities required for disposal of brine from the HBI plant cooling system to the harbour would include:

- a pumping system at the HBI complex;
- approximately 9 km of pipeline to the harbour for discharge to deep water (dredged area); and
- a manifold to allow discharge at either the surface or bottom of the water column.

On the basis of cost, and the assessment that harbour disposal would not adversely impact the environment, this option is preferred.

The potential impacts of this option are discussed in Section 5.7.

3.6.3 Disposal to Cargill Salt

Cargill Salt produces salts at Port Hedland by the solar evaporation of seawater in ponds leaving the salts to be harvested, processed and exported.

In consultation with Cargill Salt personnel, options for the disposal of the brine as a feed for salt production were reviewed.

It was determined that the facilities required could include:

- a pumping system at the HBI complex and approximately 20 km of pipeline to the Cargill Salt site; and
- the construction of an approximately 80 ha solar evaporation pond at the Cargill Salt site. To accommodate operational requirements, the pond would likely be constructed in a low lying coastal area currently partly vegetated with mangroves.

The cost and operational risks associated with this option are unfavourable.

3.7 ALTERNATIVE STOCKPILE LOCATIONS

Various material handling and stockpile locations were assessed against a range of factors, including:

- blending requirements;
- surge and buffer requirements;
- existing operations (Nelson Point and Finucane Island) and facilities;
- optimised and integrated feed and materials handling scenarios;
- environmental considerations; and
- economic and longer term considerations.

Stockpiles are required for iron ore fines (concentrator feed), concentrate (HBI plant feed) and HBI product.

On the basis of the assessment, the following stockpile locations are proposed:

Iron Ore Fines

It is necessary to transfer iron ore fines from Nelson Point to the concentrator feed (buffer) stockpile at the Boodarie site.

The rate of transfer of iron ore from Nelson Point to Finucane Island is several times the transfer rate from Finucane Island to the concentrator at Boodarie.

Blending capability is required ahead of the concentrator feed stockpile. This cannot be viably provided at Nelson Point.

For primarily security of operation, material handling optimisation and economics, it is not prudent or viable to operate a continuous conveyor system between Nelson Point and the concentrator stockpile.

To satisfy the above requirements, it is necessary to incorporate a stockpile at Finucane Island for blending and buffer storage.

Materials handling and stockpile dust suppression will be in accordance with the recently upgraded Nelson Point facilities, minimising the potential for any increased dust loading to residential areas.

Future developments may require additional stockpile area and this has been provisionally identified at Stanley Point (Figure 4.3). The potential future acquisition of this area would be the subject of a separate assessment.

Concentrate

A concentrate stockpile is required at the HBI plant as a buffer storage.

The concentrate will be damp with a consequent low dust generation potential.

Hot Briquetted Iron

An emergency hot briquetted iron stockpile (product) is required at the HBI plant site.

The briquettes are compressed and are not a dust source.

4.0 DESCRIPTION OF THE PROPOSAL

4.1 OVERVIEW

The proposed HBI plant will be based on one of a group of processes collectively known as direct reduction. Direct reduction is a relatively low temperature pyrometallurgical process which converts iron ore to metallic iron without passing through a molten phase.

Unlike high temperature iron production processes, such as the conventional blast furnace or COREX, the proposed HBI plant does not produce slags which require off-site disposal nor does it require the stockpiling and use of coal. The process also eliminates the need for coke ovens and sinter plants as well as producing less greenhouse gases.

The HBI product will be pillow shaped briquettes, each weighing about 0.5 kg and having dimensions 90 mm long, 50 mm wide and 30 mm thick. The primary use of HBI is as a feed material in the steel making process known as electric arc steel making.

Iron ore used in the HBI plant will be obtained from existing BHP Iron Ore mining operations. The grades of iron ore proposed for processing in the HBI plant require improvement in order to produce a grade of HBI suitable for sale to the international market. Upgrading of the supplied iron ore will occur in a concentrator using conventional gravity and magnetic techniques.

The nominal output of the proposed HBI plant will be 2 Mtpa of HBI from four reactor trains of nominal 0.5 Mtpa capacity each. Future expansion, which will be dictated by market requirements, may see the plant increase production to a nominal capacity of 4 Mtpa.

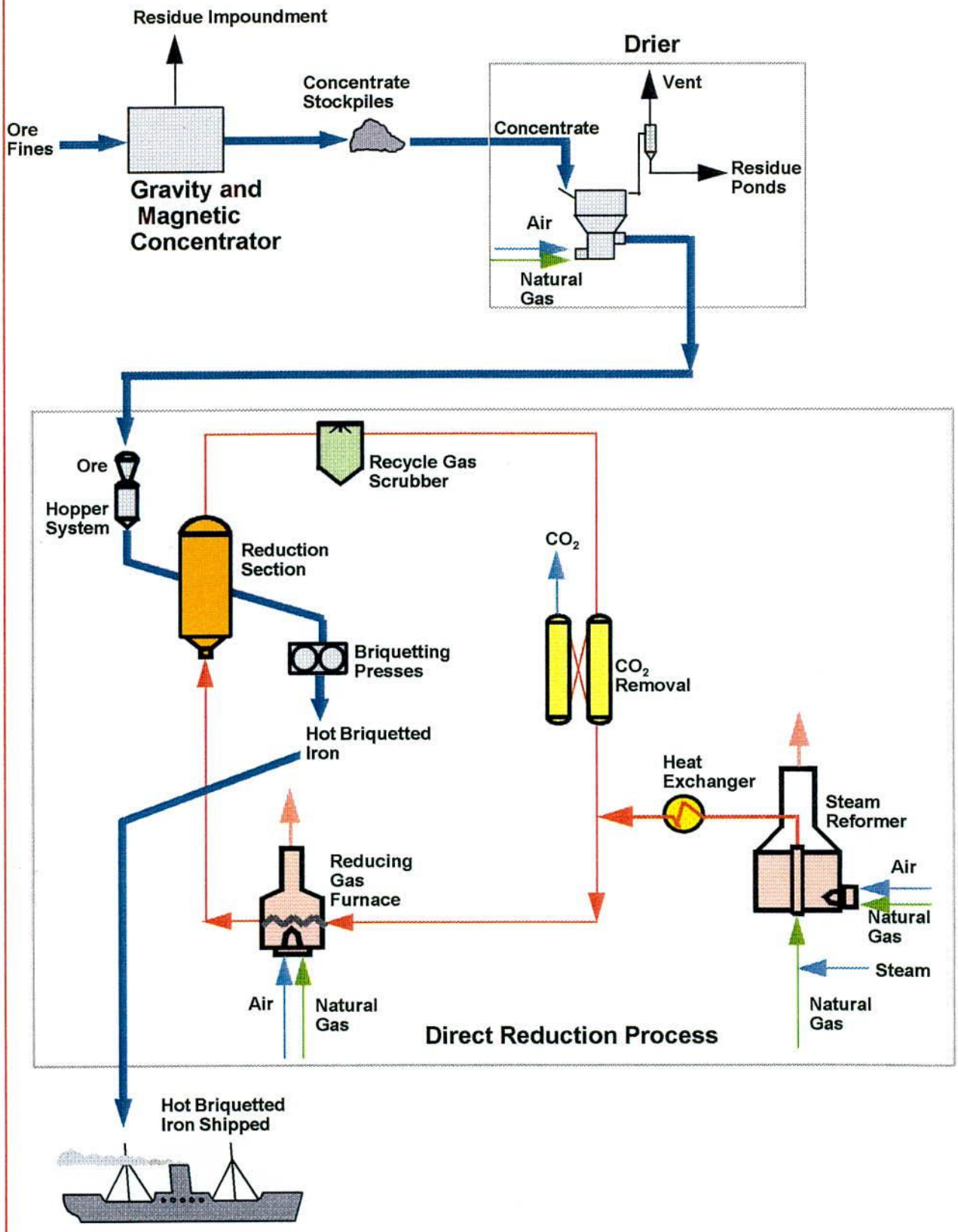
It is proposed to locate the HBI plant and concentrator approximately 7 km from Finucane Island. The HBI plant and concentrator will cover an area of approximately 120 ha. A brief description of the unit operations is given below. The site and infrastructure relationships are presented in Figure 1.1.

4.2 HBI PLANT

The HBI plant consists of an iron ore reduction section in which iron ore has the oxygen removed by modified natural gas. The gas stream is then recycled through a gas preparation, cleaning and recirculation system. The process is shown in Figure 4.1.

In the reduction process, ore is heated and progressively reduced to metallic iron. The overall chemistry of reduction is illustrated by the chemical reactions:

PROPOSED HOT BRIQUETTED IRON PROJECT



SCHEMATIC OF HBI PRODUCTION

BHP

FIGURE 4.1

$$Fe_2O_3 + 3CO \quad \rightarrow \quad 2Fe + 3CO_2$$

$$Fe_2O_3 + 3H_2 \quad \rightarrow \quad 2Fe + 3H_2O$$

The metallic iron leaving the reduction plant will be compacted into briquettes and then cooled prior to being discharged to product stockpiles.

Natural gas entering the HBI plant will be used as a fuel in gas turbines, reformer and gas heaters and, following preparation, as a source of make-up reduction gas. The make-up gas will be combined with cleaned, recycled process gas and passed to the reduction section.

Cleaning of the recycled process gas involves quenching the hot (500°C) process gas in a direct water contact cooler followed by removal of dust and condensed water vapour in a wet venturi scrubber. After recompression, CO_2 is removed by passing the gas through a scrubbing column filled with potassium carbonate solution. The CO_2 removal step is a well known and widely practised industrial unit operation known as the *Benfield Process*.

During regeneration, CO_2 from the *Benfield Process* is released to atmosphere.

Following cleaning, the process gas is reheated to the temperature required for the reduction reaction (850°C) in a natural gas fired furnace prior to being reused.

4.3 CONCENTRATOR

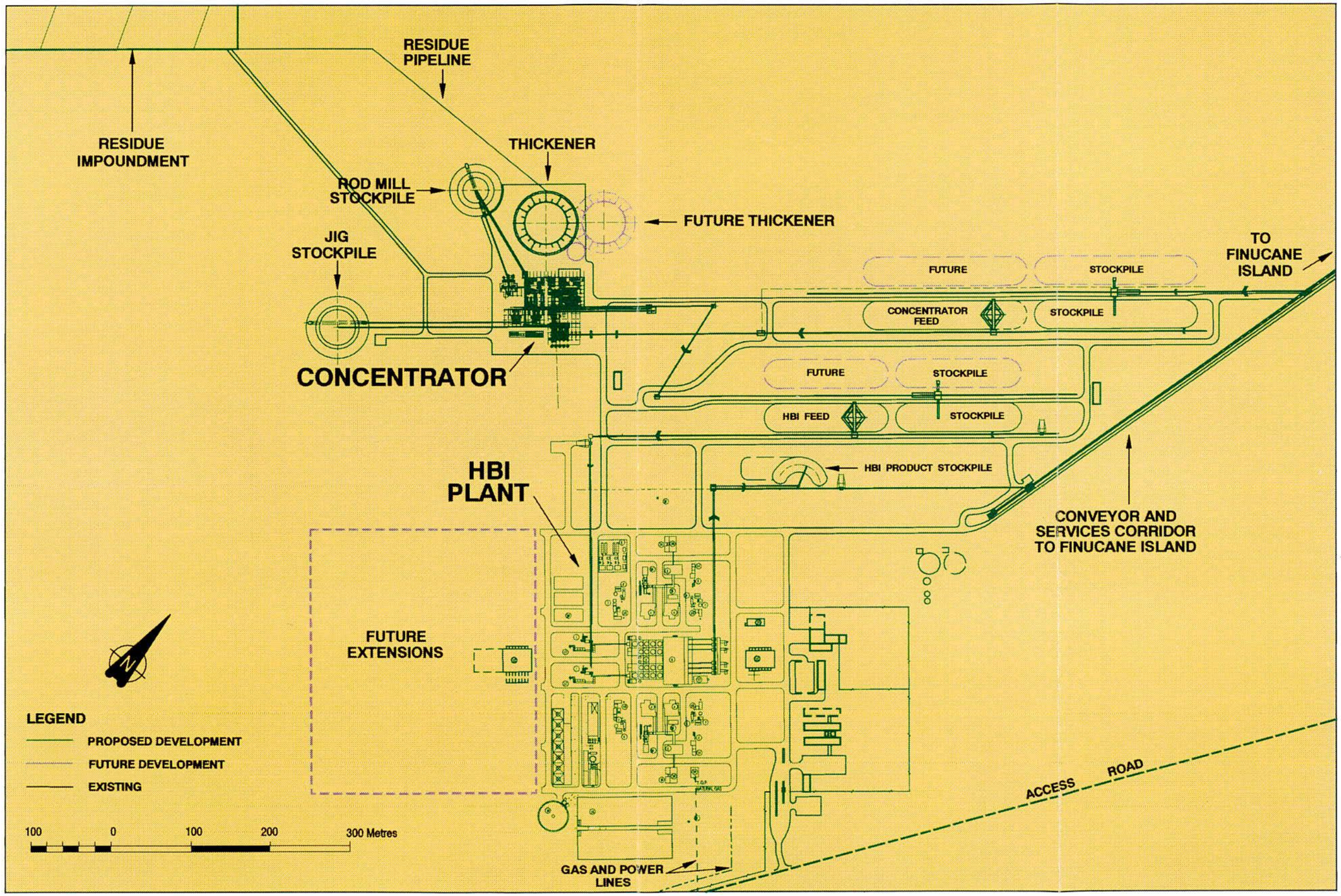
The concentrator and associated feed and product stockpiles will be located adjacent to the HBI plant site as shown in Figure 4.2 and Plate 1.

The coarsest fractions of the concentrator feed will be beneficiated (improved) in jigs within which a slurry of ore and water is stratified by water pulses produced with controlled pulses of low pressure air. The stratification process enables the separation of higher grade (higher density) fractions from lower grade (lower density) fractions.

Finer fractions will be beneficiated in spiral separators which also separate on the basis of a difference in particle density. Material too fine to be amenable to spiral separation will be beneficiated by magnetic concentration with material too fine for magnetic concentration remaining unbeneficiated.

Rejects from all beneficiation circuits will be thickened in a thickener and discharged to the residue storage impoundment as a slurry at approximately 48 % water (w/w).

PROPOSED HOT BRIQUETTED IRON PROJECT



HBI PLANT AND CONCENTRATOR

BHP

FIGURE 4.2

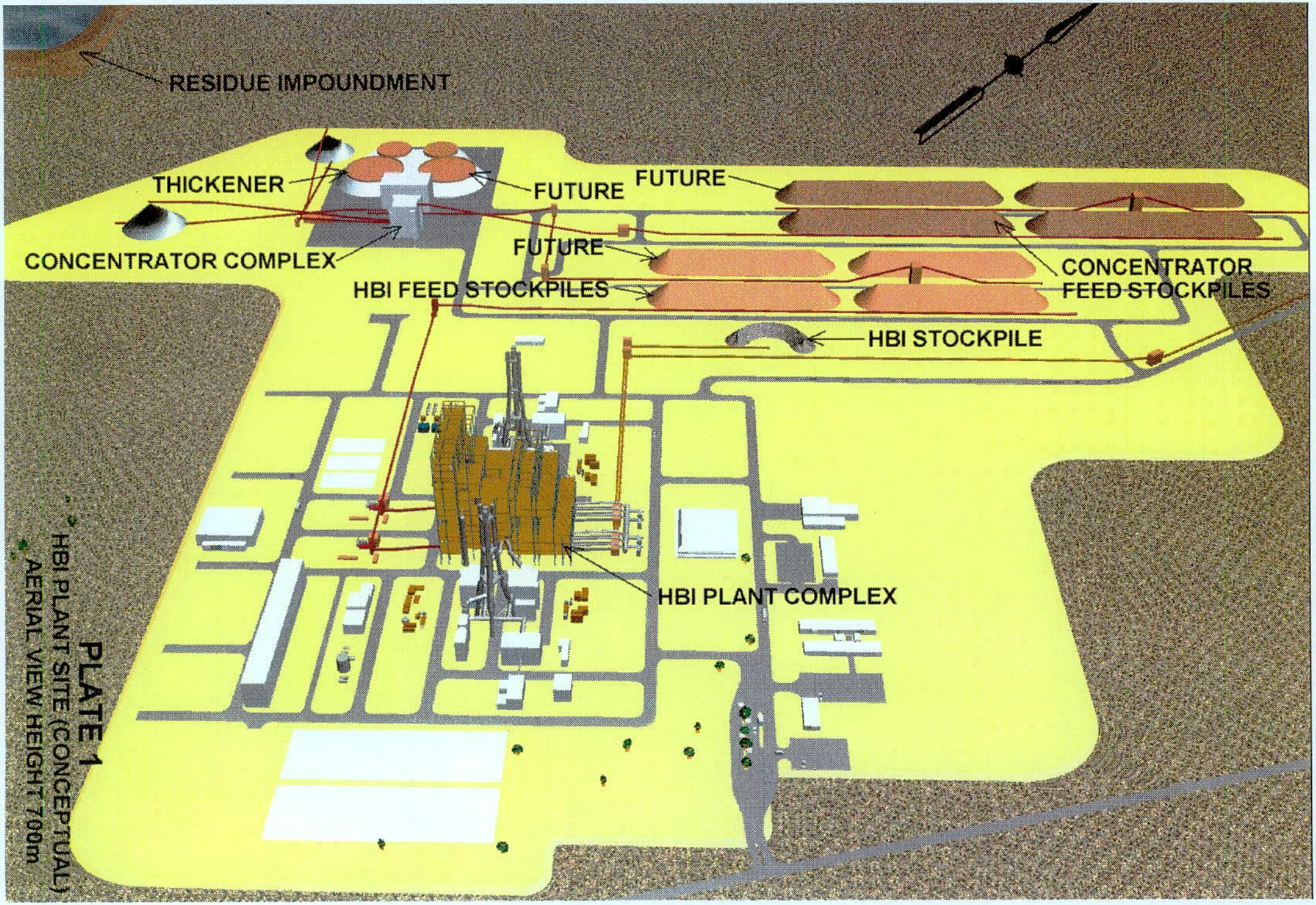


PLATE 1
HBI PLANT SITE (CONCEPTUAL)
AERIAL VIEW HEIGHT 700m

4.4 PORT MODIFICATIONS

For the initial production of a nominal 2 Mtpa of HBI, modification to the existing port infrastructure will be restricted to widening of the Finucane Island wharf to accommodate an access road and the upgrade or replacement of the shiploader. A new stockpile area will be established on cleared land to the west of the wharf (Figure 4.3).

Nelson Point iron ore fines will be delivered to Finucane Island by a below harbour tunnel and conveyor system (Figure 4.3). The tunnel is a separate project and does not form part of this assessment.

Ship movements will increase by approximately 3 to 4 per week which is within the existing capacity of the Finucane Island berth.

Should production increase to a nominal 4 Mtpa, the wharf would be extended to the south, and a new mooring dolphin would be constructed to the south of the extension. It is not envisaged that any additional dredging would be required.

4.5 OVERLAND CONVEYOR

It is proposed to construct an overland conveyor between the new Finucane Island stockpile area and the HBI plant at Boodarie, a distance of approximately 7 km (Figure 1.1).

The conveyor will have a single continuous belt with the dual function of transporting iron ore from Finucane Island to the HBI plant on the lower strand and returning briquettes to Finucane Island on the upper strand. To protect the belt from solar exposure, the conveyor will be covered.

The conveyor corridor will run adjacent to the Finucane Island road and railway and consist of an earth fill causeway approximately 50 m wide.

The conveyor corridor will include a service road, and HBI plant seawater makeup and brine disposal pipelines. The corridor will be fenced to restrict public and animal access.

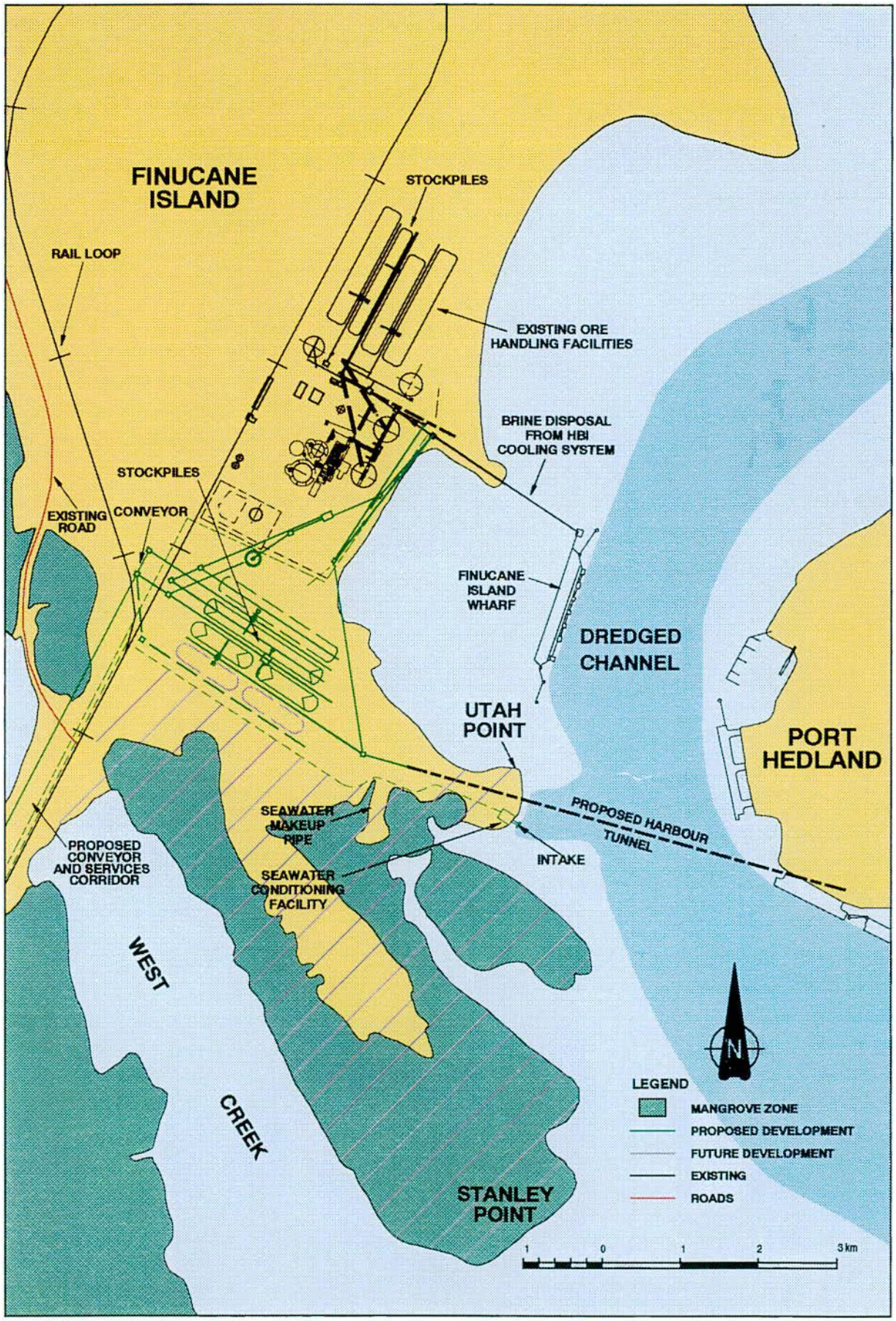
4.6 WATER SUPPLY

4.6.1 General

The project has a requirement for both fresh water and seawater makeup. Deionised water for process purposes will be produced on-site by treating fresh water in a demineralisation plant.

The proposed water supply system is shown in Figure 4.4.

PROPOSED HOT BRIQUETTED IRON PROJECT

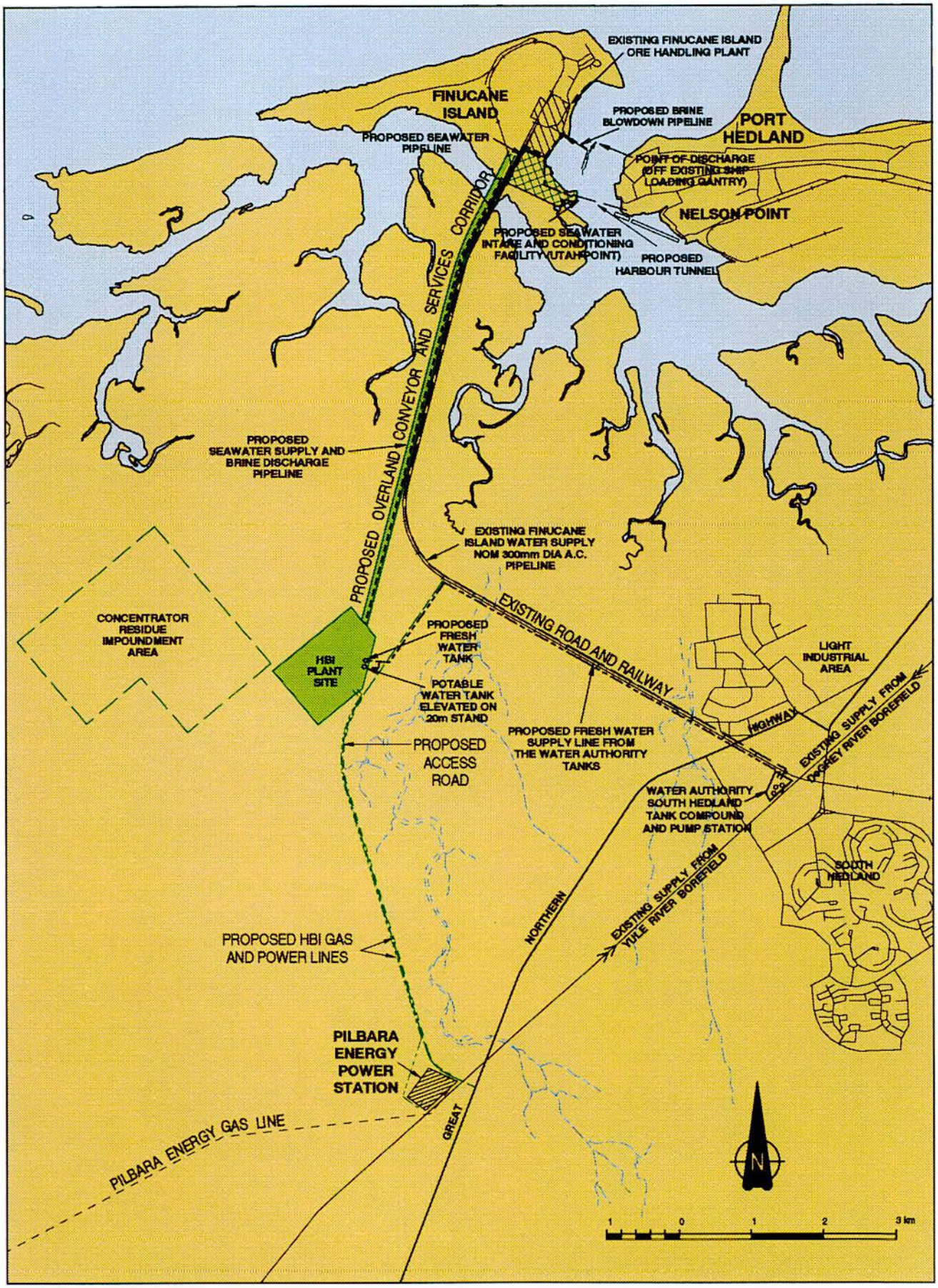


FINUCANE ISLAND FACILITIES

BHP

FIGURE 4.3

PROPOSED HOT BRIQUETTED IRON PROJECT



WATER SUPPLY GENERAL ARRANGEMENT

BHP

FIGURE 4.4

4.6.2 Fresh Water Makeup

It is proposed to draw fresh water makeup for the project from the existing Water Authority system under the terms and conditions of a water supply Agreement between BHP DRI and the Water Authority.

Fresh water requirements for the project include:

- process needs at the HBI plant and concentrator;
- dust suppression;
- residue disposal;
- domestic (potable) use;
- washdown; and
- landscape irrigation.

It is proposed to install on-site a process and industrial purposes water storage tank to provide security of supply (approximately 0.5 days demand) and to reduce the peak demand on Water Authority facilities.

A separate tank at the HBI plant is proposed for domestic (potable) supply.

4.6.3 Reformed Gas Feed Condensate (De-ionised Water)

The Benfield process is a proprietary unit operation used to remove CO_2 from the process gas. In its normal configuration, the process is a net consumer of steam (fresh water).

Modifications are proposed to the system's operating conditions which will result in the process being "water neutral". Water which would have been condensed from the reformed gas by the Benfield unit is now condensed before the unit.

This condensate will approach boiler water quality and is suitable for use in the HBI process as make-up replacement. It is estimated that approximately 0.8 Mm^3 pa will be produced for use, reducing demand on the Water Authority supply system.

4.6.4 Seawater Supply

Seawater will be used for secondary cooling in the HBI plant.

A seawater intake structure is proposed for Utah Point to the south of the existing Finucane Island wharf (Figure 4.3).

The seawater intake will include:

- a causeway with piled end structure (about 30 - 40 m long) constructed from the shore to deep water in the dredged area of the harbour;
- screened water intake pumps installed on the piled structure with a pipeline to the shore based facilities; and
- shore based conditioning facilities incorporating additional screening units, chlorine production and dosing facilities and pumps.

Conditioned seawater will be pumped to the HBI plant cooling water system (Section 3.6) via a pipeline installed in the conveyor service corridor adjacent to the existing road and rail access to Finucane Island.

The cooling system at the HBI plant will incorporate seawater cooling towers and heat exchangers.

Cooling will be achieved by evaporation of seawater from the cooling towers, resulting in a progressive increase in salinity. When the salinity reaches about three to four times that of natural seawater, water will be released from the system (blowdown) as a brine, being replaced with makeup seawater.

It is proposed to install a pipeline from the plant to the harbour to dispose of the brine adjacent to the Finucane Island wharf.

4.6.5 Water Balance

An overall objective in the water system design is to minimise fresh water demand. Methods proposed to achieve this objective include:

- use of seawater for secondary cooling;
- modification of the process so that the system becomes a producer, rather than a consumer, of water. It is proposed to use this water in the concentrator; and
- installation of facilities to collect and re-use fresh water to the maximum extent practical.

The water balance for the project is summarised in Figure 4.5.

The estimated peak demand on the Water Authority system is 11,000 - 12,000 m^3pd. The estimated peak demand for seawater is 15,000 m^3pd.

4.6.6 HBI Plant Site Water Distribution

It is proposed to install three separate water distribution systems, namely:

- a fresh water system for process requirements at the HBI plant and concentrator, and for dust suppression and fire fighting purposes;
- a seawater system for secondary cooling at the plant; and
- a potable water system to meet drinking and ablution requirements.

All systems will be designed and operated in accordance with prevailing Australian standards.

4.7 POWER AND GAS SUPPLY

The power requirements for the facility will normally be supplied by two gas turbine generator sets (32 megawatts each) located at the HBI plant site and running as a base load operation. The generators will be electrically linked with the Pilbara Energy Pty Ltd gas fired power station (approximately 5 km away) to allow flexibility for power draw (Figure 1.1).

The gases discharged from the turbines will be used within the HBI process to improve overall thermal efficiency.

It is proposed that the natural gas pipeline will run between the Pilbara Energy Pty Ltd power station and the plant within a service corridor in common with the power transmission line. The pipe will be buried.

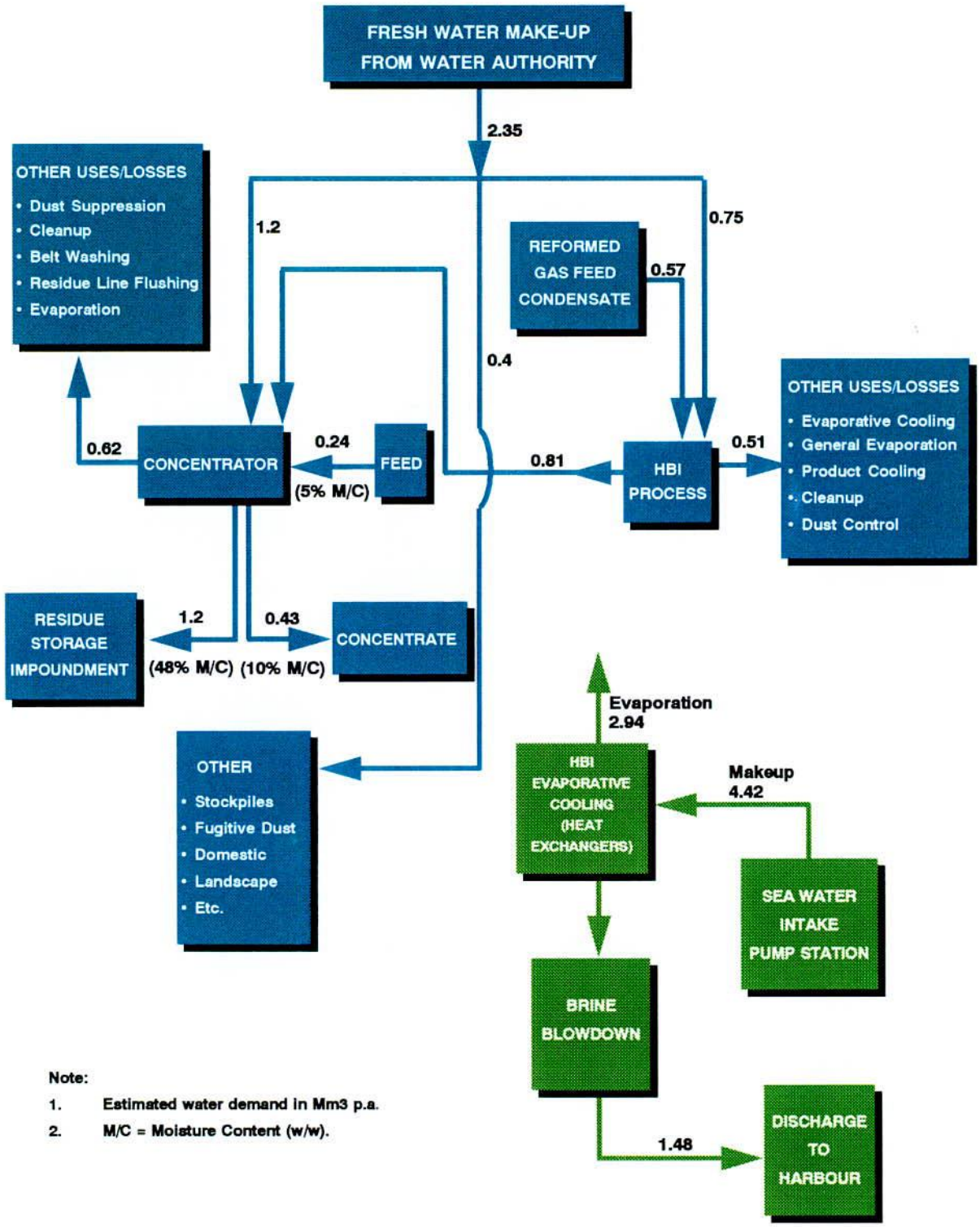
Transmission line poles will be 12-15 m high and spaced approximately 150 - 200 m apart.

4.8 PLANT INFRASTRUCTURE

4.8.1 Roads

HBI plant and concentrator site roads will be sealed. It is proposed to construct an access road from the Great Northern Highway, near the

PROPOSED HOT BRIQUETTED IRON PROJECT



Note:

1. Estimated water demand in Mm3 p.a.
2. M/C = Moisture Content (w/w).

WATER FLOW DIAGRAM FOR NOMINAL 2 MTPA HBI PRODUCTION

BHP

FIGURE 4.5

Pilbara Energy Pty Ltd power station, past the HBI plant to the Finucane Island road.

All roads will be designed in accordance with prevailing Standards. Roads will be classified according to road function and traffic type with formation widths, design speeds and pavement strength set accordingly.

4.8.2 Utilities

Utility requirements will include distribution of electricity, gas, water and other services.

4.8.3 Administration Facilities

Administration facilities will include workshop, warehousing, administration, training, first aid, security and laboratory buildings.

4.8.4 Sewage

The estimated site sewage volume of 16,000 m^3 per year will be treated in a biological treatment plant.

It is proposed to recycle treated effluent for landscape irrigation.

4.9 WORKFORCE

4.9.1 Construction Workforce

The construction phase of the project is estimated to employ up to 700 people for approximately 20 months.

The workforce will be either housed in the existing construction camp in Wedgefield (expanded) or a new temporary camp will be constructed.

Camp facilities will be managed and operation in accordance with prevailing local government and other relevant requirements including approved domestic wastewater management provisions.

4.9.2 Operations Workforce

The operations workforce is expected to be around 250 people. The plant will operate 365 days per year on 2 shifts of 12 hrs each.

The workforce will be housed in Port Hedland.

4.9.3 Maintenance Workforce

Maintenance will be conducted on an ongoing basis with each of the 4 reactor trains undergoing a maintenance programme for 2 weeks on 2 occasions each year.

For maintenance, specialist contractors will be employed, with a workforce of approximately 200. It is proposed to accommodate the maintenance workforce at the upgraded Wedgefield construction camp.

4.10 RAW MATERIALS

The process inputs to the HBI plant and concentrator are:

Table 4.1 Raw Materials

Material	Use	Annual Consumption
Process		
Iron ore fines	Process feed stock	5.4 Mt
Natural gas	Reductant/fuel	31 PJ
Magnesium oxide	Prevention of product agglomeration within the process	10,500 t
Dimethyldisuphide	Reduction vessel corrosion inhibitor	100 t
Graphite emulsion	Mould release agent for briquetting machines	1,700 t
Zinc oxide	Desulphurise natural gas	12 t
CO_2 Removal System		
Potassium carbonate	CO_2 removal	52 t
Diethanolamine	Benfield process solution activator	6 t
Potassium nitrite	Maintains corrosion protection	2 t
UCON	Antifoam	0.4 t
Vanadium pentoxide	Corrosion protection	1.6 t
CO_2 Desulphurisation System		
Iron chelate	Desulphurise CO_2 prior to atmospheric release	11 t
Potassium hydroxide	pH stabilisation	7 t
Bioside	Solution stabilisation	50 kg
Surfactant	Solution stabilisation	1 t
Boiler Feed-water Preparation		
Eliminox	Oxygen scavenger	2.5 t
Hydrochloric acid	Ion exchange regenerant	1,600 t

...cont'd

Table 4.1 Raw Materials (cont'd)

Material	Use	Annual Consumption
Sodium hydroxide	Ion exchange regenerant	1,800 t
Transport Plus	Water treatment	1.8 t
Water Treatment		
Corrosion inhibitor	Primary (fresh) cooling water corrosion Inhibition	17 t
Polyacrylamide	Flocculation of fine residue	200 t
System Maintenance/Refurbishment		
Ammonium Nitrate	Briquetting press refurbishment	unknown
Nickel on magnesium aluminate	Replacement pre-reformer catalyst	6 t
Chrome oxide/copper oxide on hemitite	Replacement shift reactor catalyst	35 t
Cobalt oxide/molybdenum oxide on aluminate	Replacement hydrogenation catalyst	2 t
Nickel on magnesium aluminate	Replacement primary reformers catalyst	6 t

It is proposed to deliver Nelson Point iron ore fines via the below harbour tunnel and conveyor system to BHP facilities on Finucane Island (Figure 4.3). From here the fines will be delivered to the concentrator via an overland conveyor, a distance of approximately 7 km.

Natural gas will be supplied through a buried pipeline from a connection point near the Pilbara Energy Pty Ltd power station (Figure 1.1), a distance of approximately 5 km.

Other raw materials will be supplied by truck.

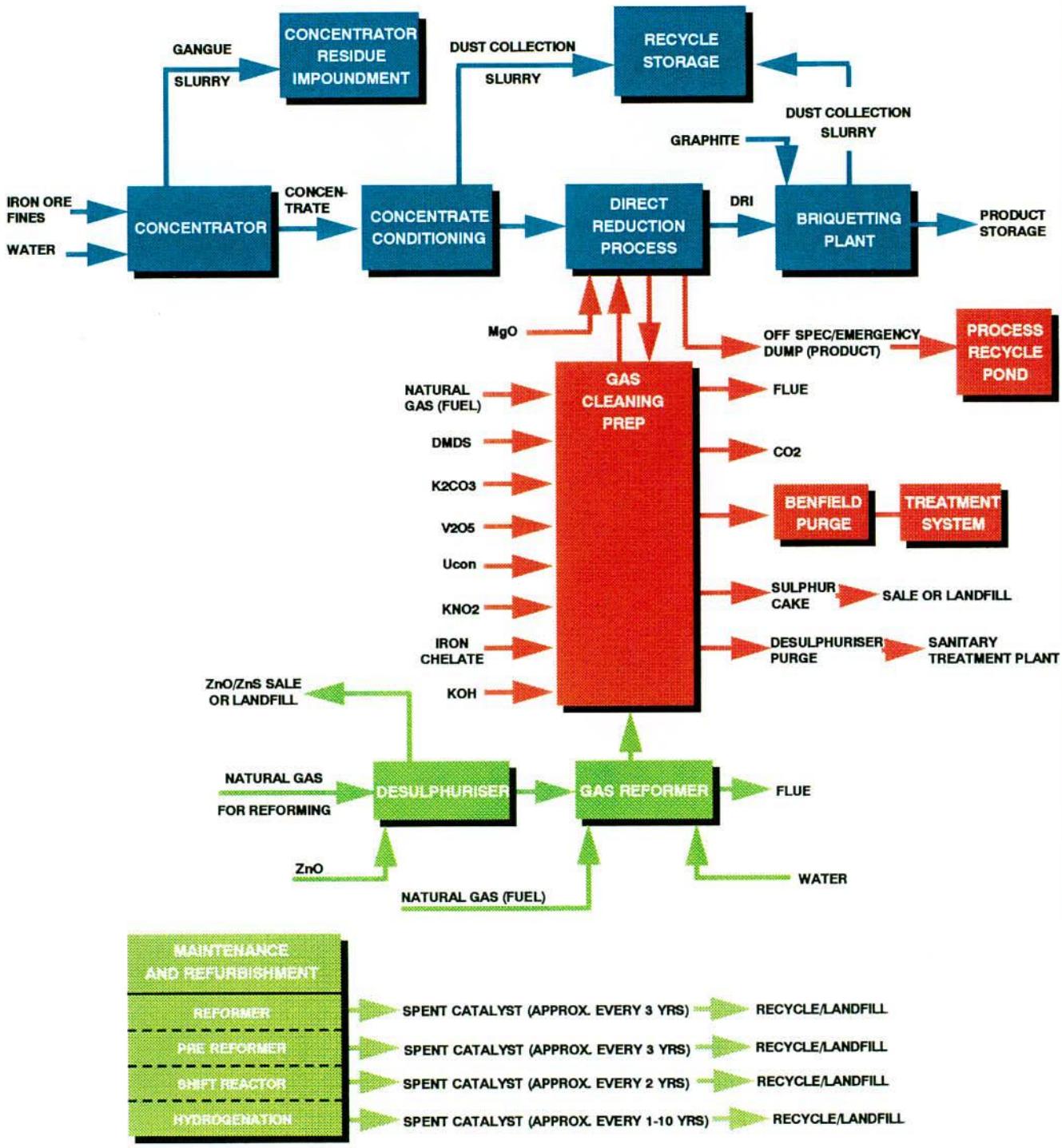
A materials flow diagram is shown in Figure 4.6.

The plant will use several potentially hazardous chemicals including magnesium oxide powder, potassium carbonate powder, diethanolamine, vanadium pentoxide, corrosion inhibitor, sodium hydroxide, hydrochloric acid, potassium hydroxide, chelated iron and zinc oxide.

To minimise the potential for any spillage from the site entering the natural environment, a three stage management approach is proposed:

- all chemicals will be handled and stored in a manner consistent with the *Explosives and Dangerous Goods* Act 1961-1986 and the *Dangerous Goods Regulations* 1992. This would include the bunding of any areas where storage or mixing will occur;

PROPOSED HOT BRIQUETTED IRON PROJECT



RAW MATERIALS FLOW DIAGRAM

BHP

FIGURE 4.6

- the emergency response plans for the operation will incorporate training, equipment and procedures consistent with managing a spill of the materials held on site (Section 5.8); and

- the stormwater drainage system for the HBI plant site (Section 4.15) will incorporate interceptor traps which will provide emergency containment for spillage and/or spillage washdowns.

4.11 ATMOSPHERIC EMISSIONS

4.11.1 Types

Atmospheric emissions from the HBI project will occur from two main source categories:

- stacks emissions; and

- fugitive emissions.

Stack emissions from the HBI plant will include sulphur dioxide, oxides of nitrogen, hydrogen sulphide, carbon dioxide, and particulates.

Fugitive emissions are limited to particulates and are grouped into lift-off and non lift-off sources. Lift-off sources include stockpiles and unsealed areas while non lift-off sources include materials handling (conveyor, transfer chutes) and vehicle movement.

4.11.2 Stack Emissions

Stack emission levels are predicted to be as follows:

Table 4.2 Stack Emissions

	Emission Rate tpa (weight/NCM)				
Source (no. units)	**Sulphur Dioxide**	**Nitrogen Oxides**	**Hydrogen Sulphide**	**Carbon Dioxide**	**Particulates**
Briquetting cooling exhaust stack (1)	negligible	negligible	-	negligible	300 (25 mg)
Briquetting dust collection wet scrubber (2)	negligible	negligible	-	26,000 (0.23 kg)	30 (30 mg)
CO_2 removal stack (4)	-	negligible	1.7 (5 mg)	670,000 (1.85 kg)	negligible
Cooling tower exhaust (1)	negligible	negligible	-	negligible	negligible

...cont'd

Table 4.2 Stack Emissions (cont'd)

	Emission Rate tpa (weight/NCM)				
Source (no. units)	Sulphur Dioxide	Nitrogen Oxides	Hydrogen Sulphide	Carbon Dioxide	Particulates
Dessicant regeneration stack (2)	negligible	negligible	-	200 (0.23 kg)	negligible
Hot flare (2)	negligible	negligible	-	890 (0.22 kg)	negligible
Materials handling dust collection bag house (2)	negligible	negligible	-	negligible	10 (25 mg)
MgO system ore feed bin vent filter (2)	negligible	negligible	-	negligible	2
Ore drier dust collection (2)	negligible	negligible	-	106,000 (0.06 kg)	56 (25 mg)
Oxide system ore feed bin vent filter (2)	negligible	negligible	-	negligible	2 (25 mg)
Reducing gas furnace stack (4)	17.7 (4.9 mg)	730 (203 mg)	-	615,000 (0.17 kg)	negligible
Reformer stack (2)	5.5 (1.7 mg)	650 (203 mg)	-	550,000 (0.16 kg)	negligible

The plant has been designed to minimise airborne emissions.

Fine solids contained within the gas streams exiting the reduction and briquetting stages will be collected in dust collection systems prior to discharge of gas to the atmosphere.

All gas emissions will be monitored to ensure compliance with regulatory requirements set as a condition of licence.

The environmental impact of atmospheric emissions is discussed in Section 5.9.

4.11.3 Fugitive Emissions

Locations within the HBI development where fugitive emissions may occur include stockpile areas at Finucane Island and the HBI site, conveying and transfer systems, road networks and general open or unpaved areas.

The estimation of emissions from fugitive sources is difficult and qualitative. Hence estimations have not been attempted in this report. However, the main causes, and therefore management, of these emissions are well understood as a result of the dust

management upgrade program currently in progress at Nelson Point and Finucane Island facilities.

Lift-off emissions from stockpiles and open areas occur when wind speeds exceed 6 m/s and the exposed surfaces are below the moisture content to inhibit lift-off. A major study by BHP Iron Ore was completed in 1992 which investigated the causes and solutions to stockpile lift-off. The findings of this study formed the basis of the development of the world class automatic stockpile watering system at Nelson Point. This system was commissioned in mid 1994 and results have shown the effective minimisation of lift-off from material stockpiles.

Emissions from the handling of materials generally occur when material is transferred from one process to another. These transfers include conveyor to conveyor (transfer point), conveyor to stockpile (stacking) and stockpile to conveyor (reclaiming).

Transfer point emissions occur as a function of enclosure design and material moisture contents. Stacking and reclaiming emissions are related to material drop distances and moisture contents.

Emissions from road systems are a function of the amount of material on the surface of the road and the number of vehicles travelling on that surface.

4.12 SOLID BYPRODUCTS AND RESIDUES

4.12.1 HBI Plant

A raw materials flow diagram for the HBI plant and concentrator is presented in Figure 4.6. This incorporates the major raw material inputs (Table 4.1) and the solid byproduct and residue outputs (Table 4.3).

Table 4.3 Solid Byproducts and Residues

Material	Origin	Composition	Annual Production
Dust slurry	Ore drier and oxide handling	Iron oxides	57,000 t
Dust slurry	Briquetting dust collection scrubber	Metallised iron	34,000 t
Dust slurry	Recirculating fresh water cooling system	Iron oxide	57,000 t
Concentrator residue	Concentrator rejects	Shale, ore	1.2 Mt

...cont'd

Table 4.3 Solid Byproducts and Residues (cont'd)

Material	Origin	Composition	Annual Production
Sulphur cake	Benfield process de-sulphuriser	Sulphur	55 t
Spent de-sulphurisation catalyst	Natural gas de-sulphuriser	ZnS:ZnO 20:80	13 t
Spent gas preparation catalyst	Reformer	Nickel on magnesium aluminate substrate	6 t
Spent gas preparation catalyst	Shift reactor	Chrome oxide/copper oxide on hematite substrate	35 t
Spent gas preparation catalyst	Hydrogenation reactor	Cobalt/ molybdenum catalyst	2 t
Spent gas preparation catalyst	Pre-reformer	Nickel on magnesium aluminate substrate	6 t

The fate of the major outputs from the HBI plant is summarised below.

Direct Reduction Process

- MgO: incorporated in product.
- Graphite: incorporated in product.
- Dust collection (iron oxide): recycled on site.
- Off spec products/emergency dump: recycled on site.

Gas Cleaning Preparation

- Benfield purge: various treatment system options are under investigation.
- Desulphuriser purge: discharged to the site biological sewage treatment plant.

Maintenance and Refurbishment

A primary objective is to recycle spent catalysts to the relevant suppliers. The viability of this is under investigation.

Should recycling not prove viable, it is proposed to dispose to either land fill or to the concentrator residue storage impoundment.

4.12.2 Concentrator Residue Storage

For the nominal 2 Mtpa HBI production it will be necessary to treat some 5 Mtpa of iron ore fines in the concentrator. Approximately 1.2 Mtpa of residue will result from the concentrator process.

Residue is the gangue separated from the concentrator feed ore and consists mainly of low grade iron ore, silica, alumina and shales and a low concentration of polyacrylamide flocculant used in the thickening process.

It is proposed to pump the residue as a slurry (approximately 48 % w/w water) to a residue storage impoundment. The impoundment areas is west of the HBI plant (Figure 1.1).

As part of the investigation programme, boreholes and test pits were constructed in the impoundment area to ascertain hydrogeological and geotechnical properties. The site is underlain by a layered sequence of alluvial clayey sands. The clayey sands gradually become more cemented with depth. Depth to groundwater at the site varies between about 4-5 m below natural surface levels with a low gradient towards the coast. Groundwater is saline, varying between about 13,000 and 52,000 mg/L TDS.

Several methods were considered for the disposal of residue including downstream, centreline and upstream construction.

The 'upstream' method is proposed based on a range of considerations including:

- the area required for the impoundment is less than the other options;
- the volume of imported fill for embankment construction is less than the other options therefore reducing the requirement for borrow pits and additional land disturbance;
- the deposited residue gains strength and stability through solar drying and consolidation, reducing the potential for seepage losses and erosion; and
- the impoundment is progressively increased in height on an "as required" basis, deferring expenditure.

Upstream Method Concept

The 'upstream method' of residue storage involves:

- construction of a low starter embankment using select fill from within the impoundment area;
- depositing residue within the impoundment and allowing it to sun dry and consolidate;
- using predominantly dried residue borrow to raise the embankment walls on a staged basis, as additional storage is required; and
- ongoing rehabilitation as the impoundment is raised and cells decommissioned.

Impoundment Construction, Layout and Size

The residue impoundment will be constructed in stages. The initial impoundment will occupy approximately 100 ha with starter embankments constructed to an average 2.5 m above ground level. The impoundment will be compartmentalised into four cells by internal dividing walls. Residue will be deposited to each cell on a rotation basis, facilitating solar drying and consolidation. When the initial impoundment is filled, the embankment walls will be raised.

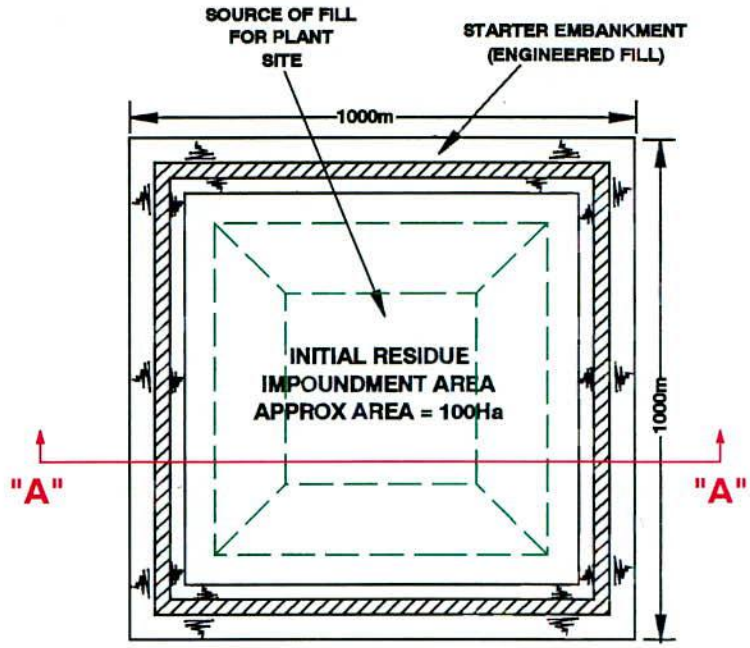
A schematic layout of the impoundment is shown in Figure 4.7.

Based on the estimated residue generation rate and average deposited density in the residue impoundment, the residue storage area will require progressive development to provide about 0.5 Mm^3pa of additional storage capacity for the nominal 2.0 Mtpa HBI production. The impoundment area has been sized for an average annual rate of embankment rise of about 1 m.

It is proposed that the ultimate height of the impoundment will be 10-12 m above ground level. This height provides a balance between operation, environmental, economic and visual impact considerations.

Seepage analysis was carried to estimate floor seepage loss. Based on an average permeability of the natural ground of 1×10^{-6} m/sec and 1×10^{-8} m/sec for the deposited residue, seepage loss in the range of 5 - 10 m^3/ha/day is expected.

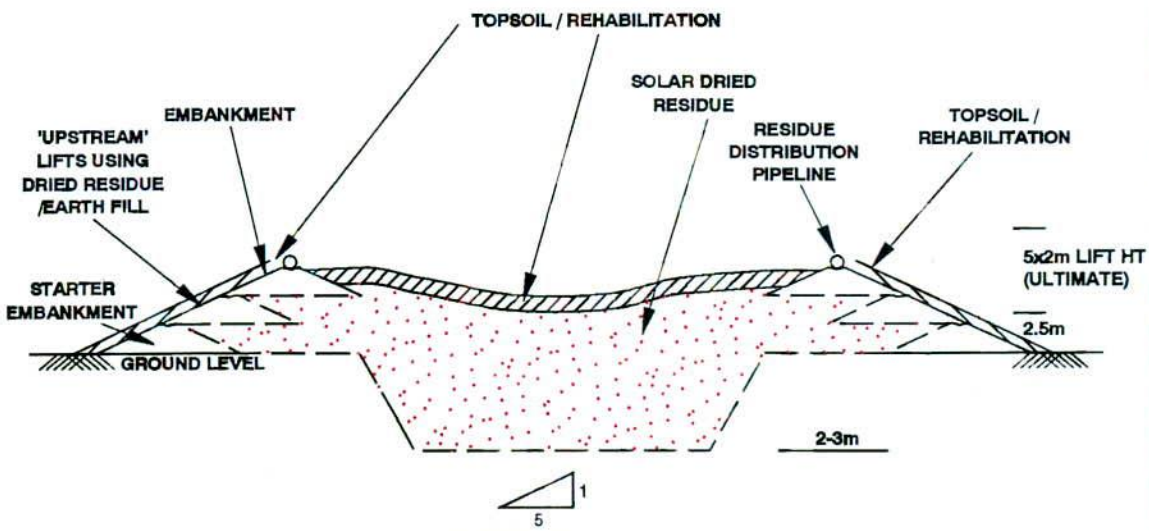
To protect the HBI plant and concentrator from extreme rainfall events an elevated earth pad is required. It is proposed to source fill for this site pad from within the residue storage impoundment area. Based on the results of groundwater level monitoring at the project



PLAN

(NOT TO SCALE)

NOTE: COMPARTMENTALIZATION INTO FOUR CELLS NOT SHOWN



SECTION "A"

(NOT TO SCALE)

RESIDUE STORAGE IMPOUNDMENT CONCEPTUAL LAYOUT

site, the floor of the pit (approximately 3 m deep) will be a nominal 1.5 m above the water table.

The residue impoundment will be designed and operated in accordance with sound professional standards approved by the regulatory agencies.

Rehabilitation

General principles for rehabilitation at the project site are presented in Section 5.11. Prior to the construction of the residue impoundment, the topsoil will be removed and stockpiled. Progressively, as areas of the impoundment are filled and decommissioned, topsoil recovered from the stockpile will be spread over the area and local vegetation established.

It is proposed that the overall slope of the embankment walls will be nominally 1V:5H, blending the rehabilitated impoundment with the surrounds while reducing the potential for erosion. The residue will be mostly iron ore fines and, with the use of fresh water for slurring, the impoundment is expected to be conducive to rehabilitation.

4.12.3 HBI Plant Residue Storage

In addition to the reside storage impoundment, a concrete sump will be constructed to contain Benfield liquid purge from the HBI plant. Partially reduced iron ore will be retained in an unlined pond.

When the sump and pond are filled their contents will be reclaimed for recycle.

4.13 AQUEOUS DISCHARGES

The major aqueous discharges generated by the operations are detailed in Table 4.4:

Table 4.4 Aqueous Discharges

Discharge	Origin	Annual	Nominal Daily	Management
Seawater blowdown	HBI seawater cooling system	1.48 Mm^3	4,000 m^3	Disposal to harbour
Treated sanitary waste water	Packaged sewerage treatment plant servicing employee amenities	16,000 m^3	45 m^3	Re-use for landscape irrigation

...cont'd

Table 4.4 Aqueous Discharges (cont'd)

Discharge	Origin	Annual	Nominal Daily	Management
Stormwater run-off	Plant site	Varies	Varies	Remove sediment and release
Washdown water	Plant site	10,000 m^3	30 m^3	Re-use where practical
Oily waste water	Equipment wash down	5,000 m^3	15 m^3	Separate, disposal of floats off-site and re-use of effluent for dust control
Regenerant liquors	Demineralisation Plant	10,000 m^3	30 m^3	Disposal to harbour

Regenerant (the spent chemicals which have been used to regenerate the ion exchange columns) after neutralisation will be similar to the brine from the seawater cooling system. It is proposed to dispose of the regenerant with the brine from the HBI plant cooling system.

A waste oil recycling plant has recently been established at the Wedgefield light industrial area and is licensed to receive waste oil, solvents, oily waste water etc.

Other minor aqueous discharges from the operations include:

- Benfield System Purge

  The Benfield system purge solution (the solution drawn off to control the concentration of potassium formate) will contain vanadium pentoxide, potassium formate, potassium carbonate/bicarbonate, diethanolamine, potassium nitrite and antifoam.

  The purge solution will be stored in a sealed pond and allowed to dry.

  Options for the ultimate disposal are being investigated, including sale to a suitable recycler/user.

- Carbon Dioxide Desulphurisation System Liquors

  The system will not have a continuous discharge but will have periodic purges, possibly on 1 occasion per year. Options for the disposal of purge liquor are being investigated and include treatment in the site sewage treatment plant.

4.14 NOISE EMISSIONS

4.14.1 Overview

An assessment of noise emissions from the project has been undertaken (Sound and Vibration Technology, 1994) which included:

- estimation of sound power levels for the proposed concentrator and HBI plant;
- development of noise contours for the project facilities incorporating the HBI plant, concentrator, conveyor between the Boodarie site and Finucane Island, and the Pilbara Energy Pty Ltd power station approximately 5 km south of the plant;
- establishment of a noise buffer zone for a worst case noise emission scenario;
- monitoring existing background noise levels; and
- estimating construction noise.

4.14.2 Method

To establish background noise levels, site measurements were made at various locations around the project. At each location the 15 minute L90 noise level was monitored.

The sites monitored and the background noise levels recorded are detailed in Table 4.5.

Table 4.5 Background Noise Levels

Site Monitored	Noise Levels dB(A)		
	0700 - 1900	1900 - 2200	2200 - 0700
Port Hedland Police Station Residence	45 - 55	44 - 53	43 - 48
Wedgefield Industrial Area	42 - 47	38 - 42	31 - 40
South Hedland Sobering Up Centre	37 - 47	35 - 43	30 - 35
South Hedland Golf Club	44 - 52	43 - 46	40 - 45
Boodarie Hill Plant Site	29 - 35	29 - 30	27 - 28

Environmental noise modelling was used to generate noise contours from the project and the Pilbara Energy Pty Ltd power station under

varying atmosphere conditions. Noise modelling was undertaken using the acoustic modelling program ENM.

To establish a scenario for the required buffer zone, a noise contour presenting the worst case emission has been developed. The worst case assumes that a following wind is prevailing between the plant site and the closest residences at Wedgefield, South Hedland and Port Hedland.

In developing noise contours, it has been assumed that all equipment is running, including standby. The results are therefore considered conservative.

Modelling has shown noise from the project meets draft regulatory criteria (Section 5.10).

Emergency venting has not been included. Vent noise is expected to occur 2 to 3 times per year and last for approximately 5 minutes. The sound level is unknown.

4.15 STORMWATER DRAINAGE

The proposed HBI plant and concentrator are located in the catchment of South West Creek (Figure 1.1).

A hydraulic analysis (Davies and Associates, 1994) of South West Creek was carried out to estimate pre and post project flood levels for the 1:50 and 1:100 year rainfall events. The analysis takes account of the existing creek morphology and discharge under ocean storm surge conditions. The analysis was conducted over an approximate 8 km length of South West Creek extending from the coast upstream to about Great Northern Highway.

Using the results of the hydraulic analysis, the stormwater drainage system proposed for the HBI plant and concentrator site has the following major objectives:

- Diversion of overland flow around the plant site, minimising the potential for contamination and reducing the risk of flooding at the plant site.

  To achieve this it is proposed that the drainage scheme incorporates a cut-off berm along the southern boundary of the site. The berm will provide a barrier and divert overland rainfall run-off, which would naturally flow across the site, around the plant site area.

- Protection of the HBI plant, concentrator and associated facilities against rainfall induced flooding.

It is proposed to locate the plant site on a pad constructed to a finished level above the estimated 1:100 year flood level; and

- Separating the storm water collection and discharge system at the plant site from the process water collection system;

  The design of the storm water drainage system at the plant site will incorporate a combination of:

  - sheet flow and open channel flow systems for unsealed hardstand areas; and

  - a piped below ground system for the sealed plant area.

Collectively, both systems will channel run-off water to the north of the site, commensurate with the fall of the land, via open catch drains located around the perimeter of the site.

Run-off water will be channelled into traps to retain sediments carried from the site prior to clean water being released, via controlled outlets, to natural drainage systems.

5.0 POTENTIAL ENVIRONMENTAL IMPACTS AND THEIR MANAGEMENT

5.1 INTRODUCTION

This section discusses the potential key environmental issues relating to the project. Where appropriate, the existing environment relating to each issue is described, the potential impacts identified and the proposed mitigation or management of the impacts discussed.

5.2 GEOMORPHOLOGY AND SOILS

Regionally, the project is located on the coastal plain which is a flat, low-lying tract 2 - 10 km wide, fringed to the north by mangroves, tidal creeks, salt flats, sand overlay and areas of low coastal dunes.

The elevation of the plant site ranges from about RL 9.0 (AHD) in the south to about RL 5.0 (AHD) in the north over a distance of approximately 2,000 m, an average slope of 1:500.

The coastal area from Finucane Island to the HBI plant site can be divided into three physiographic zones which run roughly parallel to the coast line:

- the coastal dune belt with dune and beach rock limestone;
- the coastal mud flats, mangrove and samphire flats, and silt and mud flats which are low-lying and subject to tidal inundation; and
- flood plain alluvium with low relief. The proposed HBI plant and concentrator are located on this flood plain.

Soils consist largely of sand, sand-clay and clay. Close to the coast are areas of saline muds and marine sands. Hard, red alkaline earths and Pindan soils occur in frequent patches further inland.

5.3 INITIAL SITE PREPARATION

Vegetation will be cleared from the corridors required for roads, pipework, transmission lines and the conveyor and services corridor.

Prior to construction of the HBI plant, concentrator and residue impoundment, vegetation will be stripped and the topsoil covering the area will be collected and stockpiled for later use in rehabilitation.

In total approximately 500 ha will be cleared initially. Any areas that are not required to remain cleared for access or safety reasons, will be rehabilitated as outlined in Section 5.11 (Commitment 8.16).

5.4 FLORA AND VEGETATION

5.4.1 Methods

A biological survey was undertaken of the project area during 1994 (Mattiske Consulting, 1994) and this report has been submitted to the DEP.

The area is dissected with tracks and these were traversed by vehicle and foot. Voucher specimens of several species were collected and later identified at the Western Australian Herbarium. The nomenclature used to describe the species is according to Green (1985). The current conservation status of the plant species was reviewed using the latest listing from the Department of Conservation and Land Management (1994) and the local and regional significance of the native vegetation in the project area was determined.

5.4.2 Existing Environment

107 vascular plant species, including 2 introduced, from 42 families and 78 genera were recorded in the project area and corridors during the survey. The species composition was dominated by the Families of the Poaceae - 15 species (grasses), Mimosaceae - 7 species (shrubs and trees of Wattles) and Papilionaceae - 11 species (peas). A species list is included in Appendix B.

No flora species which have been declared as Rare Flora, pursuant to Subsection 2 of Section 23F of the *Wildlife Conservation* Act 1950 - 1980 were located in the project area.

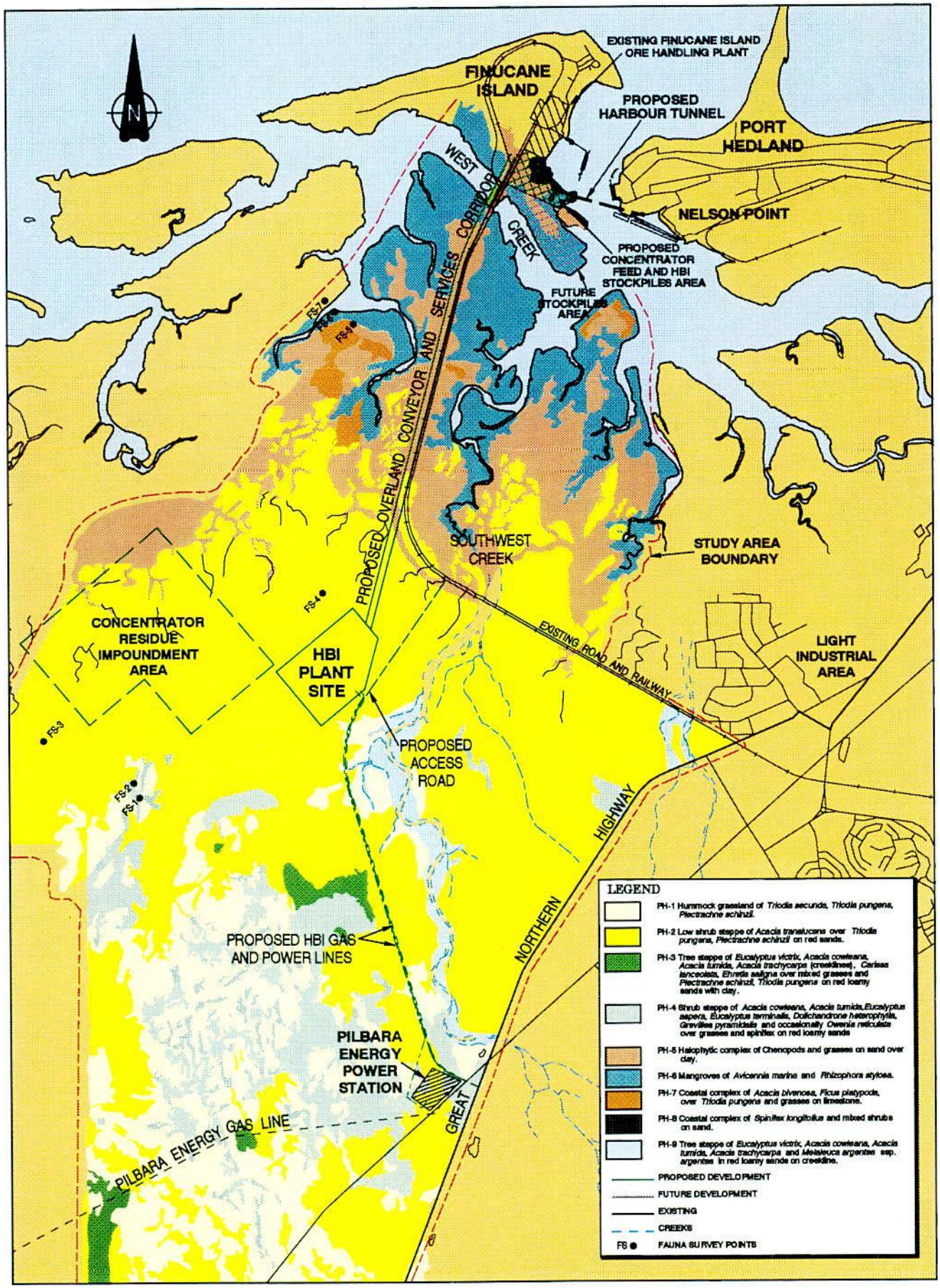
Four priority vascular plant species classified on the "Declared Rare and Priority Flora List" are known from the region (Department of Conservation and Land Management, 1994). None of these species were located during the survey, however they are considered likely to occur in the project area.

The plant communities of the project area (Figure 5.1) are:

PH-1 Hummock grassland of *Triodia secunda, Triodia pungens,* and *Plectrachne schinzii;*

PH-2 Low shrub steppe of *Acacia translucens* over *Triodia pungens* and *Plectrachne schinzii* on red sands. This is the dominant plant community that will be impacted by the project and is depicted below in Plate 2:

PROPOSED HOT BRIQUETTED IRON PROJECT



VEGETATION COVERAGE AND FAUNA SURVEY POINTS

1 0 1 2 3 km

BHP

FIGURE 5.1

Plate 2 Dominant vegetation of the HBI plant area (PH-2)

PH-3 Tree steppe of *Eucalyptus victrix* (formally *E. Coolabah* var *rhodoclada*), *Acacia cowleana, Acacia tumida, Carissa lanceolata,* and *Ehretia saligna* over mixed grasses and *Plectrachne schinzii* and *Triodia pungens* on red loamy sands with clay;

PH-4 Shrub steppe of *Acacia cowleana, Acacia tumida, Eucalyptus aspera, Eucalyptus terminalis, Dolichandrone heterophylla, Grevillea pyramidalis* and occasionally *Owenia reticulata* over grasses and spinifex on red loamy sands;

PH-5 Halophytic complex of Chenopods and grasses on sand over clay;

PH-6 Mangroves of *Avicennia marina* and *Rhizophora stylosa;*

PH-7 Coastal complex of *Acacia bivenosa* and *Ficus platypoda* over *Triodia pungens* and grasses on limestone;

PH-8 Coastal complex of *Spinifex longifolius* and mixed shrubs on sand; and

PH-9 Tree steppe of *Eucalyptus victrix, Acacia cowleana, Acacia tumida, Acacia trachycarpa* and *Melaleuca argentea* ssp. *argentea* in red loamy sands on creekline.

The plant communities defined and mapped for the project area are well represented throughout the coastal Pilbara in both a regional and local context (Beard 1975 and 1990).

5.4.3 Impacts on Flora and Vegetation

Approximately 500 ha of land will be cleared for the construction of the HBI plant, concentrator, initial residue impoundment, corridors and associated infrastructure. Minimal vegetation clearing will be required to accommodate the proposed Finucane Island stockpile area and the seawater intake facilities on Utah Point.

The flora and vegetation of the HBI plant, concentrator and residue impoundment area have previously been modified by pastoral activities and the construction of tracks.

The major impact associated with the project will be on the West Creek mangroves through construction of a causeway for the pipelines and conveyor. Construction will result in the loss of less than 3 ha of mangroves. Additional, low density, stands of mangroves also occur intermittently along the western side of the Finucane Island railway and some of these will need to be cleared to facilitate construction. The loss of mangroves will be restricted to the minimum necessary to allow construction and safe operation of the conveyor and pipelines (Commitment 8.10).

An Environmental Management Plan will be developed and implemented prior to construction commencing and will address such areas as monitoring, reporting, rehabilitation and the control of Declared species of flora (Commitment 8.3).

5.5 FAUNA

5.5.1 Methods

Regional printouts from the Western Australian Museum fauna database were obtained for amphibians, reptiles and mammals previously collected from the Port Hedland coastal plain. Relevant data sources dealing with all faunal groups were also used (How et al, 1991; E M Mattiske and Associates, 1994; Ninox Wildlife Consulting, 1991; Storr, 1984; Storr and Harold, 1985; Storr et al, 1981, 1983, 1986, 1990; Strahan, 1991; Tyler et al, 1984; Wilson and Knowles, 1988; David Robinson, personal communication). These sources provided background data which assisted in defining the significance of the terrestrial vertebrate fauna in the project area.

Seven representative plant communities were chosen as intensive sampling sites for vertebrate fauna. These sites compare with the

plant communities PH-1 to PH-7 (Section 5.4.2) and are labelled FS-1 to FS-7 (Figure 5.1).

During the field inspection all active vertebrates were recorded. Signs such as tracks, scats, diggings and nests were noted and identified, and an appraisal of habitat quality was carried out. This latter aspect included an assessment of the number of tree-hollows, the frequency of logs on the ground, the capacity of the soil to support burrows, the density of flowering shrubs and the frequency of fires.

A report presenting the results of the fauna survey (Mattiske Consulting, 1994) has been supplied to the DEP.

A combination of systematic and opportunistic sampling was undertaken, including trapping (715 trap nights) and mist netting.

5.5.2 Existing Environment

A complete list of species recorded or likely to occur in the project area is provided in Appendix C.

A total of 69 bird species were recorded in the project area, all of which are within their known ranges and all have extensive distributions in the Pilbara region and elsewhere in Western Australia. An additional 69 species may also occur . Some of these are seasonal visitors, nomads or migrants that would be expected to be recorded if censuses were conducted throughout the year. Others could be expected to occur during particularly favourable weather conditions such as infrequent inundations following tropical cyclones, or taking advantage of the lush plant growth that follows such events.

Ten species of birds listed under the Japan/Australia and China/Australia Agreements for the protection of migratory species in their habitats were recorded. In addition, another 24 species are likely to occur.

Six native mammal species were recorded during the sampling period, all are within their known range and have widespread distributions in the Pilbara region and other arid parts of Western Australia. An additional 14 species of native mammals are known from the region and could occur.

A total of 26 reptile species was recorded during the survey. With two exceptions these were all within their previously known ranges. One of these is the gecko *Gehyra nana* which was previously known only in Western Australia from the Kimberley region. This species is an obligate user of rocks and was only recorded on the limestone ridges fringing the mangroves.

None of the 5 species gazetted as rare were recorded. However the Peregrine Falcon, Grey Falcon, Loggerhead Turtle, Leathery Turtle and Woma Python are considered likely to occur.

Six birds and one native mammal which have been recorded or are expected to occur in the project area are classified under the CALM Reserve List. These species are described as fauna for which the impacts of any proposed development should be carefully considered, as there is a risk that such activities may result in the species meeting the criteria for listing as a threatened species. All reserve list species recorded or expected to occur in the project area have wide distributions extending either throughout the arid zone or coastal and sub-coastal northern Australia. None is restricted to the vicinity of the project area therefore any impact which may occur will be strictly local rather than regional.

Three habitats within the project area are judged to be of significance to fauna. These are:

- mangroves and mudflats;
- the coastal limestone with *Ficus platypoda*; and
- small, isolated patches of woodland which occur in low-lying sites.

Each of these 3 habitats have the capacity to support a range of specialised fauna not found in the surrounding country.

5.5.3 Impacts On Fauna

Fauna impacts will be comparatively small and localised in extent. The following local impacts can be expected:

- some loss of habitat resulting from construction of the facility and associated infrastructure (approximately 500 ha including 3 ha of mangroves);
- minor linear habitat partitioning by the corridors and access roads;
- minor changes to drainage patterns and possible increased erosion of habitat;
- increased potential for fire through human activity;
- potential loss of nearby habitat through elevated dust loadings on vegetation; and

- increased fauna casualties through higher traffic frequency and greater speed on upgraded access roads and tracks.

The above impacts are recognised and will be addressed through careful forward planning and the application of appropriate environmental safeguards to minimise disturbance to fauna and, more particularly, the habitats which support them. Many of these safeguards are standard procedures implemented under the relevant statutory Acts or in the maintenance of a safe working environment. These include:

- the minimisation of dust and noise levels (Commitments 8.12, 8.13, 8.24);
- the reduction of spillage and/or the contaminant of hazardous chemicals (Commitment 8.25);
- minimisation of off-site discharges (Commitment 8.21);
- the suppression of wildfires and the careful placement of access roads and site works (Commitments 8.4, 8.5, 8.9, 8.11); and
- minimisation of clearing and the protection of habitat to the maximum practical extent (Commitment 8.10).

While the project will have some effect on fauna, the area has been previously disturbed through a long history of pastoral activities. The absence of species requiring specific conservation consequently results in the overall impact of the project being minimal and manageable.

Should species requiring conservation be located on the site, discussions will be held with CALM on appropriate management techniques (Commitment 8.14). An Environmental Management Plan will be developed and implemented prior to construction which will address issues such as monitoring, reporting and the control of feral species of fauna (Commitment 8.3).

5.6 SURFACE WATER AND GROUNDWATER

5.6.1 Existing Environment

Surface Water

The major surface drainage features in the study area are the ephemeral Turner River and South West Creek.

The Turner River is 7 km west of the HBI plant site whilst South West Creek runs 0.75 km to the east of the HBI plant site in a south to north direction prior to discharging into Hedland Harbour.

The conveyor and pipeline corridor will cross West Creek on a causeway running parallel to the Finucane Island causeway.

Groundwater

A number of boreholes have been installed at the project site to investigate geotechnical and groundwater conditions. Groundwater salinity in the HBI plant site area ranges from 13,000 to 52,000 mg/L Total Dissolved Solids (TDS).

Monitoring results indicate that the depth to groundwater from the natural surface varies across the site from 4 - 5 m in the HBI plant area to 2 - 3 m closer to the ocean.

A gentle hydraulic gradient is evident across the site generally falling in a northerly direction (towards the ocean) at less than 0.05 %.

Constant head tests conducted in several bores indicate a permeability in the range of 10^{-7} - 10^{-8} m/s below 3 m depth from surface. Material above this depth (sands/silts) exhibits a higher permeability.

5.6.2 Impacts on Surface Water

Interruption to existing flow regime

The project site is located within the catchment of South West Creek.

Hydrological modelling carried out for the project indicates:

- the site is located on the fringe of the 100 year ARI flood plain of the creek;
- there will be a slight localised backwater effect in the immediate vicinity of the site; and
- the backwater will not adversely impact on other upstream facilities including the SECWA Terminal Station and the Pilbara Energy Pty Ltd power station.

It is proposed to direct overland flow around the plant site and to keep it separate from rainfall run-off from the site. The quality of surface water run-off is therefore not expected to be adversely impacted by the project.

A surface water monitoring programme will be instituted to detect changes to water quality and corrective action will be taken if unacceptable impacts are identified (Commitment 8.18).

Stormwater Run-off

All plant site storm water drainage facilities will be designed in accordance with *Australian Rainfall and Run-off* 1987. An open and piped drainage system will be installed at the plant site and this will be sized to accommodate run-off from a 1:50 year rainfall event.

Stormwater run-off from the site will be channelled through settling ponds prior to release.

5.6.3 Impacts on Groundwater

Seepage From the Residue Storage Impoundment

The raw materials used on the HBI site and proposed measures to minimise the potential for adverse environmental impacts resulting from spillages are discussed in Section 4.10.

The concept for the disposal of residue from the concentrator is presented in Section 4.12.2.

Seepage from the impoundment will be negligible due to:

- the low permeability of the natural material compromising the impoundment floor (10^{-7} - 10^{-8} m/s);
- the low permeability of the impoundment walls resulting from the engineered placement of selected low permeability fill; and
- the method of impoundment operation which will result in the solar drying of the deposited residue with a consequent reduction in permeability and the permeability reducing further through consolidation.

The concentrator residue comprises gangue and low grade iron ore. The only additives to the residue are fresh water and a nominal 34 g/t of polyacrylamide flocculant.

It is proposed to install groundwater monitoring bores up and down hydraulic gradient of the impoundment and the plant site.

A groundwater monitoring programme will be initiated at the site and corrective action will be taken if unacceptable impacts are identified (Commitment 8.19).

5.7 MARINE AND NEARSHORE CONSIDERATIONS

5.7.1 Existing Environment

The current biological knowledge of Port Hedland harbour is summarised in a report prepared by Halpern Glick Maunsell (1993) which collated all available information and added additional data from detailed site investigations. Additional information is being collected which is directed to quantifying physical, chemical and biological processes occurring in the harbour.

The principal potential impact that the project will have on the harbour will be due to the discharge of brine from the HBI cooling water system and demineralisation plant in the vicinity of the Finucane Island wharf (Sections 3.6, 4.6.4, 4.13). This discharge, 4,000 m^3 per day (possibly increasing to 8,000 m^3 per day through expansion of the facility), will be approximately 4°C above that of the receiving waters and have a salinity of up to four times that of seawater (140 ppt). The brine will not contain any additional concentrations of heavy metals over the ambient intake concentrations.

The closest vegetation to the Finucane Island wharf is a narrow strip of the mangrove *Avicennia marina* which is located approximately 1 km south of the outfall (Figure 5.1). Further to the south *Rhizophora stylosa* also occurs. Supratidally to the south west of the discharge point occurs an assemblage of salt-tolerant shrubs.

A shallow sand and mud bank occurs between the high water mark and the wharf. To the east of the wharf the harbour has been dredged to 14.2 m below chart datum (17.0 m in the Finucane Island berthing pocket).

Few sessile species of flora or fauna occur near the Finucane Island wharf due to periodic maintenance dredging and the mobilisation of sediments during ship movements.

Direct physical seawater measurements collected to date have focused on temperature, salinity and dissolved oxygen levels at selected locations around the harbour. Adjacent to the wharf, temperatures of up to 33°C (March 1993) and salinities of up to 38 ppt have been recorded throughout the water column. Within the dredged channel, no stratification of the water column is apparent.

Tidal volume and current velocities in the harbour have been estimated for both neap and spring tides by calculating the tidal prism. From these calculations the volume of water passing the Finucane Island wharf in 6 hrs (i.e. a flood or ebb tide) has been estimated at 30 Mm^3 on a neap tide and 123 Mm^3 on a spring tide.

Maximum current velocities have been estimated at 0.28 m/s on a neap tide and 1.22 m/s on a spring tide.

5.7.2 Method of Brine Discharge

Two methods of brine discharge are currently being considered. These are:

- discharge just below the water surface via a series of diffusers installed along the Finucane Island wharf; and
- discharge to the bottom of the harbour adjacent to the Finucane Island wharf.

The predicted behaviour of the discharge and the likely environmental impacts are discussed in the following sections.

5.7.3 Predicted Behaviour of Brine Discharge

The density of the discharged brine will be approximately 1,130 kg/m^3 (CRC, 1975) compared with that of seawater at 1,023 kg/m^3 (at salinity 35 ppt and temperature 25°C; von Arx, 1977). This density difference will dominate the behaviour of the brine in the initial stages prior to dilution (Fischer et al, 1979, §5.1.5).

Surface Discharge

Detailed modelling of the behaviour of the discharged brine has not been undertaken. However, initial calculations indicate that a diffuser with 10 ports, each producing a dilution of 1:100, would reduce the brine density sufficiently for the turbulent mixing from a current of 0.3 m/s (a typical value) to fully dilute the brine through the water column.

The minimum overall dilution available (i.e. on a half tidal cycle at neap tide) is approximately 30 Mm^3. The volume of brine discharged during this time will be approximately 1,000 m^3 (possibly increasing to 2,000 m^3) giving a dilution ratio of 1:30,000. At spring tide the dilution ratio is 1:123,000.

Providing the brine discharge can be mixed sufficiently to allow dispersion by the ambient flow, there should be minimal environmental impact experienced within the harbour.

At this stage surface discharge is the preferred option for brine disposal. However, the behaviour of the brine at slack water, when there is very little ambient mixing and the diluted brine may tend to collect, requires further consideration. Although it is most likely that subsequent tidal flow will "ventilate" the area and remove the brine,

this issue will be further addressed during the detailed design phase of the project.

Bottom Discharge

It is predicted that, following discharge, the brine will flow along the bottom of the dredged channel as a density-driven current with relatively little mixing. The turbulence in the tidal flow in the channel will mix and transport it, but the rate of mixing will depend on the current velocities and the turbulence levels in this flow.

Due to its relatively high density, the brine will not be lifted from the dredged channel until it is sufficiently diluted for its density to be close to that of seawater.

The possible fate of the brine has been considered at various states of the tide.

At slack water, most of the brine will tend to pond at the bottom of the channel adjacent to the discharge point. Any material left in the water column will have been diluted to a density close to that of seawater.

On a flood tide, the situation will be similar, but with the ponded brine tending to move upstream into the swinging basin and with the turbulent flow tending to shear and dilute the brine pool.

When the tide is ebbing, the brine will tend to flow out of the dredged channel being diluted and mixed as it discharges.

It is possible that pools of brine may collect in deeper parts of the harbour, for example in the berthing pocket adjacent to the Finucane Island wharf. Depending on the bottom slopes normal tidal currents may not readily "ventilate" these areas. However, daily shipping movements can be expected to mix any pockets of denser water that may form.

There are thus three possible fates for the brine discharge:

- the brine will be mixed into the water column and dispersed by the turbulent flow in the harbour;
- the brine will flow along the sea bed and out of the harbour via the dredged channel to eventually be mixed and dispersed by natural processes; or
- some of the brine will be trapped in "unventilated" deeper pockets within the harbour until mixed into the water column during shipping movements.

5.7.4 Environmental Impacts of Brine Discharge

The environmental significance of brine discharge relates to the potential for the brine to come into contact with sensitive species of flora and fauna, in particular sessile (attached) species which do not have the ability to evade a plume of brine.

As identified in Section 5.7.3 the behaviour of the brine will be dependent on the method of discharge.

Discharge of the brine just below the surface of the water and appropriate diffuser design, resulting in maximum dilution of the brine both horizontally and vertically, is expected to result in minimal environmental impact within the harbour. It is for this reason that this method of disposal is currently preferred.

Bottom discharge will result in the brine being in direct contact with the sea bed. The area affected will be the Finucane Island berthing pocket and probably nearby areas of the dredged channel and harbour basin. Vertical movement of the discharge out of the harbour basin can only occur once dilution of the discharge approximates that of seawater.

Environmental impacts associated with bottom discharge will be restricted to species of infauna occurring within the harbour sediments and any sessile species of flora and fauna which survive in an area that is periodically dredged and subject to significant disturbance during ship movements. Mangroves will not be affected by the discharge due to their vertical and significant horizontal separation from the point of discharge.

A monitoring programme will be initiated to allow the physical behaviour of the discharge to be quantified. Should unacceptable impacts be identified corrective action, such as modification to the diffuser design, will be taken (Commitment 8.20).

5.7.5 Other Impacts

Reclamation across West Creek will be required to allow construction of the conveyor and pipeline between Finucane Island and the HBI plant.

Reclamation will impact on approximately 1.7 ha of silt and mud flats adjacent to the existing causeway. Loss of this habitat will have limited impact on the recreational mud crab fishery due to the relatively small area that will be reclaimed and it is not expected that the reclamation will increase siltation rates in the western arm of West Creek.

Support of the seawater intake structure at Utah Point will require a 0.2 ha reclamation and construction of a piled end structure. The reclamation is outside of the dredged channel and will not result in the loss of any mangroves.

Construction of the stockpile area will not require reclamation.

Levels of Tributyl Tin in harbour sediments and fauna are low (Halpern Glick Maunsell, 1993). The minimal increase in shipping associated with this project is not expected to increase these levels.

5.7.6 Ballast Water Discharge

All vessels associated with the HBI project will comply with the "Voluntary Guidelines for Ballast water and sediment discharge from overseas vessels entering Australian waters" (Appendix D) or the "Draft Australian Ballast Water Management Strategy" (Commitment 8.27).

5.7.7 Contingency Planning

BHP currently has in place contingency plans for product and oil spills. These plans will encompass the expanded operations at the Finucane Island wharf.

5.8 RAW MATERIALS, WASTE AND BYPRODUCT MANAGEMENT

5.8.1 Management of Process Inputs

As identified in Section 4.10 a number of raw materials are required for input to the process. Associated with these materials is the potential for pollution impacts. The identified pollution potential and the proposed strategy for pollution mitigation are detailed in Table 5.1.

Table 5.1 Pollution Mitigation

Material	Pollution Potential	Mitigation
Corrosion inhibitor	Local spill	Immediate cleanup
Diethanolamine	Local spill	Immediate cleanup
Dimethyldisulfide	Local spill	Immediate cleanup

...cont'd

Table 5.1 Pollution Mitigation (cont'd)

Material	Pollution Potential	Mitigation
Eliminox	Local spill	Immediate cleanup
Graphite emulsion	Fugitive dust emissions from mixing area Air re-entrainment after drying of spilled solution	Dust collection in mixing area Immediate cleanup of spills
Hydrochloric acid	Local spill	Immediate cleanup and neutralisation
Iron chelate	Local spill	Immediate cleanup
Iron ore	Fugitive dust emissions	Wetted stockpiles Dust collection systems Sealed roads
Magnesium oxide	Fugitive dust emissions	Covered storage Pneumatic conveying Dust collection (if required)
Natural gas	Atmospheric discharge	Automatic shut down
Polyacrylamide	Local spill	Immediate cleanup
Potassium carbonate	Local spill	Immediate cleanup
Potassium hydroxide	Local spill	Immediate cleanup and neutralisation
Potassium nitrite	Local spill	Immediate cleanup
Sodium hydroxide	Local spill	Immediate cleanup and neutralisation
UCON	Local spill	Immediate cleanup
Vanadium pentoxide	Local spill	Immediate cleanup
Zinc oxide	Local spill	Immediate cleanup

Any area where hazardous solutions are stored or mixed will be bunded to contain any spillage.

5.8.2 Solid Waste Disposal

Solid waste produced during construction and operations will include wood, paper and domestic rubbish. Inert materials, not suitable for recycling, will be disposed at an approved landfill in accordance with Health Department of WA and Town Council

requirements (Commitments 8.8, 8.21). Other materials such as scrap steel and maintenance clean out (iron rich scale), will be recycled.

5.8.3 Liquid Treatment and Disposal

Sanitary Wastes

It is estimated that 16,000 m^3 per year of sewage will be generated and it is proposed that this will be directed to a biological treatment plant.

The effluent from the treatment plant will be used for reticulation of landscape vegetation.

The plant will be designed and operated in accordance with the requirements of the Water Authority and the Health Department of WA.

Freshwater Blowdown

All fresh wastewater blowdown from the HBI process will be reused in the concentrator. There will be no discharge of fresh water from the site.

Seawater Blowdown

Seawater blowdown will be discharged to Port Hedland Harbour adjacent to the Finucane Island wharf. Potential impacts of this discharge are discussed in Section 5.7.

Others

Waste oils, solvents and other hazardous liquids will be collected and removed from the site for recycling or disposal in an approved liquids disposal area (Commitment 8.21).

5.8.4 Solid Byproducts and Residues

Non hazardous byproducts and residues that are not suitable for recycling will be stored in the residue storage impoundment. Management of the residue ponds is discussed in Section 4.12.2.

5.9 ATMOSPHERIC EMISSIONS

5.9.1 Criteria

Current Government legislation does not specify maximum air quality objectives throughout Western Australia. However, the DEP (EPA, 1993) has recommended minimum requirements for air quality based on a review of existing national and international standards. The guidelines (Table 5.2 below) should not be viewed as

maximum permissible concentrations of contaminants in air, or as emission standards. It is proposed that these will be determined for point sources through consultation, regional strategies and environmental protection policies (EPP).

Table 5.2 General Air Quality Guidelines Recommended by DEP (EPA, 1993)

Species	Averaging Period	Level (µg/m³)
NO_2	1 hour 24 hour 1 year	320 150 60
SO_2	1 hour 24 hour 1 year	350 125 50
Particulates as PM_{50}	24 hour maximum 1 year	260 90
Particulates as PM_{10}	24 hour maximum 1 year	120 40

The DEP has promulgated only two environmental protection policies for atmospheric pollutants, these being for the Kwinana and Kalgoorlie areas. For new "Greenfield" developments (no existing sources) the DEP assesses the proposal using the Kwinana EPP's standards (which are equivalent to the recommended guidelines) and limits (EPA, 1992). These are presented in Table 5.3 and are for SO_2 and particulates. A standard is defined as "a concentration which it is desirable not to exceed". In determining the acceptability of new sources the DEP requires that the predicted 9th highest hourly concentration at any location (i.e. the 99.9 percentile value) is below the standard level. This procedure gives a high level of assurance that the 1 hour limit will not be exceeded in any given year.

Table 5.3 SO_2 and Particulate Standards and Limits for the Kwinana Policy Area (EPA, 1992)

Species	Area[2]	Averaging Period	Standard[1] (µg/m³)	Limit[1] (µg/m³)
SO_2	A	1 hour 24 hour 1 year	700 200 60	1400 365 80
	B	1 hour 24 hour 1 year	500 150 50	1000 200 60

...cont'd

Table 5.3 SO_2 and Particulate Standards and Limits for the Kwinana Policy Area (EPA, 1992) (cont'd)

Species	Area[2]	Averaging Period	Standard[1] ($\mu g/m^3$)	Limit[1] ($\mu g/m^3$)
	C	1 hour 24 hour 1 year	350 125 50	700 200 60
Total Particulates	A, B, C	15 minute	-	1000
	A	24 hour	150	260
	B	24 hour	90	260
	C	24 hour	90	150

NOTES:
1. All values expressed at 0°C and 101.3 kPa.
2. Area A: the area of land on which heavy industry is located.
   Area B: the area surrounding industry, plus other outlying land zoned for industrial use.
   Area C: land beyond areas A and B used predominantly for rural and residential purposes.

For NO_2 the DEP has yet to set any standards under an EPP and consequently the guideline in Table 5.2 will be used. This requires that the 320 $\mu g/m^3$ guideline level is not exceeded more than once a month.

For odorous pollutants such as H_2S, the EPA does not have any standards, requiring only an emission limit of 5 mg/m^3 after the Australian Environmental Council guidelines. The World Health Organisation (1987) adopt a ground level concentration guideline of 7$\mu g/m^3$ averaged over 30 minutes whilst Canada (International Association of Air Pollution Prevention, 1988) adopts a maximum desirable ground level concentration of 1 $\mu g/m^3$ averaged over 1 hr. The Victorian guildeline of 0.14 $\mu g/m^3$ averaged over 3 minutes is based on the lower limit of odour threshold and is considered to be unrealistically low. The New South Wales State Pollution Control Commission adopts a guideline of an instantaneous level of 7$\mu g/m^3$ which equates to a 3 minute average of 1.4$\mu g/m^3$. This figure will be adopted for the purpose of the current study.

5.9.2 Impact of Atmospheric Emissions

The air dispersion model AUSPLUME was used to assess the impact on air quality of cumulative airborne emissions from the HBI plant and Pilbara Energy Pty Ltd power station (Steedman, 1994). To facilitate modelling a data base was developed from measurements

undertaken near the site during 1992/93 utilising standard WA DEP models (EPA, 1992).

NO_2

Maximum concentrations of NO_2 are predicted to occur from 1 to 1.5 km from the HBI plant. For the purposes of modelling, a worst case NO_2/NO_x ratio of 0.5 was used. The predicted ground level concentrations of NO_2 from the HBI plant and Pilbara Energy Pty Ltd power station are shown in Table 5.4 below:

Table 5.4 Predicted Maximum Ground Level Concentrations of NO_2, SO_2 and Particulates

Pollutant	Air Quality Objective ($\mu g/m^3$)	Source		
		HBI Plant ($\mu g/m^3$)	Power Station ($\mu g/m^3$)	HBI and Power Station ($\mu g/m^3$)
NO_2	9th Highest Hourly 24 hour maximum Annual Average	24.0 3.5 0.5	59.5 11.1 1.74	62.5 12.1 1.87
SO_2	9th Highest Hourly 24 hour maximum Annual Average	0.36 0.05 0.01	1.28 0.26 0.04	1.29 0.26 0.04
Particulates	15 Minute Maximum 24 hour maximum Annual Average	146 10.1 1.9	0 0 0	146 10.1 1.9
H_2S	Maximum 3 minute	4.01	0	4.01

In comparison to the air quality objectives, the maximum 9th highest hourly concentration of NO_2 is approximately 5 times lower than the 1 hour objective of 320 $\mu g/m^3$ (Table 5.2). Similarly, the predicted maximum 24 hour concentration of 12.1 $\mu g/m^3$ is below the proposed standard of 150 $\mu g/m^3$ and the annual average concentration of 1.87 $\mu g/m^3$ is well below the proposed standard of 60 $\mu g/m^3$.

SO_2

Predicted SO_2 concentrations are presented in Table 5.4. These indicate that the combined concentrations from the HBI plant and power station are low, being 1.29, 0.26 and 0.04 $\mu g/m^3$ for the 9th highest hourly, 24 hour maximum and annual average respectively. Comparison of these concentrations with the proposed standards (Table 5.3) indicates the concentrations are approximately a factor of 300 smaller.

Particulates

The predicted 15 minute maximum, 24 hour maximum and annual average concentration due to the HBI plant are presented in Table 5.4. Peak concentrations occur within 500 m of the plant and drop off rapidly with distance. The peak 15 minute concentration due to the operation of the HBI plant is predicted to be 146 $\mu g/m^3$ which is below the 1,000 $\mu g/m^3$ limit (Table 5.3).

The HBI plant will contain particulate removal systems to minimise discharge to the atmosphere. In all cases the design will be based on control under upset conditions (ie. worst case).

Fugitive Dust Emissions

A number of strategies are proposed to minimise fugitive dust emissions from the facility.

Dust from construction activities will be minimised by a combination of the following measures:

- minimisation of clearing;
- avoidance of unnecessary machinery movements; and
- damping down with water trucks or sprays as necessary.

Dust generation during operation will be minimised by:

- use of water sprays on stockpiles;
- enclosing materials transfer points;
- rehabilitation or stabilisation of disturbed surfaces; and
- sealing of site roads.

H_2S

The predicted maximum 3 minute ground level concentration is presented in Table 5.4. The predicted peak concentration of 4 $\mu g/m^3$ occurs within 500 m of the plant with the concentration decreasing rapidly with distance to below 1 $\mu g/m^3$ within the 3 km of the plant. Comparison to the objective of 1.4 $\mu g/m^3$ indicates that this will be exceeded within 1 to 2 km of the plant. As this area is leased by BHP and contains no residential areas for which the objective is applicable to protect human amenity, the emission levels will be acceptable.

Air Shed Capacity

The airshed capacity concept refers to the amount of atmospheric emissions which can occur within a region without the relevant air quality criteria being exceeded.

To estimate the capacity of the airshed surrounding the proposed HBI plant, ground level concentrations were modelled under the assumption that the HBI emissions were increased by a factor of 10. For such emissions, AUSPLUME predicted ground level concentrations below the closest of the criteria, namely the 9th highest hourly NO_2 level. This suggests that the HBI plant will utilise less than 10% of the available airshed capacity.

Greenhouse Gases

In recent years the term "Greenhouse Effect" has been used to described global warming resulting from increased levels of heat-absorbing gases in the atmosphere. The increase in these gases is the combined result of man-made emissions as well as natural phenomena. It has been estimated (SECWA, 1990) that CO_2 accounts for approximately 50 % of greenhouse gas emissions world-wide.

The plant has been designed with a number of innovative heat integration concepts which minimise fuel consumption, and hence carbon dioxide generation. Included amongst these is the use of waste heat from the gas turbines as preheated air for the HBI furnaces. This reduces fuel consumption and carbon dioxide emissions by about 10% ensuring high overall energy efficiency.

Approximately 1.7 Mtpa of CO_2 will be released to the atmosphere by the HBI plant, less than 1% of the current national CO_2 production from fossil fuels.

The HBI process produces less greenhouse gases than other iron production processes such as the conventional blast furnace and gas scrubbing and recycling ensures that emissions are kept to a practicable minimum.

Abnormal Process Outputs

Abnormal process outputs will occur during plant start-ups or shutdowns or during compressor failure.

During plant start-up and shutdown gaseous emissions will be incinerated by a hot flare producing CO_2, H_2O and N_2. This is anticipated to occur 8 times per year for a duration of 2 to 5 hours each.

During compressor failure waste gases containing H_2S will be flared resulting in the release of small amounts of SO_2. This is expected to occur at most twice a year and for a period of between 5 and 10 minutes. Modelling using the DEP screening model MAXMOD (Steedman, 1994) has indicated that the highest hourly concentrations which can occur are approximately 3 μgm^{-3}. This, even when considering the other sources of SO_2 in the region (Table 5.4) indicates the concentrations of SO_2 will be approximately 100 times lower than the standard.

5.9.3 Monitoring of Atmospheric Emissions

Air dispersion modelling conducted for airborne emissions from the HBI plant has predicted that ground level concentrations are below DEP guidelines.

Fugitive dust emissions will be minimised through implementation of dust control measures.

To confirm that emissions are below the designated guidelines, monitoring will be carried out on a regular basis, as agreed with the DEP (Commitment 8.17).

5.10 NOISE IMPACTS

5.10.1 Permissible Environmental Noise Levels

The EPA is currently changing the regulations for environmental noise and to ensure that the project meets the proposed new regulations, the maximum permissible environmental noise levels outlined in the new regulations have been adopted in this assessment.

Noise emission from the HBI plant and concentrator will be tonal and hence the maximum permissible noise levels must be reduced (the amount the overall noise is reduced is termed the tonal penalty). The EPA's new draft regulations are using AS 1055 as a method to calculate the tonal noise penalty and for the case of noise emissions from the plant a tonal penalty of 6 dB has been adopted. This tonal penalty is considered conservative, and will be revised during detailed design of the plant. Table 5.5 details the maximum permissible environmental noise levels that the project must comply with for residences (the noise levels outlined include the tonal penalty adjustment).

Table 5.5 Permissible Environmental Noise for Residences

Time	15 min L90	Maximum (not to exceed)	Sunday & public holidays
0700 - 1900	44 dB(A)	63 dB(A)	59 dB(A)
1900 - 2200	39 dB(A)	49 dB(A)	49 dB(A)
2200 - 0700	34 dB(A)	44 dB(A)	44 dB(A)

The most onerous environmental noise restrictions placed on the plant occur during the night time where a maximum permissible noise level of 34 dB(A) has been set at residences.

For industrial areas the maximum permissible L90 noise level is 49 dB(A), and the maximum short term intermittent noise level (i.e. for less than 1 minute and 30 seconds) is 59 dB(A).

5.10.2 Construction Noise

It is extremely unlikely that the L90 noise emission from construction activities will exceed 44 dB(A) which is the day time maximum permissible noise level at the closest residence. To ensure that noise emission from construction activities is controlled, noise levels will be monitored at the closest residences during the construction phase of the project (Commitment 8.12).

Some increase in noise levels are expected as a result of increased vehicle movements.

5.10.3 Operational Noise

Modelling of cumulative noise emissions from the plant, concentrator, conveyor and Pilbara Energy Pty Ltd power station has been undertaken under normal operating conditions assuming the following:

- all equipment is running;
- the plant produces a nominal 2 Mtpa of HBI;
- atmospheric thermal inversion conditions; and
- unfavourable winds (light 2 m/s winds from the West, North-West, South-West and South projecting noise towards Port Hedland, South Hedland and Wedgefield).

The results of the modelling are presented in Table 5.6.

There will be a marginal increase in traffic associated with the delivery of raw materials to the operation however, this is not expected to be unduly intrusive.

Table 5.6 Noise Modelling Results

Scenario	Wind Speed	Sound Pressure Level dB(A)		
		Wedgefield	Port Hedland	South Hedland
Calm/Thermal inversion	0 m/s	<30	<33	<31
Westerly winds	2 m/s	<34	<35	<34
Southwesterly winds	2 m/s	<34	<34	<33
Southerly winds	2 m/s	<32	<31	<32
Northwesterly winds	2 m/s	<32	<34	<32

For the South Hedland area the most stringent environmental noise restriction placed on the project occurs during the night time, where a maximum permissible noise level of 34 dB(A) has been set. The maximum permissible noise level for the Wedgefield Industrial area is 49 dB(A). Due to the current high background noise levels for the Port Hedland area, the maximum permissible night time noise level is 37 dB(A).

For the South Hedland, Port Hedland and Wedgefield Industrial area, noise emission from the project satisfies the maximum permissible noise levels under normal operation of the plant. The exception will be on 2 or 3 occasions per year when emergency venting is likely to produce noise levels in excess of the criteria. Venting will last for approximately 5 minutes on each occasion.

Nonetheless, should noise levels exceed EPA standards, BHP DRI recognises its obligations under the *Environmental Protection* Act 1986 to initiate corrective measures (Commitment 8.12).

Figure 1.1 presents the 34 dB(A) buffer zone boundary (maximum permissible environmental noise) based on 2 m/s wind blowing outwards from the HBI plant, concentrator, conveyor and Pilbara Energy Limited power station. A buffer zone to exclude residential development within this area will be applied for under the State Agreement Act. This should protect the HBI Site from other environmental impacts such as air quality and risk.

5.11 REHABILITATION - GENERAL PRINCIPLES

The following principles will apply to rehabilitation:

- a "minimum disturbance" policy will be followed in all stages of construction and operation;
- the objective of rehabilitation will be to return disturbed areas to a state closely approximating their pre-disturbance condition;
- in areas where ground disturbance is necessary, vegetation clearing will be followed by stripping and stockpiling of topsoil and root material. As a component of rehabilitation, firstly topsoil and then vegetation debris will be respread over the ground surface;
- where soil compaction has occurred, such as on temporary access tracks and stockpile areas, the ground will be ripped after topsoil placement and before vegetation debris is replaced;
- where seeding is deemed necessary due to inadequate natural regrowth or other reasons, seed of local native species will be used; and
- borrow pits will be established, operated and rehabilitated in line with the *BHP-Newman Guidelines and Objectives for Borrow Pit Development and Rehabilitation* (Appendix E).

Prior to construction activities commencing, a detailed Environmental Management Plan will be developed which will cover the construction and operation phases of the project (Commitment 8.3).

6.0 SOCIAL CONDITIONS AND COMMUNITY CONSULTATION

6.1 SOCIAL CONDITIONS

6.1.1 Existing Social Environment

Port Hedland is located approximately 7.5 km north-east of the proposed HBI plant site and South Hedland, a suburb of Port Hedland, is located 7 km to the east. The Wedgefield industrial area is 5 km to the east. In 1991 the combined population of Port Hedland and South Hedland was 11,349. This is a decrease of 13.2 % from the 1986 census level. This decrease can be attributed to a decline in numbers of personnel required by major employers of the region including the industrial operations of BHP Iron Ore and Cargill Salt, and the Government Departments and Authorities of Port Hedland.

6.1.2 Regional Setting

Port Hedland is one of several major towns which have developed or have grown to service the mining and industrial operations in the region.

The proposed HBI plant is located adjacent to an area proposed by the Department of Resource Development for heavy industrial use. The plant site lies within the Town of Port Hedland boundary but is not encompassed by the existing Town Planning Scheme No. 4. An extension of the existing Town Planning Scheme or the preparation of a new Scheme to zone the land will be required.

6.1.3 Workforce

No significant impacts associated with the project workforce in the area are expected.

Housing for the workforce will be as follows:

- the construction workforce will be housed in either the existing construction camp in Wedgefield (which will be upgraded), or in a temporary camp which will be established adjacent to the HBI plant site;
- the operations workforce (of around 250 personnel) will be housed in existing accommodation in Port Hedland. With any additional housing requirements being dictated by market forces; and
- the maintenance workforce will be housed at the upgraded Wedgefield construction camp.

The workforce will increase traffic volume on the local road system to a level no greater than the historical peak.

6.1.4 Economic Impacts

This project will be a significant contributor to the economy of the region through the creation of business and employment opportunities associated with construction and supply aspects of the project and ongoing operation of the plant. Benefits will be realised through payments to local contractors for services and materials. Multiplier effects will also extend to the local communities by way of goods and services purchased. The magnitude of the benefit can be gauged through reference to other BHP Iron Ore initiated projects such as the $80 M Yandi project which has 81% Western Australian content and the $200 M Nelson Point project which was 91% Western Australian content.

6.1.5 Visual Impacts

The HBI plant site will be located 5 km west of the Great Northern Highway and will be clearly visible from the highway. The plant will also be visible from Wedgefield and South Hedland. Industrial activity is a common sight in the region and it is not expected that the plant will cause a visual offence to residents or travellers. No significant scenic views will be interrupted.

The surrounds of the HBI plant will be landscaped and planted with vegetation to enhance visual appearance.

It is anticipated that the conveyor will have minimal visual impact.

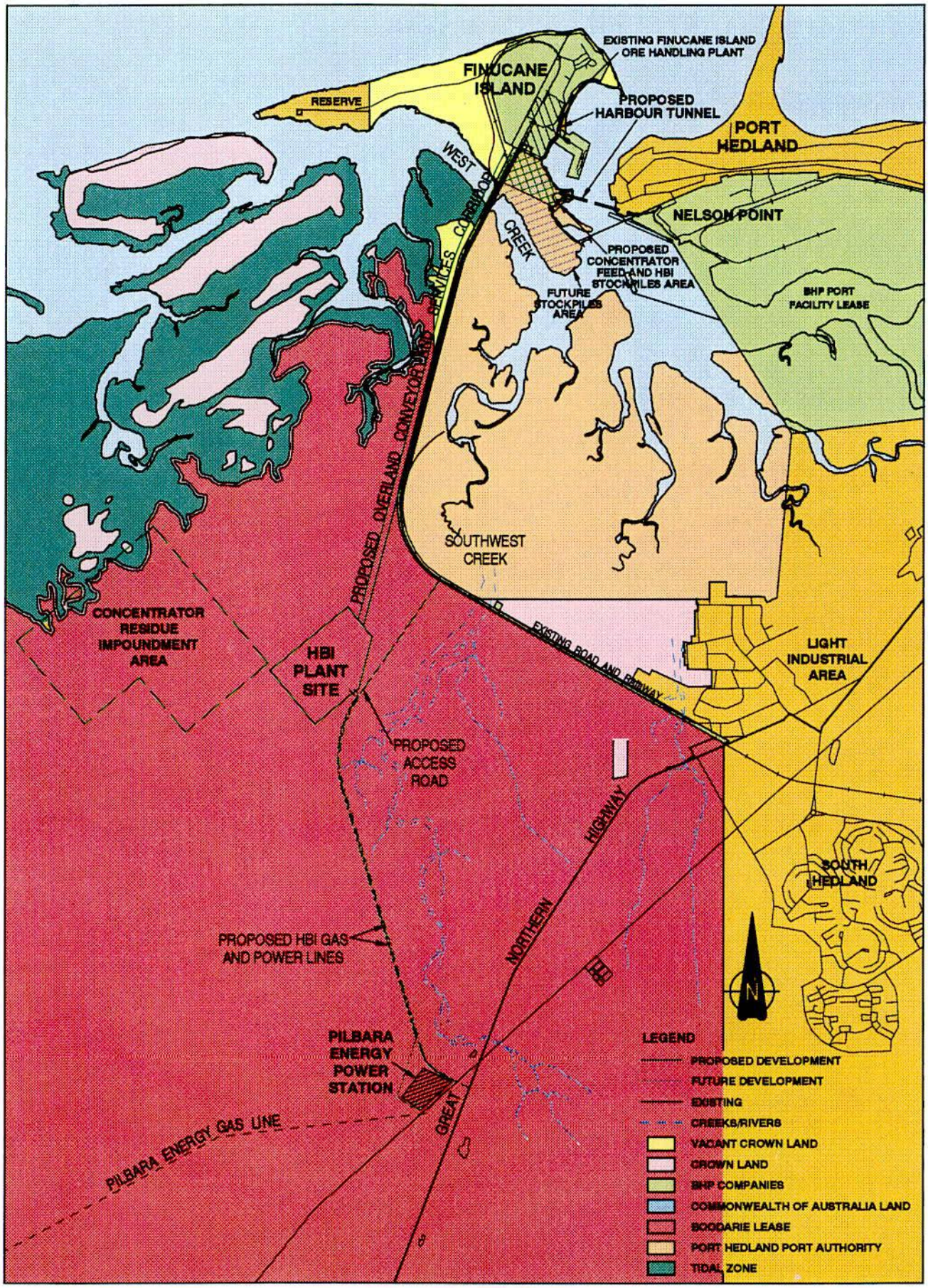
6.1.6 Landuse

The proposed HBI plant, concentrator and associated facilities will be located on the Boodarie Station Pastoral Lease (Figure 6.1), which is currently used for grazing of beef stock. The site will be subject to conditions and tenure as agreed in the State Agreement Act.

The gas pipeline and power transmission line will run in a common corridor from the Pilbara Energy Pty Ltd power station to the HBI plant. Potential impacts may include disturbance to stock, temporary obstruction of tracks, loss of pasture, and increased noise and dust. In general these disturbances will be short lived.

The HBI plant, concentrator, residue impoundment and corridors will be located on land which will be excised from Pastoral Lease under the Terms of the Agreement Act.

PROPOSED HOT BRIQUETTED IRON PROJECT



LAND TENURE

1 0 1 2 3 km

BHP

FIGURE 6.1

6.1.7 Safety

Workplace Occupational Health and Safety issues are covered under the *Occupational Health and Safety Welfare* Act 1984.

The plant will use several chemicals which will require handling and storage in a manner consistent with the *Explosives and Dangerous Goods* Act 1961 - 1986 and the *Dangerous Goods Regulations* 1992.

6.2 HERITAGE CONSIDERATIONS

6.2.1 Aboriginal Heritage

A preliminary Aboriginal Heritage Survey of the project area has identified no sites of cultural significance which may be impacted by the project (Warren, 1994). However, several middens were identified which have the potential to be impacted by the construction of the conveyor and pipeline.

Once final design is complete and the location of the various components more clearly determined a final survey of the area will be undertaken to identify any sites that may be impacted. Every effort will be made to avoid such sites (Commitment 8.2).

No sites will be disturbed unless approval has been received from the Minister of Aboriginal Affairs under the *Aboriginal Heritage* Act 1972 - 1990 (Commitment 8.2).

Should an archaeological sites be identified during construction activities, all activities that may impact on the site will cease and discussions will be held with the Aboriginal Sites Department on an appropriate course of action (Commitment 8.7).

6.2.2 European Heritage

No significant areas of European cultural heritage have been identified that are likely to be affected by the project.

6.3 COMMUNITY CONSULTATION

A community consultation and awareness program was initiated in August 1994 to ensure that the local community and other interest groups were fully informed about the project. The program had a number of components including:

Local Government Authority

A presentation was made and project details were discussed at a full Port Hedland Town Council meeting on 27 October 1994.

Aborigines

The following aboriginal organisations were consulted during the preparation of the CER:

- Kariyarra Group;
- Ngarla Group; and
- Njamal Group.

Pastoralist

A series of meetings were conducted by BHP representatives with the Boodarie Station lessee during August 1994. The purpose of these meetings was to brief the landholder on the proposal and to discuss the issues of site selection, access to property, disturbance, and rehabilitation.

Contact was maintained as surveys were undertaken.

Members of Parliament

Government and Opposition members of State Parliament received briefings on the project during the period August to October 1994.

Government Departments

Project details and associated technical issues were discussed with various government departments.

The following departments were contacted prior to, and during, the preparation of the CER:

- Department of Environmental Protection;
- Department of Resources Development;
- State Energy Commission of Western Australia;
- Pilbara Development Commission (PDC);
- Water Authority of Western Australia;
- Aboriginal Sites Department;
- South Hedland Task Force;
- Airport Operations (Port Hedland);
- Main Roads Department Western Australia;

- Department of Education, Employment and Training; and
- Commonwealth Employment Service.

Local Industry

The following industries and organisations were briefed on the project:

- Port Hedland Chamber of Commerce;
- Port Hedland Port Authority;
- Port Hedland Port Authority - Port Users;
- Hedland College; and
- Pundulmurra College.

General Public

Letters explaining the environmental assessment procedures including the public involvement process were sent to community organisations in Port Hedland.

A full colour information brochure was prepared to accompany these letters and for general distribution. The brochure provided details about the project including a project description, details of environmental studies, the community consultation program and the benefits of the project to the region. The brochures were sent to most organisations contacted during the preparation of the CER.

A free standing information display panel was prepared as a means of providing information to interested persons in the project area. The display included a map showing the project location, a computer generated impression of the project and text describing various project components. A sheet advising of the display and its location was distributed to major shopping centres to be placed on community information boards.

The information display was erected in the foyer of the Port Hedland Town Council building which will remain until the end of the public review period.

A meeting was held with a Local Environmental Affinity Force (LEAF) representative to discuss potential concerns and issues regarding the proposal.

Enquiry Line

An information line (free of charge) has been installed for those seeking further information about the proposal. This phone number has been distributed to interested persons and is also provided on the information display. The telephone number is (008) 64 4433.

Issues

A number of issues were raised during the public consultation programme prior to publishing the CER. These are summarised, together with BHP DRI's response, in Appendix F. Consultation will continue during the public review period.

7.0 RISKS AND HAZARDS

7.1 INTRODUCTION

A qualitative risk assessment was conducted to identify each hazard and the potential persons at risk, the worst case outcome and the probability of the hazard affecting employees or the public. A quantitative analysis will be carried out if required by the DEP.

A hazard assessment was conducted to determine the potential consequences of each hazard and identify the control measures required to eliminate or minimise the potential of the hazard affecting employees or the public.

For each hazard requiring a control measure, a reference document is shown which will document the control procedures.

7.2 RISK ASSESSMENT MATRIX

The HBI plant, with the degree of planning, engineering and control proposed, will be a safe plant to operate.

The risk assessment conducted on the HBI plant addresses all potential risks of injury to employees and to the public from all major emissions and events.

The risks identified and whether they have any effect on employees or the public have been included in the risk assessment matrix shown in Appendix G.

7.3 HAZARD ASSESSMENT AND CONTROL

For each hazard, the consequences have been identified and control measures documented and referenced to operating documents (Appendix G).

The following sections discuss the significant hazards identified which could have a potential effect on employees, the public or the natural environment.

7.3.1 Hydrogen Sulphide

There is the potential for an emission from the CO_2 removal stack to contain up to 200 ppm of H_2S. The CO_2 removal stack is 40 metres high. Employees near the stack and down wind when there is a gas release will be exposed to high concentration of H_2S for a short period of time.

An Emergency Response Plan will be prepared which will address this potential exposure to employees and will document procedures

for evacuating plant areas affected (Commitment 8.22). Employees will be trained in the Emergency Response Plan procedures with regular exercises to refresh their knowledge of procedures.

There is the potential for members of the public in South Hedland and the Wedgefield Industrial Area as well as Pilbara Energy Pty Ltd power station employees to be exposed to low concentrations of H_2S which will be a nuisance odour problem rather than a health problem.

There will be a community education programme developed and implemented prior to the start-up of the HBI plant to inform the members of the public of the potential of H_2S gas release, the low ambient levels and the odour issue (Commitment 8.23).

7.3.2 Dust Emissions

There are a number of potential dust emissions in the plant such as baghouses, conveyors and stockpiles. The dust is classed as a nuisance dust and with well designed and maintained water suppression dust systems, dust will be kept to a minimum.

The plant is not considered to have the same potential as the Nelson Point plants to generate dust.

7.3.3 Fire Due to a Gas Leak

There is the potential, although very low, in a well designed and maintained plant with flammable gas and high pressure, for gas leaks to occur which could ignite. It is unlikely that a large leak would occur undetected in normal operation.

If a gas leak did occur and the gas ignited, any employee in the immediate vicinity may be at risk of being burnt. This however is considered a very remote possibility. Operating procedures and regular plant inspections would minimise the risk of significant gas leaks.

7.3.4 Explosion in a Reactor Train which is Down for Maintenance

There are four reactors which are in pairs. There is a risk that if the reactors are down for maintenance and not thoroughly isolated, reducing gas may enter the reactors causing an explosive mixture.

An explosion of this nature would not damage the reactor vessels but may result in loose materials being blown around causing injury to maintenance personnel.

An explosion of this type is remote and unlikely if the isolation procedures are followed. Isolation procedures will be documented in the operating procedures. All employees and contractors will

undergo isolation procedures training at induction and prior to maintenance shutdowns (Commitment 8.22).

7.3.5 Noise

The major noise issue would be a plant shutdown requiring depressurisation of the plant and release of gas to flare. The noise from this flaring would last about 5 minutes and be very noticeable in surrounding areas of South Hedland, Wedgefield and the Pilbara Energy Pty Ltd power station.

The community education programme will include information on this noise issue (Commitment 8.23).

A noise monitoring, documentation and employee education programme will be introduced at the start of plant operation to ensure minimum employee exposure to high noise levels (Commitment 8.24).

7.3.6 Hazardous Materials Management

There will be a hazardous materials management programme developed, introduced and maintained (Commitment 8.25) to achieve the following:

- material safety data sheets for all hazardous materials;
- employees trained in material safety data sheet information and precaution procedures;
- storage of hazardous materials will comply with the *Dangerous Goods Regulations* 1992;
- all environmentally sensitive chemicals will be stored in fully bunded compounds; and
- there will be regular hazardous materials audits to ensure compliance with storage and handling procedures.

7.3.7 Waste Materials

There will be procedures developed, implemented and maintained for the safe containment and disposal of all waste materials such as drums, waste oil and solvents, plastic containers and metal (Commitment 8.21).

Regular environmental audits will determine compliance with these procedures.

7.3.8 Occupation Health and Safety

A comprehensive Occupational Health and Safety programme will be developed prior to the plant opening. All employees will be trained in all occupation health and safety procedures, operating procedures and environmental procedures prior to final commissioning of the plant (Commitment 8.26).

There will be regular safety and environmental inspections and audits, safety meetings, inductions and specific skills training to ensure a continuous improvement programme and upgrading of procedures.

The HBI plant is in a cyclone prone area. The plant will be engineered and built to cyclone specifications. The plant will adopt the local cyclone procedures, these being a three colour coded alert system.

8.0 PROPONENT COMMITMENTS

The following commitments have been developed by BHP DRI to reduce the potential impacts of the project.

PRE-CONSTRUCTION

8.1 All supervisory construction personnel will be instructed in the protection of cultural and ecological resources in the project area and will be briefed on all agreed commitments, to the satisfaction of the DEP.

8.2 Once final design is complete a final Aboriginal Heritage Survey will be conducted. Appropriate approvals will be obtained from the Minister of Aboriginal Affairs should disturbance to any archaeological or ethnographic sites be required. This will be to the satisfaction of the Aboriginal Sites Department.

8.3 An Environmental Management Plan will be prepared and approved by DEP prior to construction activities commencing. This will be implemented during the construction and operational phases of the project. Issues addressed will include monitoring, reporting, rehabilitation and the control of feral fauna and declared species of flora.

DURING CONSTRUCTION

8.4 The limits of construction activities will be determined by BHP DRI with activities restricted to, and confined within, those limits. All construction vehicle movements outside of the construction areas will be restricted, where practicable, to predesignated roads and tracks. This will be to the satisfaction of the DEP.

8.5 The contractor will be instructed to do everything reasonably within its power to prevent and suppress fires on, or near, the development site. BHP DRI will also comply with Bushfire Board requirements. This will be to the satisfaction of the DEP.

8.6 The contractor will be required to maintain suitable crossings for all roads, trails and fences that will be affected during construction and operation activities, to the satisfaction of the DEP.

8.7 Should any archaeological sites be identified during construction activities, BHP DRI recognises its obligations under the *Aboriginal Heritage* Act 1972 - 1990 to cease activities that may impact on the site and to initiate discussions with the Aboriginal Sites Department on an appropriate course of action.

8.8 All waste materials generated during construction activities will be disposed of in a manner satisfactory to the DEP.

8.9 No new access ways will be constructed where existing access is available and suitable for BHP DRI purposes. This will minimise ground disturbance and limit unauthorised access. This will be to the satisfaction of the DEP.

8.10 During construction of the pipelines, transmission lines, conveyor and access roads, BHP DRI will only remove vegetation that is essential for construction purposes, or the safe operation of the infrastructure, to the satisfaction of the DEP.

8.11 Wherever possible, existing borrow pits will be used. If new sites are required pits will be sited, excavated and rehabilitated according to the standards set out in the *BHP-Newman Guidelines and Objectives for Borrow Pit Development and Rehabilitation*, to the satisfaction of the DEP.

8.12 BHP DRI recognises its obligations under the noise provisions of the *Environmental Protection* Act 1986 to take corrective action to ensure that noise levels comply with EPA standards.

8.13 Appropriate dust control measures, such as the spraying of exposed surfaces with water, will be implemented should dust levels prove to be an issue, to the satisfaction of the DEP.

8.14 Should important species of fauna be located on the site, discussions will be held with CALM on appropriate management techniques, to the satisfaction of the DEP.

POST CONSTRUCTION

8.15 Any roads, fences or trails that may be damaged as a result of construction work will be repaired, to the satisfaction of the DEP.

8.16 All areas not required for permanent facilities outside of the project boundaries will be rehabilitated consistent with the Environmental Management Plan, to the satisfaction of the DEP.

8.17 During operation, air quality monitoring will be carried out to ensure compliance with EPA standards. This will include ambient air monitoring as outlined in the EMP approved by the DEP. Corrective action will be taken if emission standards are exceeded. This will be to the satisfaction of the DEP.

8.18 During operation, a suitable surface water quality monitoring programme will be instituted and corrective action will be taken if unacceptable impacts are identified, to the satisfaction of the DEP.

8.19 Groundwater quality in the vicinity of the plant site will be monitored and corrective action will be taken if unacceptable impacts are identified, to the satisfaction of the DEP.

8.20 The physical behaviour of brine discharge will be quantified through the implementation of a monitoring programme. If unacceptable environmental impacts are identified, corrective action will be taken, to the satisfaction of the DEP.

8.21 Solid and liquid wastes generated during operation and maintenance activities will be either recycled or disposed of in an approved manner, to the satisfaction of the DEP.

8.22 Prior to commissioning, an Emergency Response Plan will be prepared that address issues relating to the release of H_2S, fires, gas leaks and explosions. Employees will be trained in the Emergency Response Plan. This will be to the satisfaction of the DEP.

8.23 Prior to commissioning, a community education programme will be developed and implemented to ensure that the community is fully informed on issues relating to potential H_2S release and noise. This will be to the satisfaction of the DEP.

8.24 A noise monitoring, documentation and employee education programme will be introduced at the start of plant operation to ensure minimum employee exposure to high noise levels. This will be to the satisfaction of the DEP.

8.25 A hazardous materials management programme will be developed, introduced and maintained to the satisfaction of the DEP.

8.26 An Occupational Health and Safety programme will be developed prior to commissioning with all employees trained in the procedures, to the satisfaction of the DEP.

8.27 All vessels associated with the HBI Project will comply with the "Voluntary guideline for Ballast water and sediment discharge from overseas vessels entering Australian waters" or the "Draft Australian Ballast Water Management Strategy".

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10.0 ABBREVIATIONS

ARI	Average recurrence interval
AHD	Australian Height Datum
BHP	Broken Hill Proprietary Company Limited
CALM	Department of Conservation and Land Management
CER	Consultative Environmental Review
dB(A)	decibels (A weighting)
DEP	Department of Environmental Protection
DRI	Direct Reduced Iron
ENM	Environmental Noise Model
EPA	Environmental Protection Authority
EPP	Environmental Protection Policy
g	gram
ha	hectare
HBI	Hot Briquetted Iron
hr	hour
kg	kilogram
km	kilometre
kPa	kilopascal
L	litre
L90	the noise level which is exceeded 90 % of the time during the 15 minute period over which the noise level was measured
M	Million
m	metre
m^3	cubic metre
mg	milligram
mm	millimetre
Mt	Million tonnes
ng	nanogram (10^{-12})
pa	per annum
pd	per day
PJ	Petajoule (10^{15})

ppm	parts per million
ppt	parts per thousand
RL	Reduced Level
s	second
t	tonne
TDS	Total Dissolved Solids
w/w	weight for weight
°C	Degrees Celsius
µ	micro

APPENDIX A

Consultative Environmental Review Guidelines

(The principal section of the CER which addresses the issues raised in the guidelines are identified in brackets)

PROPOSAL FOR DIRECT REDUCTION IRON PROJECT, PORT HEDLAND

(ASSESSMENT NO. 899)

GUIDELINES FOR THE CONSULTATIVE ENVIRONMENTAL REVIEW

Overview

In Western Australian, the environmental assessment process is about protecting the environment. The fundamental requirement is for the proponent to described the proposal in some detail, to discuss the environmental impacts and potential environmental impacts of the proposal, and then to describe how those environmental impacts are going to be avoided, ameliorated or managed so that the environment is protected.

If the proponents can demonstrate that the environment would be protected from unacceptable environmental impacts, then the proposal would be found environmental acceptable: if the proponent cannot demonstrate this, then the Environmental Protection Authority (EPA) would recommend against the proposal.

Throughout the process, it is the aim of the EPA to advise and assist the proponent to improve or modify the proposal in such a way that the environment is protected. However, it is the responsibility of the proponent to design and implement proposals which protect the environment, and to present the design proposals for review.

These guidelines have been prepared to assist the proponent in identifying key issues which should be addressed within the Consultative Environmental Review (CER) for the Direct Reduction Iron Project at Port Hedland. They are not intended to be exhaustive and the proponent may consider that other issues should also be included in the document.

Purpose and Objective of the CER

The principal function of the CER is to facilitate a review of key environmental issues, and to communicate clearly with the public and Government agencies, so that the EPA can obtain informed comments of the proposal. This provides the basis for the EPA to assess the proposal and to advise the State Government on protecting the environment.

The CER should place this project in the context of the local and regional environment. It seeks to explain why this project is being proposed in the way it is , at this place and at this time. In this respect, the need for the proposal and alternatives available should be clearly stated. A comparison of alternative sites and processes in the context of the stated objectives and biophysical and social environmental impacts of the proposal should be included. In this way the rationale for not choosing certain alternatives should be clear as well as the basis for choosing the preferred option. The CER should also set out the environmental impacts the project will have, and what management steps the proponent intends to use to avoid, ameliorate or mitigate any negative environmental impacts.

The Document

The purpose of the CER should be explained, and the contents should be concise and accurate as well as being readily understood. Specialist information and technical description should be included only where it assists the understanding of the proposal. Where specific information has been requested by a Government department or by the local authority this should be included in the document.

It is not intended that the document be unduly lengthy. Rather it is intended that all relevant material should be succinctly presented in order that the key environmental issues may be assessed.

A copy of these guidelines should appear in the CER document.

Description of Proposal and Existing Environment

It is important to include a description of the proposal itself, including specifically what is proposed, how it is to be carried out, the timing of the project, and what measures will be taken to ameliorate possible negative effects.

Detailed plans of the areas to be affected by the proposal should be included showing:

- location of the proposal;
- existing land uses and land status;
- relationship to other infrastructure; and
- relationship of the proposal to the proposed industrial estate at Port Hedland.

These plans may be included in the text, or included as appendices to the report, as appropriate.

The existing environment should be clearly described including physical, biological and human environment.

Environmental Impacts and Management

Key Environmental Issues

The key issues for this proposal should be clearly identified and the content of succeeding sections determined by their relevance to these issues.

The CER should address how the proponent (and its associated companies) has performed to date in managing environmental impacts associated with existing iron ore operations at Port Hedland, and how this new proposal would affect the environment, in particular cumulative impacts.

In this case the key environmental issues in both construction and operational phases include:

- relationship to regional planning for the area in general (Section 6.1.2);
- requirements for and provision of buffer zones around the project area (Section 5.10.3);
- impacts on existing industrial operations in the area including possible improvements to environmental quality in existing facilities (Section 1.4);
- energy and water requirements, and potential for new water resource projects (Sections 4.6 and 4.7);
- accommodation and management of construction workforce (Section 4.9.1);
- impacts on flora, fauna, particularly on restricted and endangered species (Sections 5.4 and 5.5);
- facilitation of the spread of exotic plants and animals, both marine and terrestrial (Sections 5.4.3, 5.5.3 and 5.7.6);
- marine and nearshore impacts resulting from clearing, construction, dredging, filling and operation of facilities and infrastructure, especially impacts on mangroves, corals, island fauna and marine fauna (Sections 5.4.3 and 5.7);
- heavy metal contamination of cooling water from heat exchanger tubing (Sections 5.7.1);
- impacts on quality and quantity of the local surface and ground water resources (Section 5.6);
- noise levels, odours, light, gaseous emissions (such as oxides of sulphur and nitrogen, greenhouse gases), particulates, and the containment of these impacts to acceptable levels within the confines of the project area (Sections 5.9 and 5.10);
- liquid waste treatment and disposal (Sections 5.7 and 5.8.3);
- solid waste disposal including tailings dams (Sections 4.12 and 5.8);
- recycling/utilisation of solid and liquid wastes (Sections 4.12, 5.8.2 and 5.8.3);
- risks and hazards (Section 7.0);
- visual impacts on landscape values (Section 6.1.5);
- impacts on local communities and nearest neighbours (Section 6.1); and
- protection of areas of importance to aboriginal and non-aboriginal heritage (Section 6.2).

Predicted environmental impacts and proposed measures to overcome or minimise these problems should be discussed in sufficient detail so as to allow an adequate assessment to be made. Proposed monitoring programs and contingency plans to ameliorate unplanned events should also be discussed.

Public Participation and Consultation

A description should be provided of the public participation and consultation activities undertaken by the proponent in preparing the CER. Cross reference should be made with the description of environmental management for the proposal which should clearly indicated how community concerns have been addressed. Where these concerns are dealt with via other departments or procedures out side the Environmental Protection Authority process, these can be noted and referenced in this section.

Commitments

Where a social or biophysical environmental problem has the potential to occur, the proponent should cover this potential problem with a commitment to rectify it. Where appropriate, the commitment should include:

(a) who is responsible for the commitment and who will do the work;

(b) what is the nature of the work;

(c) when and where the work will be carried out; and

(d) to whose satisfaction will the work be carried out.

A summary of commitments in numbered form should be given. A set of well written concise commitments covering the key issues of the proposal and its effects will help to expedite assessment of the proposal.

APPENDIX B

Vascular Plant Species for the Hedland HBI Project Area

VASCULAR PLANT SPECIES LIST FOR THE HEDLAND HBI PROJECT AREA

FAMILY	GENUS	SPECIES
POACEAE	*Cenchrus*	*ciliaris*
	Chrysopogon	*fallax*
	Eragrostis	*falcata*
	Eragrostis	*xerophila*
	Eriachne	*aristidea*
	Eriachne	aff. *benthamii*
	Eriachne	*flaccida*
	Eriachne	*obtusa*
	Panicum	*decompositum*
	Paspalidium	*tabulatum*
	Plectrachne	*schinzii*
	Sporobolus	*australasicus*
	Triodia	*basedowii*
	Triodia	*pungens*
	Triodia	*secunda*
CYPERACEAE	*Cyperus*	*cunninghamii*
	Fimbristylis	*dichotoma*
ANTHERICACEAE	*Tricoryne*	*elatior*
MORACEAE	*Ficus*	*platypoda*
PROTEACEAE	*Grevillea*	*pyramidalis*
	Hakea	*suberea*
SANTALACEAE	*Santalum*	*lanceolatum*
CHENOPODIACEAE	*Atriplex*	*codonocarpus*
	Enchylaena	*tomentosa*
	Neobassia	*astrocarpa*
	Rhagodia	*eremaea*
	Salsola	*kali*
AMARANTHACEAE	*Aerva*	*javanica*
	Amaranthus	*mitchellii*
	Gomphrena	*canescens*
	Ptilotus	*clementii*
	Ptilotus	*fusiformis*
	Ptilotus	*obovatus*
NYCTAGINACEAE	*Boerhavia*	*gardneri*
AIZOACEAE	*Trianthema*	*turgidifolia*
MOLLUGINACEAE	*Mollugo*	*molluginis*
PORTULACACEAE	*Portulaca*	*oleracea*

LAURACEAE	*Cassytha*	*capillaris*
CAPPARACEAE	*Capparis*	*spinosa*
	Cleome	*viscosa*
MIMOSACEAE	*Acacia*	*bivenosa*
	Acacia	*coriacea* ssp. *coriacea*
	Acacia	*cowleana*
	Acacia	*inaequilatera*
	Acacia	*trachycarpa*
	Acacia	*translucens*
	Acacia	*tumida*
PAPILIONACEAE	*Canavalia*	*rosea*
	Desmodium	*filiforme*
	Indigofera	*?linnaei*
	Indigofera	*monophylla*
	Psoralea	*lachnostachys*
	Psoralea	*pustulata*
	Rhynchosia	*minima*
	Tephrosia	*rosea*
	Tephrosia	*rosea* ssp. *clementii*
	Tephrosia	*sphaerospora*
	Zornia	*muelleriana ssp. congesta*
ZYGOPHYLLACEAE	*Tribulus*	*?occidentalis*
MELIACEAE	*Owenia*	*reticulata*
EUPHORBIACEAE	*Adriana*	*tomentosa*
	Euphorbia	*tannensis*
SAPINDACEAE	*Dodonaea*	*coriacea*
	Atalaya	*hemiglauca*
TILIACEAE	*Corchorus*	*walcottii*
	Triumfetta	*ramosa*
MALVACEAE	*Abutilon*	*otocarpum*
	Abutilon	sp.
	Hibiscus	sp.
	Sida	*fibulifera*
	Sida	aff. *platycalyx*
	Sida	*rohlenae*
ELATINACEAE	*Bergia*	aff. *henshallii*
FRANKENIACEAE	*Frankenia*	*pauciflora* var. *pauciflora*
VIOLACEAE	*Hybanthus*	*aurantiacus*
THYMELAEACEAE	*Pimelea*	*ammocharis*

RHIZOPHORACEAE	*Rhizophora*	*stylosa*
MYRTACEAE	*Eucalyptus*	*aspera*
	Eucalyptus	*victrix*
	Eucalyptus	*hamersleyana*
	Melaleuca	*argentea* ssp.*argentea*
	Melaleuca	*lasiandra*
PLUMBAGINACEAE	*Muellerolimon*	*salicorniaceum*
OLEACEAE	*Jasminum*	*didymum* ssp. *lineare*
APOCYNACEAE	*Carissa*	*lanceolata*
ASCLEPIADACEAE	*Sarcostemma*	*viminale* ssp. *australe*
CONVOLVULACEAE	*Bonamia*	*linearis*
	Bonamia	*rosea*
	Ipomoea	*muelleri*
	Merremia	*davenportii*
	Polymeria	*ambigua*
BORAGINACEAE	*Ehretia*	*saligna*
AVICENNIACEAE	*Avicennia*	*marina*
SOLANACEAE	*Solanum*	*diversiflorum*
	Solanum	*lasiophyllum*
BIGONONIACEAE	*Dolichandrone*	*heterophylla*
MYOPORACEAE	*Myoporum*	*acuminatum*
RUBIACEAE	*Dentella*	*minutissima*
CUCURBITACEAE	*Mukia*	*maderaspatana*
GOODENIACEAE	*Goodenia*	aff. *tenuiloba* (=MET1540)
	Goodenia	sp.
	Scaevola	aff. *ovalifolia*
	Scaevola	*spinescens*
ASTERACEAE	*Pluchea*	*tetranthera* var. *?tetranthera*
	Pluchea	*tetranthera* var. *tomentosa*
	Pterocaulon	*sphacelatum*
	Streptoglossa	*bubaki*

APPENDIX C

Vertebrate Fauna for the Hedland HBI Project Area

BIRD SPECIES RECORDED IN THE HEDLAND HBI PROJECT AREA

KEY

FS-1 to FS-7 = Systematic sampling sites
OP = Opportunistic sites
ST = Conservation status
T = Listed under the Japan/Australia and China/Australia Agreements
R = Reserve List species
# = Opportunistically recorded
Numbers are the total number of individuals for all sampling periods

BIRD SPECIES		ST	FS-1	FS-2	FS-3	FS-4	FS-5	FS-6	FS-7	OP
DROMAIIDAE										
Dromaius novaehollandiae	Emu									#
ANHINGIDAE										
Anhinga melanogaster	Darter									#
PHALACROCORACIDAE										
Phalacrocorax varius	Pied Cormorant									#
ARDEIDAE										
Ardea novaehollandiae	White-faced Heron								2	
Nycticorax caledonicus	Rufous Night Heron									#
PANDIONIDAE										
Pandion haliaetus	Osprey		1							
ACCIPITRIDAE										
Elanus scriptus	Letter-winged Kite		2							#
E. notatus	Black-shouldered Kite									#
Milvus migrans	Black Kite				1					
Haliastur indus	Brahminy Kite		1				2	1	2	
Haliaeetus leucogaster	White-bellied Sea-Eagle	T								#
Circus assimilis	Spotted Harrier					1				#
FALCONIDAE										
Falco longipennis	Australian Hobby			1						#
F. berigora	Brown Falcon		5		1					#
F. cenchroides	Australian Kestrel		1							#

BIRD SPECIES		ST	FS-1	FS-2	FS-3	FS-4	FS-5	FS-6	FS-7	OP
TURNICIDAE										
Turnix velox	Little Button-quail		2		5					#
OTIDIDAE										
Ardeotis australis	Australian Bustard	R			1					
CHARADRIIDAE										
Charadrius leschenaultii	Large Sand Plover	T							2	
C. veredus	Oriental Plover	T					123			#
SCOLOPACIDAE										
Numenius madagascariensis	Eastern Curlew	T							3	
N. phaeopus	Whimbrel	T							3	#
Tringa hypoleucos	Common Sandpiper	T							3	
T. nebularia	Greenshank	T							2	#
T. terek	Terek Sandpiper	T							10	
Calidris tenuirostris	Great Knot	T							8	
LARIDAE										
Larus novaehollandiae	Silver Gull									#
Gelochelidon nilotica	Gull-billed Tern						5		2	
COLUMBIDAE										
Phaps chalcoptera	Common Bronzewing									#
Ocyphaps lophotes	Crested Pigeon			3	3					#
CACATUIDAE										
Cacatua roseicapilla	Galah									#
POLYTELITIDAE										
Nymphicus hollandicus	Cockatiel		2							

BIRD SPECIES		ST	FS-1	FS-2	FS-3	FS-4	FS-5	FS-6	FS-7	OP
PLATYCERCIDAE										
Barnardius zonarius	Port Lincoln Ringneck			4						
Melopsittacus undulatus	Budgerigar		5							#
CUCULIDAE										
Chrysococcyx basalis	Horsfield's Bronze-Cuckoo			1						
STRIGIDAE										
Ninox novaeseelandiae	Southern Boobook									#
CAPRIMULGIDAE										
Caprimulgus guttatus	Spotted Nightjar	R		1						
ALCEDINIDAE										
Halcyon pyrrhopygia	Red-backed Kingfisher									#
H. sancta	Sacred Kingfisher								1	
H. chloris	Collared Kingfisher	R							5	
MEROPIDAE										
Merops ornatus	Rainbow Bee-eater	T			1	2			1	#
ALAUDIDAE										
Mirafra javanica	Singing Bushlark		1		5					
HIRUNDINIDAE										
Cheramoeca leucosterna	White-backed Swallow									#
Hirundo neoxena	Welcome Swallow				1					#
Cecropis nigricans	Tree Martin		6	1	8	1			10	
C. ariel	Fairy Martin				1					#
MOTACILLIDAE										
Anthus novaeseelandiae	Richard's Pipit		1		1	2	3			#
CAMPEPHAGIDAE										
Coracina novaehollandiae	Black-faced Cuckoo-shrike			3					1	#

BIRD SPECIES		ST	FS-1	FS-2	FS-3	FS-4	FS-5	FS-6	FS-7	OP
MUSCICAPIDAE										
Eopsaltria pulverulenta	Mangrove Robin								4	
Pachycephala melanura	Mangrove Golden Whistler								5	
P. rufiventris	Rufous Whistler			1						
P. lanioides	White-breasted Whistler								3	
Rhipidura phasiana	Mangrove Grey Fantail								5	
R. leucophrys	Willie Wagtail							1	2	#
SYLVIIDAE										
Cinclorhamphus cruralis	Brown Songlark		1		5	6				#
MALURIDAE										
Malurus leucopterus	White-winged Fairy-wren			10	48		6			#
M. lamberti	Variegated Fairy-wren									#
ACANTHIZIDAE										
Gerygone tenebrosa	Dusky Gerygone								3	
MELIPHAGIDAE										
Lichenostomus penicillatus	White-plumed Honeyeater									#
L. virescens	Singing Honeyeater			5				8	6	#
Lichmera indistincta	Brown Honeyeater							2	5	
Manorina flavigula	Yellow-throated Miner			2						#
PARDALOTIDAE										
Pardalotus rubricatus	Red-browed Pardalote			2						#
ZOSTEROPIDAE										
Zosterops lutea	Yellow White-eye								18	
PLOCEIDAE										
Poephila guttata	Zebra Finch		6	69	48			8		#
GRALLINIDAE										
Grallina cyanoleuca	Australian Magpie-lark			1						#
ARTAMIDAE										
Artamus leucorhynchus	White-breasted Woodswallow		2	2				1	2	
A. cinerus	Black-faced Woodswallow			5						#
CRACTICIDAE										
Cracticus nigrogularis	Pied Butcherbird									#

BIRD SPECIES		ST	FS-1	FS-2	FS-3	FS-4	FS-5	FS-6	FS-7	OP
CORVIDAE										
Corvus bennetti	Little Crow									#
TOTAL NUMBER OF SPECIES			14	16	14	5	5	6	25	41
TOTAL NUMBER OF INDIVIDUALS			36	111	129	12	139	21	108	
TOTAL NUMBER OF SPECIES RECORDED		69								

BIRD SPECIES EXPECTED TO OCCUR IN THE HEDLAND HBI PROJECT AREA

KEY

FS-1 to FS-7 = Systematic sampling sites
ST = Conservation status
T = Listed under the Japan/Australia and China/Australia Agreements
R = Reserve List species
D = Declared Rare Species

BIRD SPECIES		ST	FS-1	FS-2	FS-3	FS-4	FS-5	FS-6	FS-7
PELECANIDAE									
Pelecanus conspicillatus	Australian Pelican						X		X
ARDEIDAE									
Ardea pacifica	Pacific Heron						X		X
Egretta alba	Great Egret	T					X		X
E. garzetta	Little Egret						X		X
E. intermedia	Intermediate Egret						X		X
E. sacra	Eastern Reef Egret	T							X
Butorides striatus	Striated Heron								X
CICONIIDAE									
Xenorhynchus asiaticus	Black-necked Stork								X
PLATALEIDAE									
Plegadis falcinellus	Glossy Ibis	T					X		X
Threskiornis aethiopica	Sacred Ibis						X		X
T. spinicollis	Straw-necked Ibis						X		X
ANATIDAE									
Dendrocygna eytoni	Plumed Whistling-Duck						X		X
Anas gibberfrons	Grey Teal						X		X
ACCIPITRIDAE									
Lophoictinia isura	Square-tailed Kite		X	X	X	X	X	X	X
Hamirostra melanosternon	Black-breasted Buzzard	R	X	X	X	X	X	X	
H. sphenurus	Whistling Kite		X	X	X	X	X	X	X
Accipiter fasciatus	Brown Goshawk		X	X	X	X	X	X	X
A. cirrhocephalus	Collared Sparrowhawk		X	X	X	X	X	X	X
Aquila audax	Wedge-tailed Eagle		X	X	X	X	X	X	X

BIRD SPECIES		ST	FS-1	FS-2	FS-3	FS-4	FS-5	FS-6	FS-7
Hieraaetus morphnoides	Little Eagle		X	X	X	X	X	X	X
C. aeruginosus	Marsh Harrier						X		
FALCONIDAE									
Falco peregrinus	Peregrine Falcon	D	X	X	X	X	X	X	X
F. hypoleucos	Grey Falcon	D	X	X	X	X	X		
PHASIANIDAE									
Coturnix novaezealandiae	Stubble Quail		X	X	X	X	X	X	
RALLIDAE									
Gallinula ventralis	Black-tailed Native-hen						X		
GRUIDAE									
Grus rubicundus	Brolga						X		
BURHINIDAE									
Burhinus magnirostris	Bush Thick-knee	R	X	X	X	X	X	X	
B. neglectus	Beach Thick-knee								X
HAEMATOPODIDAE									
Haematopus longirostris	Pied Oystercatcher								X
H. fuliginosus	Sooty Oystercatcher								X
CHARADRIIDAE									
Vanellus tricolor	Banded Plover						X		X
Pluvialis squatarola	Grey Plover	T					X		X
P. dominica	Lesser Golden Plover	T					X		X
Charadrius mongolus	Mongolian Plover	T					X		X
C. ruficapillus	Red-capped Plover						X		X

BIRD SPECIES		ST	FS-1	FS-2	FS-3	FS-4	FS-5	FS-6	FS-7
SCOLOPACIDAE									
Arenaria interpres	Ruddy Turnstone	T					X		X
Numenius minutus	Little Curlew	T					X		X
Tringa brevipes	Grey-tailed Tattler	T							X
Limosa limosa	Black-tailed Godwit	T							X
L. lapponica	Bar-tailed Godwit	T							X
Calidris canutus	Red Knot	T							X
C. acuminata	Sharp-tailed Sandpiper	T					X		X
C. ruficollis	Red-necked Stint	T					X		X
C. ferruginea	Curlew Sandpiper	T					X		X
C. alba	Sanderling	T							X
Limicola falcinellus	Broad-billed Sandpiper	T							X
GLAREOLIDAE									
Glareola maldivarum	Oriental Pratincole	T	X	X	X	X	X	X	
Stiltia isabella	Australian Pratincole						X		
LARIDAE									
Chlidonias hybrida	Whiskered Tern						X		X
C. leucoptera	White-winged Tern	T					X		X
Hydroprogne caspia	Caspian Tern	T							X
Sterna albifrons	Little Tern	TR							X
S. bergii	Crested Tern						X		X
S. bengalensis	Lesser Crested Tern	T							X
COLUMBIDAE									
Geopelia humeralis	Bar-shouldered Dove							X	X
CUCULIDAE									
Cuculus pallidus	Pallid Cuckoo		X	X	X	X	X	X	X
TYTONIDAE									
Tyto alba	Barn Owl			X				X	X
PODARGIDAE									
Podargus strigoides	Tawny Frogmouth			X					
AEGOTHELIDAE									
Aegotheles cristatus	Australian Owlet-nightjar			X					

BIRD SPECIES		ST	FS-1	FS-2	FS-3	FS-4	FS-5	FS-6	FS-7
APODIDAE									
Apus pacificus	Fork-tailed Swift	T	X	X	X	X	X	X	X
HIRUNDINIDAE									
Hirundo rustica	Barn Swallow	T	X	X	X	X	X	X	X
CAMPEPHAGIDAE									
Lalage sueurii	White-winged Triller		X	X	X	X	X	X	
SYLVIIDAE									
Cinclorhamphus mathewsi	Rufous Songlark			X					
ACANTHIZIDAE									
Smicrornis brevirostris	Weebill			X					
MELIPHAGIDAE									
Acanthagenys rufogularis	Spiny-cheeked Honeyeater			X					
Certhionyx niger	Black Honeyeater		X	X	X	X		X	
EPHTHIANURIDAE									
Ephthianura tricolor	Crimson Chat		X	X	X	X	X	X	
DICAEIDAE									
Dicaeum hirundinaceum	Mistletoebird		X	X	X	X	X	X	X
ARTAMIDAE									
Aartamus personatus	Masked Woodswallow		X	X	X	X	X	X	
TOTAL NUMBER OF SPECIES EXPECTED TO OCCUR		69							

MAMMAL SPECIES RECORDED IN THE HEDLAND HBI PROJECT AREA

KEY

FS-1 to FS-7 = Systematic sampling sites
OP = Opportunistic sites
S = Signs of presence, eg scats, tracks, diggings etc.
# = Opportunistically recorded
Numbers are the total number of individuals for all sampling periods

NATIVE MAMMAL SPECIES		FS-1	FS-2	FS-3	FS-4	FS-5	FS-6	FS-7	OP
DASYURIDAE									
Sminthopsis macroura	Stipe-faced Dunnart						1		
Dasykaluta rosamondae	Little Red Kaluta				2	1			
MACROPODIDAE									
Macropus robustus	Common Wallaroo	2	1	S	S	S	1		#
M. rufus	Red Kangaroo								#
MURIDAE									
Pseudomys hermannsburgensis	Sandy Inland Mouse		3	7	6				
CANIDAE									
Canis familiaris dingo	Dingo								#
TOTAL NUMBER OF SPECIES		1	2	2	3	2	2	0	3
TOTAL NUMBER OF INDIVIDUALS		2	4	7	8	1	2	0	
TOTAL NUMBER OF SPECIES RECORDED		6							

INTRODUCED MAMMAL SPECIES		FS-1	FS-2	FS-3	FS-4	FS-5	FS-6	FS-7	OP
MURIDAE									
Mus musculus	House Mouse					3	6		
CANIDAE									
Canis familiaris	Domestic Dog					S			
FELIDAE									
Felis catus	Feral Cat	S							#
EQUIDAE									
Equus caballus	Horse								#
BOVIDAE									
Bos taurus	Domestic Cattle	S	S	S	S				#
Ovis aries	Sheep	S	S	S					#
TOTAL NUMBER OF SPECIES		3	2	2	1	2	1		4
TOTAL NUMBER OF INDIVIDUALS						3	6		
TOTAL NUMBER OF SPECIES RECORDED		6							

MAMMAL SPECIES EXPECTED TO OCCUR IN THE HEDLAND HBI PROJECT AREA

KEY

FS-1 to FS-7 = Systematic sampling sites
ST = Conservation status
R = Reserve List species

NATIVE MAMMAL SPECIES		ST	FS-1	FS-2	FS-3	FS-4	FS-5	FS-6	FS-7
DASYURIDAE									
Sminthopsis youngsoni	Lesser Hairy-footed Dunnart		X	X	X	X	X		
Ningaui timealeyi	Pilbara Ningaui		X	X	X	X	X		
PTEROPODIDAE									
Pteropus scapulatus	Little Red Flying-fox								X
P. alecto	Black Flying-fox								X
EMBALLONURIDAE									
Taphozous georgianus	Common Sheathtail-bat		X	X	X	X	X	X	X
MOLOSSIDAE									
Chaerephon jobensis	Northern Mastiff-bat		X	X	X	X	X	X	X
VESPERTILIONIDAE									
Nyctophilus geoffroyi	Lesser Long-eared Bat		X	X	X	X	X	X	X
N. bifax	Nth Queensland Long-eared Bat		X	X	X	X	X	X	X
Chalinolobus gouldii	Gould's Wattled Bat		X	X	X	X	X	X	X
Scotorepens greyii	Little Broad-nosed Bat		X	X	X	X	X	X	X
S. balstoni	Western Broad-nosed Bat		X	X	X	X	X	X	X
Eptesicus finlaysoni	Little Brown Bat		X	X	X	X	X	X	X
MURIDAE									
Hydromys chrysogaster	Water-rat	R							X
Pseudomys delicatulus	Delicate Mouse		X	X	X	X	X		
TOTAL NUMBER OF SPECIES EXPECTED TO OCCUR		14							

INTRODUCED MAMMAL SPECIES		FS-1	FS-2	FS-3	FS-4	FS-5	FS-6	FS-7
CANIDAE								
Vulpes vulpes	Fox	X	X	X	X	X	X	X

AMPHIBIAN AND REPTILE SPECIES RECORDED IN THE HEDLAND HBI PROJECT AREA

KEY

FS-1 to FS-7 = Systematic sampling sites
OP = Opportunistic sites
ST = Conservation Status
# = Opportunistically recorded
Numbers are the total number of individuals for all sampling periods

AMPHIBIAN AND REPTILE SPECIES		ST	FS-1	FS-2	FS-3	FS-4	FS-5	FS-6	FS-7	OP
GEKKONIDAE	Geckos									
D. conspicillatus							1			
D. stenodactylus					1					
Gehyra nana								6		
G. variegata				4				1		#
Heteronotia binoei			1							
Rhynchoedura ornata						1				
PYGOPODIDAE	Legless Lizards									
Delma butleri			1							
D. pax				2						
Pygopus nigriceps						1				
AGAMIDAE	Dragon Lizards									
Ctenophorus inermis			3		3	1				#
C. i. isolepis			7	3	10	3		3		#
Gemmatophora longirostris				5						#
SCINCIDAE	Skinks									
Carlia triacantha			2		1					
Ctenotus colletti				1		1				
C. grandis titan			1		1					
C. pantherinus ocellifer			1			1		2		
C. piankai			1		2	1	1			
C. saxatilis								4		
Lerista bipes			1	17	5	19				
Menetia greyii			1		1	2				

AMPHIBIAN AND REPTILE SPECIES		ST	FS-1	FS-2	FS-3	FS-4	FS-5	FS-6	FS-7	OP
Morethia r. ruficauda								2		
Notoscincus ornatus						1				
Tiliqua multifasciata					1					#
VARANIDAE	Monitors									
Varanus acanthurus										#
V. gouldii			1							
TYPHLOPIDAE	Blind Snakes									
Ramphotyphlops diversus ammodytes					1					
TOTAL NUMBER OF RECORDED SPECIES			11	6	10	10	2	6	0	6
TOTAL NUMBER OF INDIVIDUALS			20	32	26	31	2	18	0	
TOTAL NUMBER OF SPECIES RECORDED		26								

AMPHIBIAN AND REPTILE SPECIES EXPECTED TO OCCUR IN THE HEDLAND HBI PROJECT AREA

KEY

FS-1 to FS-7 = Systematic sampling sites
ST = Conservation Status
D = Declared Rare Species
# = Opportunistically recorded

AMPHIBIAN AND REPTILE SPECIES		ST	FS-1	FS-2	FS-3	FS-4	FS-5	FS-6	FS-7
LEPTODACTYLIDAE	Ground Frogs								
Limnodynastes spenceri			X	X	X				
Neobatrachus aquilonius			X	X	X				
Notaden nichollsi			X	X	X				
Uperoleia glandulosa			X	X	X				
U. russelli			X	X	X				
HYLIDAE	Tree Frogs								
Cyclorana australis			X	X	X				
C. maini			X	X	X				
Litoria rubella				X	X				
CHELONIIDAE	Sea-turtles								
Caretta caretta gigas		D							X
Lepidochelys o. olivacea		D							X
GEKKONIDAE	Geckos								
Crenadactylus o. ocellatus								X	
Diplodactylus ciliaris aberrans				X	X	X		X	
D. jeanae				X	X	X			
Gehyra pilbara				X	X	X			
Nephrurus levis pilbarensis					X	X	X		
PYGOPODIDAE	Legless Lizards								
Delma borea			X	X	X	X	X	X	
D. nasuta			X	X	X	X	X	X	
D. tincta			X	X	X	X	X	X	
Lialis burtonis			X	X	X	X	X	X	
AGAMIDAE	Dragon Lizards								

AMPHIBIAN AND REPTILE SPECIES		ST	FS-1	FS-2	FS-3	FS-4	FS-5	FS-6	FS-7
Diporiphora winneckei				X	X	X	X		
Gemmatophora g. gilberti									X
Pogona minor mitchelli				X	X	X		X	
SCINCIDAE	Skinks								
Cryptoblepharus carnabyi				X				X	
C. plagiocephalus				X				X	
Ctenotus serventyi					X	X			
Cyclodomorphus melanops			X	X	X	X	X		
Eremiascincus fasciolatus				X	X	X	X		
E. richardsonii				X	X	X	X		
Lerista muelleri			X				X		
Proablepharus reginae			X	X	X	X	X	X	
VARANIDAE	Monitors								
Varanus brevicauda			X	X	X	X	X	X	
V. eremius			X	X	X	X	X	X	
V. giganteus				X				X	
V. p. panoptes			X	X	X	X	X	X	
V. t. tristis			X					X	
TYPHLOPIDAE	Blind Snakes								
Ramphotyphlops grypus				X	X	X	X		
R. hamatus				X	X	X	X		
BOIDAE	Pythons								
Aspidites melanocephalus			X	X	X	X	X	X	
A. ramsayi		D		X	X	X			
Liasis perthensis				X					
L. s. stimsoni				X					
HOMALOPSIDAE	Water-snakes								
Fordonia leucobalia									X
ELAPIDAE	Elapid Snakes								
Acanthophis pyrrhus			X	X	X	X	X	X	
Demansia psammophis cupreiceps			X	X	X	X	X	X	
D. rufescens			X	X	X	X	X	X	

AMPHIBIAN AND REPTILE SPECIES		ST	FS-1	FS-2	FS-3	FS-4	FS-5	FS-6	FS-7
Furina ornata			X	X	X	X	X	X	
Pseudechis australis			X	X	X	X	X	X	
Pseudonaja nuchalis			X	X	X	X	X	X	
Rhinoplocephalus punctatus				X	X	X			
Simoselaps anomalus				X	X	X			
S. approximans				X	X	X	X	X	
TOTAL NUMBER OF SPECIES EXPECTED TO OCCUR		51							

APPENDIX D

Voluntary guidelines for Ballast water and sediment discharge from overseas vessels entering Australian waters.

VOLUNTARY GUIDELINES FOR BALLAST WATER AND SEDIMENT DISCHARGE FROM OVERSEAS VESSELS ENTERING AUSTRALIAN WATERS

alenb49

AQIS NOTICE

Australian Quarantine and Inspection Service
Department of Primary Industries and Energy

AQIS Notice Number
BARRIER
COORDINATION 92/2

Title
Controls on the Discharge of Ballast Water and Sediment from Ships Entering Australia from Overseas

Central Office File Number

Enquiries
Peter Mills
Barrier Operations, AQIS.
Tel. 06 2724523

Date of Effect	Date of Expiry
Immediate	Until further notice.

	Distribution Category	Last Notice to this Category		Distribution Category	Last Notice to this Category
X	Central and State Office	92/1		International Airline Operators	
X	Quarantine Staff	92/1		International Airline Caterers	
X	Shipping Coys/Agents	92/1		Statutory Authorities/Industry/ Organisations	

This Notice replaces AQIS Notice (General Quarantine) 90/1 issued in January 1990. It details voluntary controls to apply to the discharge of shipping ballast water and sediment from overseas vessels entering Australian territory. It takes into account the recommendations of the International Maritime Organisation (November 1991) concerning the discharge of ballast water which have been subsequently promulgated by way of International Guidelines. These International Guidelines were modelled very much on Australian arrangements.

This Notice also incorporates changes to some previous arrangements which stem from our experience since 1990 and take account of current and planned research.

Denis Paterson
Assistant Director
Barrier Corrdination and Development Branch

20 July 1992

PURPOSE

1 The purpose of this Notice is to continue the application of guidelines aimed at minimising the entry, establishment and/or spread in the Australian marine environment of toxic and harmful organisms via shipping ballast water and sediment discharge. It also takes into account the recommendations of the International Maritime Organisation (IMO) in November 1991 and Australia's experience in operating voluntary guidelines over the past two years.

THE ISSUE

2 It has been established that ballast water and sediment in vessels entering Australian waters has been contaminated with a range of organisms, including toxic dinoflagellate species known to cause paralytic shellfish poisoning in humans. The introduction of diseases may also arise as a result of port waters being inoculated with large quantities of ballast water containing viruses or bacteria, thereby posing health threats to indigenous human, animal and plant life.

STRATEGIES FOR MINIMISING THE INTRODUCTION OF UNWANTED AQUATIC ORGANISMS AND PATHOGENS FROM SHIP'S BALLAST WATER AND SEDIMENT DISCHARGES

AQIS is looking to ships Masters and owners to comply with voluntary arrangements to minimise the entry of exotic and harmful forms of marine life through the discharge of ballast water and sediment.

3 Ship Operational Procedures

3.1 When loading ballast, every effort should be made to ensure that only clean ballast water is being taken on and the uptake of sediment with the ballast water is minimised. Where practicable, ships should endeavour to avoid taking on ballast water in shallow water areas, or in the vicinity of dredging operations, to reduce the likelihood that the water will contain silt, which may contain the cysts of unwanted aquatic organisms and pathogens, and to otherwise reduce the probability that unwanted aquatic organisms and pathogens are present in the water. Areas where there is a known outbreak of diseases, communicable through ballast water, or in which phytoplankton blooms are occurring, should be avoided wherever practicable as a source of ballast.

3.2 When taking on ballast water, records of the dates, geographical locations, salinity and amount of ballast water taken on should be recorded in the ship's log book. The procedure to be followed by the ship should be described in detail in the ship's operational manual. The sample used to determine the salinity of the loaded ballast water should be obtained, whenever possible, from the ballast tanks themselves or from a supply piping tap. Surface sea water samples should not be taken as indicative of the water in the ballast tanks, since sea water salinity may vary significantly with depth.

3.3. Subject to accessibility, all sources of sediment retention such as anchors, cables, chain lockers and suction wells should be cleaned routinely to reduce the possibility of spreading contamination.

OPTIONS FOR BALLAST WATER MANAGEMENT

Ballast water may be managed in a number of ways which are outlined in Paragraphs 4 through to 8.

4 Non- release of Ballast Water

4.1 The most effective means of preventing the introduction of unwanted aquatic organisms and pathogens from ships' ballast waters and sediments is to avoid, wherever possible, the discharge of ballast water.

4.2 An undertaking may be given that ballast water discharge will not take place in Australian territory

5 Ballast Water Exchange and Sediment Removal.

5.3 Exchange of ballast water in deep ocean areas or open seas currently offers a means of limiting the probability that fresh water or coastal species will be transferred in ballast water. The Master of the vessel must take into account safety, stability and structural factors when undertaking this course of action. When ballast water exchange is being used as a control measure, care should be taken to flush out ballast tanks, chain lockers and other locations where silt may accumulate, to dislodge and remove such accumulations, wherever practicable. Before taking on exchange ballast water, tanks should be drained until pump action is lost. This will minimise the likelihood of residual organism survival.

5.4 The vessel may produce evidence that re-ballasting at sea en route to Australia has taken place:

- preferably in open tropical waters
- it should not take place within or adjacent to Australian territorial waters, or in designated national marine park areas
- details should be fully documented as detailed in paragraph 3.2. in the official log book for the vessel and be available for inspection by quarantine staff on arrival.

5.5 Where it is not possible to carry-out an "at sea" exchange of ballast water, a "flow-through" exchange of ballast water may be an acceptable alternative. Details of procedures for exchange of this type must be submitted to the Australian Quarantine and Inspection Service (AQIS) for approval.

5.6 To facilitate administration of ballast water exchange and sediment removal procedures on board ships, a responsible officer familiar with those procedures should be appointed to maintain appropriate records and to ensure

that all ballast water exchange and sediment removal procedures are followed and recorded. These procedures should be included in the ship's operational manual.

5.7 To enable monitoring of ballast control procedures Ships' Masters should ensure the completion of questions relating to ballast in the Request for Radio Pratique. See Appendix No 1.

6 Compliance Arrangements with Australian Quarantine and Inspection Service (AQIS).

6.1 A compliance arrangement may be entered into between the vessel's owners and AQIS to ensure the cleanliness of ballast water, basically through effective ship management procedures. Typically, such arrangements would include

- properly documented operational procedures to ensure and monitor the cleanliness (ie. freedom from sediment) of loaded ballast water.
- clearly defined lines of command and directives and, as appropriate, training of operational staff in the function
- a commitment to notify AQIS where clear water loading practices cannot be implemented or where water is loaded at the time of a toxic 'bloom'. Such notification should be well in advance of the vessel's arrival, to allow alternative strategies to be developed with minimal disruption to the ship on arrival.

6.2 The arrangement would be monitored by AQIS at least twice per year and if found not to be in accordance with the arrangement between the vessel's owners and AQIS, corrective action will be required.

7 Alternative treatments

7.1 AQIS is willing to consider proposals for water treatment, either in-tank (or hold) or on shore to render the organisms non-viable. The vessel's Master, or the owners would need to demonstrate the efficacy of such treatments and seek prior AQIS agreement for their use. It would also need to be demonstrated that treated water would be disposed of subsequently in a manner which would not, of itself, create quarantine or environmental concerns. AQIS currently is not aware of any suitable treatments, but these could come about in future as a result of ongoing research.

8 Guide-lines for Control of Ballast Sediment

8.1 Under no circumstances should sediment resulting from tank or hold cleaning or stripping be disposed of in Australian waters. Sediment should not be shovelled or tipped over the side of the vessel after de-ballasting. Where such disposal is necessary, as a result of tank or hold cleaning or drydocking, it should be disposed of in a manner which prevents it entering the Australian marine environment.

8.2 Where one or more of the recommended guide-lines for ballast water discharge has been taken, and loose sediment which is likely to be discharged in an initial flush, for instance in the bilge well of a hold space, such sediment should be drawn off by a suitable means, (e.g. via shipping pumps, priming taps on either the main or stripping pumps, or by tapping into pressure gauge lines) into holding drums, tanks, or the bilge, or by carrying out initial release into an approved discharge area, or at sea outside territorial limits, before full discharge overboard takes place.
(NOTE Bearing in mind that some minor suspended sediment discharge is unavoidable, this procedure need not apply to relatively insignificant amounts of suspended sediment in the water)

9 PROCEDURES IN THE ABSENCE OF CONTROL ACTION

9.1 Where appropriate control action has not been taken, AQIS should be advised, preferably at the time of and in applying for Pratique so that an appropriate course of action can be determined.

9.2 Appropriate action in such cases may include:

- allowing the vessel to discharge normally, based on risk assessment taking into account the type of vessel, its origin, the risk factors at the port of entry (including tidal flows and proximity to shellfish farms and aquaculture);

OR

- withholding discharge until samples of water/sediment are taken, analysed, and found free of harmful organisms

OR

- vessel given the option of departing Australian territorial water to carry out appropriate re-ballasting. In exceptional circumstances, the operation may be carried out in Australian territorial waters, subject to agreement on case by case basis by AQIS, after consultation with State and local authorities if necessary. Factors taken into account in considering and determining such approved discharge areas may include

  .. water depth (discharge would not normally be agreed to in waters less than 340 metres deep)
  .. tidal flows (should be away from land)
  .. the need to be distanced from estuaries and agriculture.

9.3 The procedures in paragraphs 9.1 and 9.2 may also be applied in cases where testing on arrival indicates the presence of harmful organisms.

BALLAST WATER SAMPLING PROCEDURES

To assist in monitoring the effectiveness of the voluntary arrangements, masters of overseas vessels entering Australian territory in ballast, who intend to de-ballast, may be requested to supply to quarantine staff samples of ballast tank sediment in accordance with the sampling regime which shall be determined from time to time by AQIS. Whenever practicable, such samples shall be provided at the time of initial boarding by quarantine staff. Sampling procedures apply under the general powers of Proclamation 6G of the *Quarantine Act 1908*.

Sampling procedures

The master of the vessel shall be advised of the need to obtain a ballast tank sediment sample of the vessel. **It is important that the Master is made aware that it is the sediment (mud) that is of interest.**

Samples can be taken in a number of ways. Adequate safety precautions must be followed. Sampling procedures shall be as follows

(a) from holding tanks, in areas where sediment is likely to accumulate (around outlet points, bulkhead and hold corners etc) are accessible.

(b) by run-off from the priming taps on either the main pumps or the stripping pump where fitted, or from a tap inserted into the pressure gauge line. If necessary, the taps should be allowed to run to clear any line sediment or water before hold or tank samples are taken.

(c) by obtaining two samples of harbour sediment at the time of ballasting.

Holding of samples for collection

Samples must be taken under the supervision of a Quarantine Officer.

- the sample containers used are 500ml plastic containers with wide screw tops. Clear plastic containers should not be used due to the need to retain the sample in a dark environment.

- each container should have a label with the following information
  - .. name of vessel
  - .. date and port or place where the sample was collected
  - .. date and port or place(or at sea) where ballasting was carried out
  - .. hold or tank from which the sample was taken

  or

  - .. the sample number generated by the Vessel Monitoring System.

The samples can be stored under refrigeration at the Quarantine Office until forwarded as a lot to the laboratory, unless instructions are received to the contrary.

Samples forwarded from distant ports are to be transported in an esky or other suitable cool container.

The address of the laboratory for analytical purposes is: -

The Australian Government Analytical Laboratories,
51 - 65 Clarke Street South Melbourne Vic 3205
Telephone 03 685 1777
Facsimile 03 6851788

Where samples are to be taken from a vessel which is some distance from quarantine operations, appropriate arrangements, in line with the above requirements, may be made with Customs, local port authorities, etc for the collection of samples.

Appendix 1

REQUEST FOR PRATIQUE QUESTIONNAIRE

COMMONWEALTH OF AUSTRALIA
QUARANTINE ACT 1908
REQUEST FOR PRATIQUE (HEALTH CLEARANCE)

Note: Masters or Medical Officers who wilfully make a false statement in answer to questions A-H, are liable to a fine not exceeding $5,000 or imprisonment for a period not exceeding two years.

	Question	Answer
A	Name, call sign, type and nationality of vessel	
B	Where from and departure date?	
C	Where bound and ETA first port?	
D	ETD and name of next port?	
E	Details of any deaths during the current voyage or cases of illness during the last 21 days with a fever of 38°C or above, and (a) Accompanied by rash, jaundice or glandular swelling, or (b) accompanied by diarrhoea lasting longer than 24 hours.	
F	Are there any animals on board?	Yes / No
G	Have you carried livestock in the last six months? If Yes: - List type, ports visited and cleaning performed since last livestock voyage.	Yes / No
H	Date of issue of derat/derat exemption certificate	
I	**Optional Section - Ballast Water** (answering this section may assist in the clearance of your vessel when it arrives in port) (a) Do you undertake not to discharge ballast while in Australian waters?	Yes / No
	If No have you: (b) Exchanged ballast water at sea during the voyage and logbook certification of time and co-ordinates when re-ballasting occurred; or	Yes / No
	(c) Is your vessel part of a compliance arrangement for ballast water control accepted by Australian Quarantine and Inspection Service?	Yes / No

NOTE: The granting of pratique to a vessel does not release it from being subject to quarantine. Goods require separate clearance.

DATE SIGNED

SHIPPING AGENCY NAME

AQIS AUSTRALIAN QUARANTINE AND INSPECTION SERVICE
DEPARTMENT OF PRIMARY INDUSTRIES AND ENERGY

Request for Pratique (Health Clearance)

Commonwealth of Australia
Quarantine Act 1908

Note: Masters or Medical Officers who wilfully make a false statement in answer to questions A-H, are liable to a fine not exceeding $5,000 or imprisonment for a period not exceeding two years.

A Name of vessel

Call sign | Type

Nationality

B Where is the vessel from? | Departure date

C Destination | ETA first port

D Name of next port | ETD

E Have there been any deaths during the current voyage?

YES ☐ NO ☐

Have there been any cases of illness during the last 21 days with a fever of 38°C or above, and accompanied by:

(a) rash, jaundice or glandular swelling,

YES ☐ NO ☐

(b) diarrhoea lasting longer than 24hours.

YES ☐ NO ☐

F Are there any animals on board?

YES ☐ NO ☐

G Have you carried livestock in the last six months?

YES ☐ NO ☐

If YES, list the type, ports visited and cleaning per formed since last livestock voyage.

H Date of derat/derat exemption certificate?

/ /

I Ballast Water

Do you intend to discharge ballast while in Australian waters?

YES ☐ NO ☐

If YES, have you:

(a) Exchanged ballast water at sea during the voyage and have logbook certification of time and co-ordinates when re-ballasting occurred;

YES ☐ NO ☐

OR

(b) Is your vessel part of a compliance arrangement for ballast water control accepted by the Australian Quarantine and Inspection Service?

YES ☐ NO ☐

J In the past 2 years has your ship been in a Russian Far East port/s between 40° N and 60° N during any period between July and September?

YES ☐ NO ☐

(a) If YES, since your last visit to the port/s, has your ship been inspected and cleared as being free of Asian Gypsy Moth by agricultural authorities in Australia, Canada, New Zealand or the USA.

YES ☐ NO ☐

(b) If NO, during your last visit to a Russian Far East port, did you obtain a certificate issued by the Russian agricultural authorities certifying that they had inspected the ship and found it free of Asian Gypsy Moth egg masses?

YES ☐ NO ☐

Shipping Agency Name

Signature and Date

/ /

Note:
The granting of pratique to a vessel does not release it from being subject to quarantine. Goods require separate clearance.

APPENDIX E

Guidelines and Objectives for Borrow Pit Development and Rehabilitation

GUIDELINES AND OBJECTIVES
FOR BORROW PIT
DEVELOPMENT AND REHABILITATION

TABLE OF CONTENTS

GUIDELINES AND OBJECTIVES FOR BORROW PIT DEVELOPMENT AND REHABILITATION

1.0 ABSTRACT

The following is an outline of the principles and objectives for management and rehabilitation of borrow pits. Borrow pit is a term describing an area where gravel, sand and general material for road making, building and fill is obtained. It can also describe any quarry or open cut mining operations, operations associated with road building, mining operations, railroad operations and industrial sites.

These guidelines are intended for soil, gravel and sand extraction with rehabilitation specifically using indigenous (local) species as treatment of these areas being highlighted.

Rehabilitation is the term used to describe the physical landscaping and improvement of a disturbed area to promote and encourage the return of vegetation and prevent erosion to that area.

The principal objective of rehabilitation is to return disturbed areas back to their original condition as closely as possible.

2.0 INTRODUCTION

There is mounting awareness of the need to implement engineering design for proposed borrow pits, roads and industrial sites to include landscaping, conservation and rehabilitation management to reduce the amount of unnecessary damage we cause to the environment.

This awareness is also expressed in the repair and rehabilitation of old borrow pits and disturbed sites to prevent erosion and promote the establishment of indigenous flora and a return of fauna communities (local plants and animals).

The need to reduce the visual impact of these disturbances is most important.

These guidelines and principles will fundamentally apply to most situations. Additional requirements for contractors are defined under Section 12.0, Contractors - Borrow Pit Development and Rehabilitation Checklist.

3.0 SECTION A - PROPOSED PITS

3.1 PLANNING

Location, access, clearing and stockpiling of overburden and topsoil needs to be carefully planned to provide overall efficiency in both development and rehabilitation of disturbed sites. It must be recognised that situations will vary between sites. Areas of significance must be recognised and avoided, e.g. drainage systems, Aboriginal sites.

3.2 LOCATION AND ACCESS

Approval to open a borrow pit must be given by the Resource Development Department, Newman. A clearance must also be obtained from that Department for possible sites of Aboriginal significance.

Borrow pits are located where the required material is most readily and economically available. Borrow pit locations should avoid large trees or heavy stands of timber.

Placement of borrow pits should be out of sight of roadways and any prominent observation areas, with consideration being given to placement of borrow pits behind screens of vegetation or terrain. If this is not possible, then a buffer zone of vegetation at least 150 metres wide should be left between the road and the proposed borrow pit. Location of borrow pits could also be influenced by lease conditions and agreements with other lease holders.

The shape of the borrow pit will be longitudinal (see Figure 1) and will be operated parallel to any roads to further reduce visual impact.

Vehicle movement should be confined to a single access road to the borrow pit area to avoid additional unnecessary rehabilitation work.

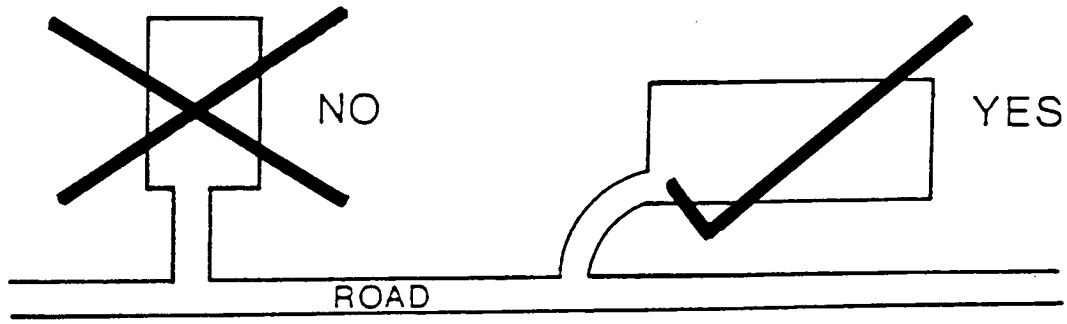


Figure 1 - Location and Access

3.3 WATERCOURSES

Watercourses should be avoided by at least 50 metres to ensure that natural flows of water are not impeded to any great degree, with the exception of sand extraction, which in the Pilbara would generally have to come from a major watercourse.

3.4 SIZE OF BORROW PITS

Borrow pit development will be a rectangular design and have a maximum dimension of 200 metres long by 50 metres wide (one hectare). Distance from any road would be at least 150 metres.

Where large quantities of material are required, then a series of borrow pits will need to be developed, with each pit being separated by a 50 metre undisturbed buffer zone (see Figure 2).

Borrow pits should conform with the natural contours and drainage systems of the area so that ecosystems associated with those drainage systems are not destroyed.

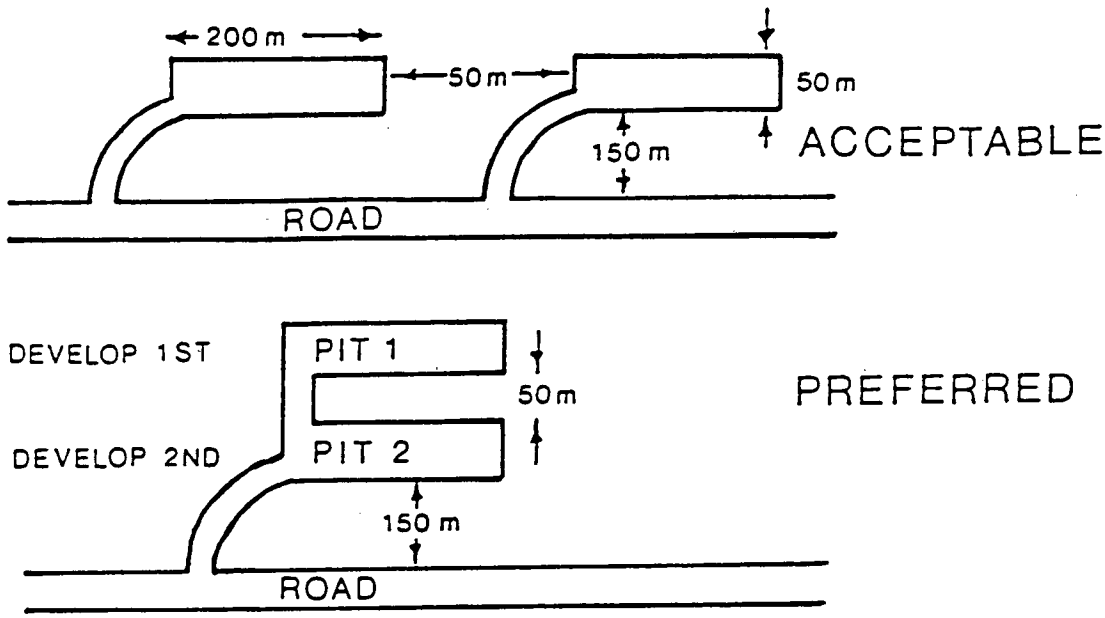


Figure 2 - Borrow Pit Size and Location

3.5 CLEARING AND STOCKPILING OF OVERBURDEN AND TOPSOIL

Borrow pits should firstly be pegged to the determined amount of material required, but in any case be no greater than 200 metres x 50 metres in a single borrow pit.

Where the extent of material is not known, costeans can be dug to determine the material required. Unnecessary damage to vegetation should be avoided and costeans must be backfilled should they not be part of the borrow pit development.

Overburden, which is the vegetation cover should then be pushed off to the longitudinal sides of the intended borrow pit and left in a neat windrow for future use in rehabilitation (see Figure 3). Do not burn the overburden as this destroys organic material, seed and biological content beneficial for successful rehabilitation.

Topsoil to a depth of 100-150mm is then removed to the longitudinal sides of the borrow pit and left in a neat windrow. This topsoil also contains organic matter, seeds, nutrients and biological content. This operation can best be carried out by a dozer or front end loader. Overburden and topsoil on the access track should be pushed to one side of the track for use in the final rehabilitation phase of the access track.

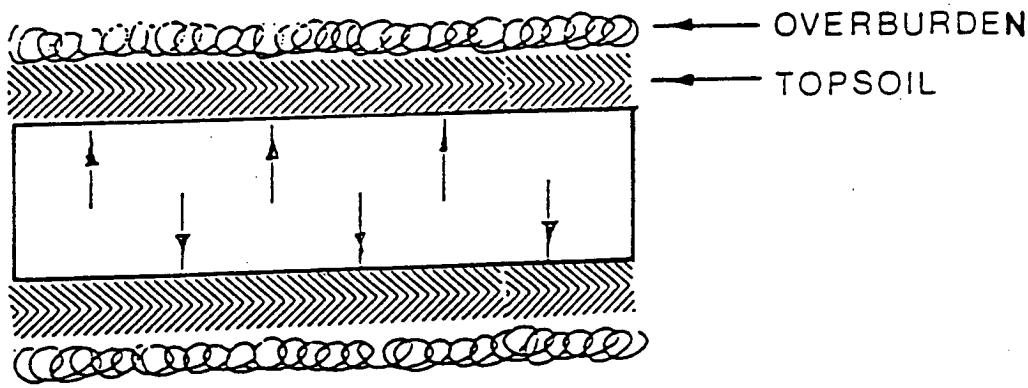


Figure 3 - Overburden and Topsoil Stockpile

3.6 REMOVAL OF BORROW PIT MATERIAL

All operations are to be confined to the internal pit area and access is to be by a single track only, or in some instances for safety reasons, two tracks. The depth of the borrow pit should not exceed 1.5 metres.

4.0 ENVIRONMENTAL IMPACTS OF BORROW PITS

SHORT-TERM

- Destruction of flora and fauna;
- dust generation;
- erosion;
- scar on the landscape;
- high density of pioneer plant species because of increased water collecting in the borrow pit; and
- increased activity of feral animals because of water ponding, which will increase the above impacts.

LONG-TERM

- o Change of environment because of increased water collection in the borrow pit;
- o time period for total or acceptable rehabilitation will be at least 10 years; and
- o slow return of native fauna due to the absence of required vegetation communities and soil structures.

5.0 FUTURE USES OF BORROW PITS

Within Mt Newman Mining operations, there is little scope for future use of borrow pits other than for the extraction of further material where a pit has not been extracted to the allowable capacity. This requirement should be planned so that progressive extraction and rehabilitation can take place.

With our harsh environment and isolation there is little scope for developing borrow pits for any other uses, e.g. recreational uses.

6.0 SECTION B - REHABILITATION

6.1 INDUSTRIAL RUBBISH

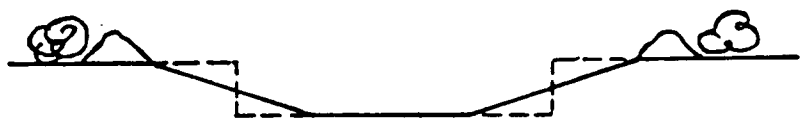
Once extraction of material is completed all industrial rubbish should be deeply buried or removed for proper disposal.

The borrow pit floor should be left neat with any stockpiles of material being respread over the borrow pit floor.

6.2 LANDSCAPING

Borrow pit walls should then be pushed out or battered to blend closely with the surrounding environment, with a slope of not less than 3H:1V (3 horizontal to 1 vertical) (see Figure 4).

BEFORE LANDSCAPING



AFTER LANDSCAPING

Figure 4 - Landscaping

6.3 SPREADING TOPSOIL

The stockpiled topsoil is then spread over the borrow pit floor as evenly as possible (Figure 5).

Figure 5 - Spreading Topsoil

6.4 SPREADING OVERBURDEN

Stockpiled overburden is then spread evenly over the top of the topsoil.

6.5 RIPPING

Ground that has been compacted by the movement of equipment (trucks, loaders, etc.) within the borrow pit requires deep ripping, which breaks this compaction and allows water infiltration, seed lodging and plant root penetration.

Ripping must be worked along the contour to reduce the possibility of erosion. Ripped ground must not be driven over and should be left as rough as possible. This also helps to prevent people from driving into pits and damaging rehabilitation development. A windrow should be placed at the entrance of the borrow pit to prevent entry.

The final phase of rehabilitation is to spread stockpiled topsoil and overburden over the access track and then rip.

Rehabilitation of borrow pits and access tracks is not complete until ripping has been carried out.

6.6 SEEDING

Rehabilitation progress should be monitored and if necessary seeding of borrow pits may also need to be carried out. Seed used must be of the local surrounding species.

The Rehabilitation Officer is to be informed of all borrow pit rehabilitation completion so that this monitoring can be scheduled for action.

7.0 SECTION C - REHABILITATION - OLD BORROW PITS

Old borrow pits are those where material has been extracted with no attempt at landscaping or rehabilitation. These borrow pits are in various stages of revegetation, most of which are unsatisfactory and not of an acceptable standard.

It is therefore necessary to look at these borrow pits objectively and start from the beginning, regardless of vegetation establishment, unless the pits have been landscaped and the vegetation is acceptable.

During the following phases of rehabilitation, it is desirable that every attempt should be made to save as much established vegetation as possible.

7.1 LANDSCAPING

The sides of borrow pits are to be battered as per Section 6.2 of this manual. Every effort should be made to achieve a 3H:1V batter angle.

7.2 TOPSOIL AND OVERBURDEN

Topsoil and overburden from a depth of 100-150mm should then be removed from a strip no more than 10 metres wide from around the edge of the borrow pit and spread evenly over as much of the borrow pit as possible.

7.3 RIPPING

Ripping to contour is the final phase of rehabilitation. This includes the entire pit area together with that area from where the topsoil and overburden were removed. This operation allows for seed lodging, water infiltration and root penetration to promote rehabilitation success.

Access tracks to these borrow pits are then ripped to prevent entry and to promote regrowth.

7.4 OLD ROADS AND DISTURBANCES

Old unnecessary roads and all disturbed sites should be treated using the principles described in this manual to promote vegetation establishment and the removal of that scar on the landscape.

8.0 SUPPLEMENTARY TREATMENTS

Monitoring of treated borrow pits is important and where necessary, seeding operations should be carried out. This monitoring is to be scheduled by the Rehabilitation Officer. Species used must be indigenous, that is those that are growing in the surrounding area. Current technology will determine seeding rates and treatments.

Rehabilitation technology to date does not indicate any need to apply fertilisers.

Water harvesting techniques are applied through the ripping to contour phase.

9.0 SUMMARY

It is important that we understand and preserve the environment to maintain a heritage for future generations.

It is more important that BHP Iron Ore Pty Limited and the employees of this company be equally concerned for the environment. With proper planning, management and rehabilitation of borrow pits as outlined in this manual, those objectives are possible.

10.0 BORROW PIT TECHNICAL DATA

Maximum Size (one Hectare)	-	200m x 50m
Distance from Roads Minimum	-	150 metres
Distance between Pits Minimum	-	50 metres
Depth of Topsoil Recovery	-	100-150mm
Depth of Borrow Pits Maximum	-	1.5 metres
Depth of Spreading Topsoil/Overburden	-	Evenly over disturbed area
Depth of Topsoil/Overburden Strip (Old Pits)	-	100-150mm
Width of Topsoil/Overburden Strip (Old Pits)	-	Maximum 10 metres
Batter Angle	-	3H:1V

11.0 PROPOSED BORROW PITS - PROGRESSIVE CHECKLIST

Pit No.	*Location*	*Date*
1 - Approval to open borrow pit		
2 - Aboriginal site clearance		
3 - Planning	Out of sight of prominent observation points Trees and heavy stands of vegetation preserved Screened behind vegetation belt or terrain 150 metre buffer zone from road Watercourses avoided Single access Borrow pit pegged - single pit - multiple pits Borrow pits longitudinal to major roads Maximum dimension 200m x 50m Minimum distance between pits 50m Maximum depth of pit 1.5m	
4 - Overburden	Stockpiled - longitudinal sides	
5 - Topsoil	Stockpiled - longitudinal sides Depth removed 100-150mm	
6 - Removal of Material	Maximum depth 1.5m All activity inside pit area Access by single track	
7 - Rehabilitation	Industrial rubbish buried/removed Landscaping 3H:1V Topsoil spread evenly Overburden spread evenly Ripping of entire pit and disturbance Ripping of access road Seed broadcasting	
8 - Rehabilitation	Passed By:	
9 - Comments		

12.0 CONTRACTORS BORROW PIT DEVELOPMENT AND REHABILITATION CHECKLIST

It is the responsibility of the Contractor to obtain permission for removal of material from borrow pits and the opening of new borrow pits.

The following checklist is for progressive borrow pit operations and rehabilitation.

1. Approval for removal of material or permission to open a borrow pit - Contact Resource Development Department, Newman.

2. Pegging of area, defined access:
   Pit Dimensions: Area Max. 200m x 50m
   Depth Max. 1.5m

3. Overburden - Stockpiled.

4. Topsoil - Stockpiled
   Depth of removal 100-150mm.

5. Rehabilitation
   - o Industrial rubbish buried/removed
   - o Landscaping 3H:1V
   - o Topsoil spread evenly
   - o Overburden spread evenly
   - o Ripping of entire pit and disturbance
   - o Ripping of access road.

6. Rehabilitation checked by:

   RESOURCE DEVELOPMENT .....

   REHABILITATION OFFICER .....

On occasions one borrow pit may provide material for a number of contractors. In these cases records of material removed is required so that disputes about rehabilitation requirements can be resolved.

In all cases a record of material removed is to be lodged with the Resource Development Department in Newman.

APPENDIX F

Community Consultation for HBI Project

Social Impact - Local Communities Response

Note: The responses provided below may differ slightly to the information provided in the CER as these responses were the best information available at the time.

	ISSUE		RESPONSE
	Port Authority		
1	Quantity of iron ore required to make briquettes?	1	Ratio is 2 or 2.5:1
2	What are the discharges?	2	HBI Plant: briquettes, water and CO_2 . Concentrator: water, silica, alumina, and fine low grade iron ore.
3	Water required?	3	Fresh: 2.4 Mtpa sourced from existing allocation.
4	How will briquettes be loaded at Finucane Island?	4	Via existing shiploader at Finucane Island or may build a new one.
5	DRI is combustible before compression - does it burn when it breaks up?	5	No.
6	Danger from hydrogen?	6	It is explosive but will be contained in properly engineering pressure vessels.
7	Residue - can it be used to grow things or any other purpose?	7	Similar to Pilbara soil - residue area will be rehabilitated.
8	Residue from HBI Plant?	8	No- residue is from concentrator.
9	How much gas will it use?	9	Gas - 100 Tj/day. One third of the Pilbara Energy Pipeline capacity.
10	Area covered?	10	Approximately 250 hectares for Plant. Thirteen square kilometres for residue impoundment for 50 years at 5 Mtpa.
11	Expected EPA approval date?	11	March 1995
12	Public access to fishing areas?	12	Several access points - public access near Finucane Island.
13	Any problems with flooding in residue area?	13	Have found the highest ground without having a much longer conveyor - will have to build up the Plant by 1.5 metres with fill taken from the residue impoundment areas.
14	Existing or new markets?	14	Both - generally the PACRIM countries.

	ISSUE		RESPONSE
15	How is HBI discharged from ships?	15	Using magnets.
16	How is it put into the furnace?	16	Direct charge into EAF - so buyer has to do less than using other products.
17	How big are the stockpiles?	17	2 x 30,000 tonne stockpiles at HBI Plant.
18	What maintenance has to be done?	18	Each train of the Plant has to be shut down, cleaned out and overhauled about every 160 days. Will use a workforce of approx. 250 people.
19	Is the maintenance frequency a function of ore quality?	19	Ore that tends to fracture is a problem, - ours tends to fracture less than that used in Venezuelan plant
20	Will sampling be important?	20	Yes
21	Marandoo ore?	21	Would rather use Mining Area C. We are testing Marra Mamba ore. So far have only used shipping grade Mt Newman blended fines.
22	Any problems with explosions like grain silos?	22	The gas is contained in a gas circuit - similar to a blast furnace or an oil refinery.
23	What economic contribution will the downtime make to Port Hedland?	23	Permanent workforce is estimated to be 220 - 250. Reactor trains will be shut down for 2 weeks every 160 days. Will need 200 people and estimate that half of them will be available from Port Hedland and the remained will have to fly in/fly out initially.
24	How much CO_2 is emitted and how does that compare with a forest fire?	24	Plant will emit approximately 1.7 Mtpa CO_2 - will get a suitable comparison and reply.
	Port Authority Users Group		
1	Can CO_2 be used?	1	Could use it in a petrochemical plant.
2	Please described the conveyor?	2	Conveyor has a double strand and will be used both ways. 2,000 tph. 800 mm wide. It will be fenced for safety, but will have public access crossing points.

	ISSUE		RESPONSE
3	Will you load through the existing Goldsworthy berth?	3	Yes.
4	With a mixed shipment will there be breakage problems with dropping the briquettes?	4	Briquettes are dropped 23 metres in Venezuela. We are looking at softer loading systems.
5	Where will Stage 2 be located?	5	Adjacent to Stage 1.
6	Does the Plant have to keep running?	6	Yes - except for maintenance shutdowns.
7	Will you need a second berth on Finucane Island?	7	Unknown at present.
8	When will the tunnel be constructed?	8	Has to be ready for the start of HBI Plant but is a separate project.
9	What is the time schedule for the petrochemical plant.	9	Unknown. May be a part of BHPP's plans.
10	Will there still be public access to Utah Point?	10	No - will become the stockpile area.
11	Will you provide access for underwater barge cleaning?	11	Will have to consider how that can be done.
12	Why didn't you out an additional Concentrator at Newman?	12	Four sites were considered for the Concentrator. For may reasons the Boodarie Hill Site was the most practical.
13	Processing of Shay Gap?	13	We will try many types of ore and may even try a briquette with manganese.
14	Could future stockpile area be moved inside the rail loop at Finucane Island?	14	Finucane Island will continue to operate until 2005 with material coming from Kennedy Gap area.
15	Can the cooling water intake be located at Finucane Island berth?	15	The intake and outfall for the seawater have to be at a different point.
	Pilbara Development Commission, WAWA, SECWA, DEET, MRWA, Education Department, Pundulmurra		
1	What is the residue area?	1	Thirteen square kms for 50 years at 5 Mtpa production rate.
2	Can you use the residue?	2	Same as Pilbara Sands.
3	Will the residue cause dust?	3	Dust controls will be built in.

	ISSUE		RESPONSE
4	Could you return the residue to Newman?	4	Uneconomic.
5	Will the residue area enroach on the industrial site?	5	Only a small amount - discussing width DRD.
6	How much of Finucane Island will be occupied?	6	Existing area plus Utah and at Stanley Points.
7	Will flooding affect the conveyor?	7	Conveyor will be raised.
8	How many people will need TEE standard Maths and Science?	8	About 100 people with that level of process and chemistry understanding.
9	Will the workforce live locally?	9	Yes the permanents will live locally.
10	Where will the construction contractors be located?	10	About 800 people who will live at Wedgefield or at a new camp.
11	What skills will they need?	11	Riggers - experience in high rise buildings - a major safety factor.
12	What safety measures are being taken?	12	Major safety reviews is being undertaken to identify all the risks.
13	What is the explosion footprint - i.e. 1:1000000?	13	Safety valves similar to blast furnace bleeder valves will prevent explosions.
14	When will you start recruiting?	14	Start end of next year - extensive training programme.
15	What new service industries will be required?	15	Instrumentation, pneumatics, machining. Briquetting roll segments need heat treatment and this must be developed in Australia.
16	Is there a flare?	16	If it is necessary to shut the reactor down, it is filled with inert gas and gas displaced from reactor is flared off. Very infrequent occurrence.
17	Where is the methane burnt?	17	In the gas reformer.
18	What noise can be expected?	18	Noise modelling shows that it will be acceptable at a 5 km radius from the Plant.

	ISSUE		RESPONSE
19	What is the power usage expected?	19	Plant will have its own 2 x 32 MW gas turbines - will use 50 MW so will be an exporter of power.
20	How will the other users of the industrial park be able to get to the port if they have to cross the residue areas?	20	The access to the port will be discussed with DRD.
	Local Environmental Affinity Force		
1	Are emissions colourless and odourless?	1	Yes - water and CO_2.
2	What is in the mud?	2	Residue from the concentrator - fines iron ore, silica and alumina (sand and gravel).
3	Why isn't the concentrator at Newman?	3	Have considered that option - Newman may have limited life, need a tertiary crusher system, transport is costly, insufficient fines for long production.
	Port Hedland Town Council		
1	Dust from conveyor?	1	Same controls will be used as at Nelson Point. Water will be added along the conveyor.
2	Will the conveyor be enclosed?	2	No, but it will be fenced with alternative access points provided.
3	Quantity of water used?	3	2.4 million m^3 of fresh water. No additional water will be required above the WAWA water contract. Improvements in the process have reduced the water requirement to 0.2 tonnes water for 1 tonne of briquettes.
4	Water temperature at discharge point to sea?	4	About 4°C above sea temperature.
5	Is it likely to cause damage by dropping the briquettes into the ships?	5	No, but may have to rebuild the shiploader.
6	Is the Plant on Crown Land?	6	On a pastoral lease outside the Town Plan.
7	What rates will be paid?	7	Will be decided under the State Agreement.

	ISSUE		RESPONSE
8	What royalties will be charged?	8	Will be decided under the State Agreement. Compared with low Venezuelan costs.
9	Will extra water be stored on site?	9	Water from the concentrator will evaporate as it does at Finucane Island.
10	What are the solids returning to the ocean from the Plant?	10	Seawater will be used for evaporative cooling. It will be concentrated by evaporation but will not have anything added to it.
11	What chemicals, gases and noise will be emitted?	11	Will send information from CER document.
12	What is the volume of exhaust gases coming out of the stack and what effect will it have on Port Hedland?	12	Approximately 1.7 M tpa of CO_2 - about 1.0 % of Australia's total. Unlikely to have any effect on Port Hedland's climate.
13	What will be the effect on the local environment - will it increase the rain?	13	Unlikely to have any effect on Port Hedland's climate.
14	When will the CER document be available?	14	CER document will be public in early December.
15	Does this replace the sinter plant proposal?	15	Yes.
16	Will you have a counter-disaster plan and contamination controls?	16	The discharge is CO_2 except in an emergency shutdown then the gases in the chambers are flared off - rarely happens. There will be safety valves and pressure relief valves which will be monitored. If there is a build up there will be a rush of air for about 30 seconds until the pressure is released. A HAZOPS study is being conducted to identify any hazards.
17	What are the markets?	17	Mostly PACRIM countries.
18	Could this residue be used for road base?	18	Too fine.
19	It is likely that a steel plant will be next?	19	Economics still show this is not viable.
20	Does this mean that cheap power will be available?	20	Power will be available at commercial rates.

	ISSUE		RESPONSE
	Port Hedland Chamber of Commerce		
1	Can you use low grade fines?	1	No - it requires high grade fines ore.
2	What emissions come from the Plant?	2	Water and carbon dioxide.
3	If it is a Hydrogen process, isn't it dangerous?	3	The plant will be built to ensure there is no danger - similar to petrochemical plants and refineries - must take similar precautions.
4	Where are the market?	4	General looking to PACRIM countries.
5	Are briquettes used in blast furnaces?	5	No.
6	What local content will be used in construction?	6	As in previous projects we will maximise the amount of local content.
7	What corrosion problems will you get with seawater cooling?	7	Important to use proven materials to transport the water, then it is possible without corrosion problems.
8	Any byproducts from the seawater?	8	Just concentrated seawater. Explored the possibility of piping it to Cargill Salt but it proved uneconomic.
9	Waste - any useable products?	9	No - low grade fine iron ore, sand and gravel.
10	Dust problems?	10	Similar dust controls to those at Nelson Point will be used.
11	Rehabilitation of storage areas?	11	Storage areas will be filled, covered with course material topsoiled and revegetated to complete rehabilitation.
12	Dust from the conveyor?	12	Water will be added to the ore at the distribution points.
13	Is methane a byproduct?	13	Methane will be burnt as fuel in the process.
14	Any odours?	14	No - the emissions are heat and CO_2.
15	If the project doesn't go ahead will the sinter proposal proceed?	15	No.
16	Will there be a mini-mill here?	16	No.
17	Japanese market for briquettes?	17	The Japanese market has not been specifically targeted.

	ISSUE		RESPONSE
18	What is the difference in the steel from this process?	18	Steel from mini-mills has relied on scrap and therefore the steel produced has been of lower quality. When the consistent quality of the briquettes is introduced, higher quality steels can be produced.
19	When will the decision to proceed be announced?	19	We will probably make an announcement in December if we receive a qualified approval to proceed.

APPENDIX G

Risk Assessment Matrix and Hazard Assessment/Controls

BHP HBI PROJECT - RISK ASSESSMENT MATRIX

ITEM NO.	HAZARD IDENTIFIED	PERSONS AT RISK		WORST CASE OUTCOME						PROBABILITY				
		Employees on Site	Public	F	PD	MI	NI	P/E	ENV	L/F	PRO	POS	REM	IMP
A1	Briquetting cooling exhaust stack	Y	N				✓				✓			
A2	Briquetting dust collection wet scrubber	Y	N				✓					✓		
A3	CO_2 Removal Stack	Y	Y				✓		✓			✓		
A4	Cooling Tower Exhaust	N	N				✓							✓
A5	Desiccant Regeneration Stack	N	N				✓							✓
A6	Hot Flare	N					✓							✓
A7	Materials Handling Dust Collection Bag House	Y	N				✓					✓		
A8	MgO System Ore Feed Bin Vent Filter	N	N				✓							✓
A9	Ore Drier Dust Collection Bag House	Y	N				✓					✓		✓
A10	Oxide System Ore Feed Bin Vent Filter	N	N				✓							✓
A11	Reducing Gas Furnace Stack	N	N				✓							✓
A12	Reformer Stack	N	N				✓							✓
A13	Fire Due to Leak in Pressurised Plant	Y	N	✓				✓					✓	
A14	Explosion in Reactor Train Down for Maintenance	Y	N	✓				✓					✓	
A15	Dust Emission from Conveyors	Y	N				✓					✓		

ITEM NO.	HAZARD IDENTIFIED	PERSONS AT RISK		WORST CASE OUTCOME						PROBABILITY				
		Employees on Site	Public	F	PD	MI	NI	P/E	ENV	L/F	PRO	POS	REM	IMP
A16	Failure of a Dust Collector	Y	N				✓					✓		
N1	Noise	Y	Y		✓							✓		
C1	Hazardous Materials Storage	Y	N	✓					✓				✓	
C2	Hazardous Materials Handling	Y	N	✓					✓				✓	
C3	Specific Hazardous Materials Handling of Vanadium Pentoxide	Y	N			✓			✓			✓		
L1	Seawater Blowdown	N	Y						✓			✓		
L2	Surface Water Runoff	N	Y						✓		✓			
L3	Seepage from Residue Storage Impoundment	N	Y						✓				✓	
L4	Ballast Water Discharge	N	Y						✓			✓		
L5	Sanitary Wastes	Y	N						✓				✓	
L6	Waste Oils and Solvents	N	Y						✓			✓		
S1	Domestic Rubbish	N	Y						✓				✓	
S2	Recyclable Materials	N	Y						✓				✓	
S3	Spent Catalyst	N	Y						✓				✓	

ABBREVIATIONS:

ENV - Environmental Damage
F - Fatality
IMP - Improbable
L/F - Likely/Frequently
MI - Minor Injury
N - No
NI - No Injury
PD - Permanent Disability
P/E - Plant/Equipment Damage
POS - Possible
PRO - Probable
REM - Remote
Y - Yes

BHP HBI PROJECT - HAZARD ASSESSMENT/CONTROLS

ITEM NO.	HAZARD	CONSEQUENCES	CONTROL MEASURES	DOCUMENT REFERENCES
A1	Briquetting cooling exhaust stack.	Potential employee exposure to a nuisance dust only.	No controls necessary except if employee working continuously in area affected by dust plume. PPE respirator would be required.	OH&S procedures manual.
A2	Briquetting dust collection wet scrubber.	Potential employee exposure to a nuisance dust only.	No controls necessary for such a low concentration of dust.	
A3	CO_2 Removal Stack.	Potential over exposure of employees in vicinity.	Address in Emergency Response Plan to evacuate areas affected.	Emergency Response Plan.
A4	Cooling Tower Exhaust.	Nuisance odour issue for public in South Hedland, Wedgefield or PEPL Power Station.	Advise Public through an education program of the likelihood of an event and the potential effects..	Emergency Response Plan.
A5	Desiccant Regeneration Stack.	No potential effect on employees or the public.		
A6	Hot Flare.	No potential effect on employees or the public.		
A7	Materials Handling Dust Collection Bag House.	Potential employee exposure to nuisance dust only.	No controls necessary for such a low concentration of dust.	
A8	MgO System Ore Feed Bin Vent Filter.	No potential effect on employees or the public.		
A9	Ore Drier Dust Collection Bag House.	Potential effect on employees to a nuisance dust only.	No controls necessary for such a low concentration of dust.	
A10	Oxide System Ore Feed Bin Vent Filter.	No potential effect on employees or the public.		

ITEM NO.	HAZARD	CONSEQUENCES	CONTROL MEASURES	DOCUMENT REFERENCES
A11	Reducing Gas Furnace Stack.	No potential effect on employees or the public.	Ensure correct operating procedures and plant condition monitoring is conducted.	
A12	Reformer Stack.	No potential effect on employees or the public.	Ensure isolation procedure are known by all employees and complied with.	
A13	Fire Due to Leak in Pressurised Plant.	A remote possibility of employees being exposed to flaring gas from a leak in the plant.	Ensure correct operating procedures and plant condition monitoring is conducted.	Operating Procedures.
A14	Explosion in Reactor Train Down for Maintenance.	A remote possibility of employees being injured by an explosion during maintenance on reactors.	Ensure isolation procedures are known by all employees and complied with.	Isolation Procedures.
A15	Dust Emission from Conveyors.	Potential employee exposure to nuisance dust.	Ensure dust suppression systems maintained and operated.	Operating Procedures.
A16	Failure of a Dust Collector.	Potential employee exposure to nuisance dust.	Ensure schedule of dust collection maintenance and inspections complied with.	Operating Procedures.
N1	Noise.	Continual employee exposure to noisy equipment can produce hearing disability. Plant depressurisation will result in significant noise which will be a nuisance to public.	Noise reduction by insulation of equipment. Designating mandatory hearing protection areas. Advise the public of potential for plant depressurisation and its impact.	OH&S Procedure Manual. Operating Procedures.
C1	Hazardous Materials Storage.	Potential employee exposure to hazardous materials in confined storage area.	Hazardous materials to be stored in compliance the Dangerous Goods Regulations 1992. Environmentally sensitive materials stored in bunded areas. Emergency response procedures developed for each potential leak or spillage.	OH&S Procedures Manual. Environmental Manual & Table 5.1 CER. Emergency Response Plan.

ITEM NO.	HAZARD	CONSEQUENCES	CONTROL MEASURES	DOCUMENT REFERENCES
C2	Hazardous Materials Handling.	Potential employee exposure to hazardous materials during use or handling.	MSDS to be obtained for all hazardous materials. Employees educated in safe handling and use of all hazardous materials. Regular safety audits to ensure hazardous materials handling and use is to required standards. Emergency response procedures developed for each potential leak or spillage.	OH&S Procedures Manual. Emergency Response Plan.
C3	Specific Hazardous Materials Handling of Vanadium Pentoxide.	Vanadium entering drainage systems. Potential exposure of employee to vanadium pentoxide dust.	Fully contained storage area Employees educated in precautions for handling material. Iron Vanadate to be sold.	OH&S Procedures Manual.
L1	Seawater Blowdown.	Potential effect on marine flora/fauna in local area of discharge.	Discharge procedure to be devised which results in negligible effect on marine flora/fauna. Monitor effects of brine discharge.	Environmental Study and Procedures.
L2	Surface Water Runoff.	Potential oil/chemical contamination of South West Creek.	Plant base built to 1 in 100 year flood level. Surrounding surface water runoff diverted around plant. Stormwater runoff from plant channelled to settling ponds for oil and sediment collection.	Environmental Procedures Manual.
L3	Seepage from Residue Storage Impoundment.	Potential effect on downstream vegetation.	Low permeability material in floor and walls of impoundments. Solar drying results in good consolidation. A groundwater monitoring programme to be initiated and maintained.	Environmental Procedures Manual.

ITEM NO.	HAZARD	CONSEQUENCES	CONTROL MEASURES	DOCUMENT REFERENCES
L4	Ballast Water Discharge.	Potential effect on marine flora/fauna.	Ballast water will be discharged in line with BHP Iron Ore existing approved strategy.	Environmental Procedures Manual.
L5	Sanitary Wastes.	Improper treatment of sewage waste could affect the health of employees.	A biological sewage treatment plant will be installed. Treated effluent will be used for landscape irrigation.	
L6	Waste Oils and Solvents.	Potential soil contamination and damage to flora and fauna.	Design water oil collection facilities with secondary containment. Disposal of waste oil/solvents to an approved waste oil contractor for disposal or recycling at an approved site.	Environmental Procedures Manual.
S1	Domestic Rubbish.	Littering of surrounding area if rubbish not contained and regularly removed from site.	Provide adequate rubbish collection containers. Dispose of rubbish at the approved landfill council site.	Environmental Procedures Manual.
S2	Recyclable Materials.	Littering of work areas if scrap materials are not contained and regularly removed from site.	Provide collection systems for designated waste materials for recycling eg. 200l drums, cans and plastic.	Environmental Procedures Manual.
S3	Spent Catalyst.	Spent catalyst could effect flora and fauna if disposed of incorrectly.	Return all spent catalyst to the suppliers for reprocessing.	Operating Procedures.