State Development
WESTERN AUSTRALIA

Consultative Environmental Review

MEENAAR
INDUSTRIAL PARK

The Industrial Lands Development Authority

The Department of State Development

ACKNOWLEDGEMENT:

Data for this report have been drawn from a number of sources:

. Ashton Mining Limited, Flora and Fauna

. Ashton Mining PER prepared by Kinhill Engineers Pty Ltd

. Meenaar Industrial Estate Preliminary Assessment by BHP Engineering

. Aboriginal Site Survey - Report on an Ethnographic and Archaeological Survey at the proposed Meenaar Industrial Park by Barbara Dobson, Ken Macintyre and Jacqueline Harris

. Mines Department - Notes on Seismic Risk in relation to proposed evaporation ponds, Meenaar Industrial Park Geological Survey of Western Australia

Copies of these reports are available for perusal at the offices of the Department of State Development and of the Environmental Protection Authority.

Department of State Development

Perth Office

8th Floor (Library)
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PERTH WA 6000

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Other sources of information were supplied by the Department of Agriculture, Water Authority of Western Australia, SECWA, Shire of Northam, Avon Community Development Foundation, Building Management Authority.

The Proponent would like to thank all those who assisted in the preparation of the Review.

MEENAAR INDUSTRIAL PARK

CONSULTATIVE ENVIRONMENTAL REVIEW

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

The Consultative Environmental Review (CER) for the proposed Meenaar Industrial Park has been prepared by the Department of State Development on behalf of the Industrial Lands Development Authority and the Department of State Development, in accordance with Western Australian Government procedures. The report will be available for comment for 4 weeks:

. beginning Monday, 16 March 1992

. finishing Monday, 13 April 1992.

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

Following receipt of comments from government agencies and the public, the EPA will summarise these comments and forward them to the proponent and may ask for further information. The EPA will then prepare an assessment report with recommendations to Government, taking into account issues raised in 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 suggestions which could improve the proposal.

All submissions received will be acknowledged.

DEVELOPING A SUBMISSION

You may agree or disagree, or comment on, the general issues discusses in the PER 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 environmentally more 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;
. frame your queries in the form of questions; 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 that there is no confusion as to which section you are considering.

Attach any factual information you wish to provide and give details of the source. Make sure your information is accurate.

Please indicate whether your submission can be quoted, in part or in full, by the EPA in its Assessment Report.

REMEMBER TO INCLUDE:

Your name, address and date.

THE CLOSING DATE FOR SUBMISSIONS IS: Monday, 13 April 1992

SUBMISSIONS SHOULD BE ADDRESSED TO:

The Chairman
Environmental Protection Authority
8th Floor
Westralia House
38 Mounts Bay Road
PERTH WA 6000

Attention: Mr Victor Talbot

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1.0 SUMMARY

The Department of State Development and the Industrial Lands Development Authority are the proponents for the development of a heavy industrial estate at Meenaar, located between Northam and Meckering and adjacent to the Great Eastern Highway.

The State Government has determined that industrial development in Western Australia should be regionalised and that heavy industrial sites should be located in the following regions: Geraldton, Kalgoorlie, Collie, Bunbury, Northam and the Pilbara.

Assessment of the Northam region by the Avon Community Development Foundation (ACDF) identified four sites, but determined that Meenaar was the most suitable site as it is removed from major population centres and has ready access to necessary infrastructure.

The suitability of the Meenaar location has been confirmed by a study carried out by BHP Engineering for the Department of State Development and the Industrial Land Development Authority.

Land proposed for the industrial area in the park has been cleared for agriculture but the land is considered to be of poor quality. An uncleared area of some 80 hectares of natural bushland occurs south of the cleared agricultural area. Uncleared land of this type is unusual in the region and as such is important for preservation of flora and fauna. This land has been incorporated into the buffer zone of the park and its conservation value will be augmented by the proposed addition of new areas of natural vegetation connecting it to other small uncleared areas.

Meenaar's climate is semi-arid with hot dry summers and mild, wet winters. Groundwater is saline, and the soils on site contain sand, clay and granite intrusions. The high evaporation rates combined with the impermeability of the soils make the site suitable for disposal of wastewater in evaporation ponds.

Anthropological and archaeological surveys have been carried out on the site. Two sites of low archaeological significance were recorded and these have been recorded in accordance with the requirements of the Department of Aboriginal Sites, Western Australian Museum. These sites will be preserved within the park's buffer zone.

The types of industry proposed for the site are mainly based around agricultural and mineral processing to add value to resources already produced in the region. Such industries are expected to have little environmental impact. Potential impacts from noise, air emissions, odour, leachates, risk and hazard, and groundwater drawdown have been assessed and control limits or monitoring programmes have been proposed.

A social impact assessment has been carried out as an integral part of this report. This assessment has indicated that capacity and skills exist in the region to fill some 80% of the predicted 700 jobs once the site has reached capacity.

The majority of people interviewed were in favour of the proposal as it met with community goals to expand the employment base in the region and halt the rural decline in the area. Major issues of concern raised during a public open day and discussions with the nearest neighbours and Grass Valley residents were:

- Types of Industries
- Emissions
- Nearest Neighbours
- Employment Opportunities
- Radiation Questions
- Transport
- Groundwater
- Contents of Evaporation Ponds
- Use of Buffer Zone and Remnant Bushland
- Lights at Night
- Water Catchment
- Dust on Organic Gardens
- Monitoring Arrangement/Policy
- Management of Industrial Park (local control?)
- Flora and Fauna on Remnant Bushland
- Use of Water
- Waste Disposal - Residue
- Occupational Safety Procedure
- Property values in Northam

The majority of these concerns have been addressed in the report.

Commitments to environmental management proposed by the proponents are also included in the report (Appendix I).

2.0 INTRODUCTION

2.1 Identification of Proponent

The proponents for the development of the Meenaar Industrial Park are the Industrial Lands Development Authority and the Department of State Development.

It is intended that an advisory board (The Meenaar Industrial Park Advisory Board) will be formed by the State Government to oversee the development of Meenaar Industrial Park (Section 9.0) and may ultimately become the proponent.

2.2 Background and Objectives of the Proposal

The site for the Meenaar Industrial Park (Fig. 1) was initially identified by the Avon Community Development Foundation, a non-government public organisation. The Foundation's objective was to locate potential industrial sites that would offer economically viable locations for processing agricultural and mineral products produced in, or passing through, the region and could be serviced from the towns in the region, e.g. Northam, Toodyay, York, Beverley, Quairading, Cunderdin, Tammin, Wyalkatchem, Dowerin and Goomalling.

Criteria used by Avon Community Development Foundation in selecting a series of sites in the region were:

- access to:
  - major road routes
  - rail
- availability of:
  - water
  - power
- ability to develop on "park" lines
- readily accessed by the region's workforce
- prime agricultural land not to be used
- as few neighbours as possible
- low environmental impact

Four sites were located (Fig. 1) and of these Meenaar was preferred for initial development.

The Foundation negotiated an option for the Meenaar site with the landholder and then lobbied the State Government to develop the estate.

In 1991 the Deputy Premier, Ian Taylor, announced that the Government was to encourage the development of industrial parks in regional centres throughout the State, and Northam was identified as an appropriate region.

Impetus for the development of the Meenaar Industrial Park was increased when Ashton Mining Limited completed a "siting study" to determine the most appropriate location for a plant separating rare earths from carbonatite ore recovered from that company's Mount Weld deposit, which is located east of

Laverton. The study identified the Northam region as being the most economic and environmentally acceptable location for the proposed plant.

In order to assess the appropriateness and to develop a potential layout for the Meenaar site, the Department of State Development and the Industrial Lands Development Authority initiated a study by BHP Engineering. The study provided a preliminary assessment of the planning, environmental and engineering issues associated with the development of the industrial park east of Northam and qualitatively evaluated alternative sites in close proximity (Fig. 2).

Findings of the study were that the Avon Community Development Foundation proposed Meenaar site is at least as good as other sites in the immediate area and could be developed for the proposed use with minimal external impact. As a result of these findings the proponent wrote to the Environmental Protection Authority (EPA) requesting environmental clearance for development of the Meenaar site as an industrial park. The EPA determined that the project required assessment as a Consultative Environmental Review (CER) and this document has been prepared to meet this requirement. Open days and public interaction are being used in conjunction with the CER document to ensure interested individuals and groups are aware of the proposal and are in a position to contribute to the development of the site.

2.3 Details of Scope and Timing of the Proposal

Development of the Meenaar Industrial Park is proposed to take place in a number of stages.

Stage 1 is based around the Ashton rare earth plant. The company's schedule includes all necessary development approvals by January 1993. In order for the proponent to have sufficient time to finalise development proposals for the park and be in a position to meet Ashton's timetable, State and local government approval processes for the Meenaar Industrial Park need to be completed by the end of 1992 (Fig. 3).

Timing of expansion of the park past Stage 1 will depend on the demand by industry to locate within the park. Development of the park to its current nominated capacity of 290 hectares for industrial land is expected to be a long term project lasting several decades.

2.4 Relevant Statutory Requirements and Approvals Process

The environmental assessment process (Fig. 4) is designed to enable members of the public to obtain details of the proposal and to comment on any matters of interest to them.

It also enables relevant authorities to consider in detail the environmental and social implications of development proposals. These considerations are based on technical assessments of the nature and extent of changes to the existing natural and social environment, on the handling of any wastes, on proposed management strategies to control or limit adverse changes, and on monitoring programmes designed to discover and analyse the effectiveness of such strategies.

Proposals for major developments have to be referred to the EPA for assessment. In respect to the Meenaar Industrial Park the EPA set the level of assessment at CER, requiring 4 weeks' public review. This is a public document and interaction between the proponent and interested members of the public is encouraged.

After a CER has been prepared, released for public comment and comment received from interested parties, the EPA prepares an assessment. Results of the assessment are published in the form of an assessment report which includes recommendations in regard to the project which are made to the Minister for the Environment. Interested parties can appeal to the Minister for the Environment against the content of and recommendations in the EPA assessment report.

2.5 Scope, Purpose and Structure of the CER

The objective of the Consultative Environmental Review is to inform interested parties of the concept of a heavy industrial park at Meenaar, catering for industry such as mineral and agricultural processing and seek environmental approval of that concept from the Minister for the Environment.

Such approval is for the concept of the industrial park, any proposal by future proponents wishing to establish within the industrial park will need to undergo a separate environmental assessment. In this instance, Ashton Mining Limited is anticipating the release of its Public Environmental Review for the rare earths plant in March 1992.

This CER outlines the proposal, describes the existing environment, discusses potential environmental impacts, makes commitments to monitoring and management of the park and invites public comment.

Key issues covered by the report are waste water treatment and disposal, air emissions, odour and noise control, solid waste disposal, seismology of the area, ethnographic and archaeological management of uncleared areas on the site and establishment of buffer zones.

3.0 NEED FOR THE PROPOSAL

3.1 Current and Future Demand for Development of Industrial Land for Heavy Industry

Western Australia's major heavy industrial estate is located at Kwinana, approximately 28 km south of Perth. Other smaller parks in the southern half of the State are located at Narngulu near Geraldton, servicing the Mid-West Region, and Kemerton near Bunbury, servicing the South-West Region.

Major inland regions do not contain heavy industrial sites. Consequently, although a range of raw materials may be generated in these regions the lack of designated industrial areas results in them being processed elsewhere causing loss of employment opportunities in the region of origin.

The Premier recently released an economic statement that confirmed government policy in regard to the development of regional heavy industrial sites.

Establishment of such industrial estates requires the identification of sites that are suitable for industrial development. In addition to the Northam region, sites in Geraldton, Kalgoorlie, Collie, Bunbury and Karratha, are scheduled to obtain development approvals by December 1993.

The Meenaar site has been given a high priority in this process due to the presence of the Ashton Mining Limited's rare earth proposal.

3.2 Benefits at Local and Regional Level

Development of the Meenaar Industrial Park will result in significant benefits at both local and regional level.

The industrial land will be developed in stages and the park design and provision of services allows for this kind of sequential development. Stage 1 of the development is based around the proposed rare earth plant and a small precinct for service developments. This can be commenced with the provision of a road access to the front boundary, a 500 metre long rail spur from the main line, and a passing loop and siding (if rail connection is required), water from the main Goldfields & Agricultural Water Supply Scheme conduit to a storage tank on site and power from Grass Valley. The estimated cost for this is $4.85 million. If the rail connection is deleted and the site's rail needs are serviced from Grass Valley development costs would be $2.5 million.

Future expansion of the industrial land in the park can be developed in discrete stages depending on the requirement of each new industry. As currently envisaged (Fig. 5) the final layout plan for the park will cost in the vicinity of $14.5 million.

Much of this development expenditure will benefit the local and regional economies.

Industrial operations such as the Ashton rare earth plant are expected to source the majority of the workforce from the local community with only a small number of management and technical personnel being relocated into the region.

The potential also exists for local personnel to be involved in the construction phase of industrial development.

Participation of the local workforce in both the construction and operation phases will ensure that a significant proportion of expenditure by the industries will remain in the region.

In addition to direct employment, industries will require other services to be supplied by local businesses, such as:

- landscaping, gardening
- light vehicle maintenance
- contract electrical and mechanical maintenance
- boilermaking and welding
- cartage contracting
- miscellaneous plant hire.

Employment will also be created through the multiplier effect of increased employment through use of local infrastructure such as shops, hotels, banks and demand on the building industry. Generation of more jobs and a widening of the employment base are major goals for the shires in the region.

Availability of high quality, serviced and competitively priced industrial land will open up the potential for processing of local agricultural and resource products.

Such developments will not only help the region but will also bring benefits to the State and Federal economy. Increased investment, development of jobs and increased exports will all have positive effects on the economy.

3.3 Consequences of Not Implementing the Proposal

Should the Meenaar industrial park not proceed as scheduled, it is likely that the benefits described in 3.2 would be lost to the region.

This would result in the Avon region remaining totally dependent on the current agricultural based economy.

4.0 EVALUATION OF ALTERNATIVE INDUSTRIAL SITES IN THE AVON REGION

4.1 Introduction

In determining the most appropriate site for a regional industrial park a range of potential sites are normally investigated. From this investigation the most appropriate site or sites are nominated for development.

4.2 Location of Sites in the Avon Region

The Avon Community Development Foundation has evaluated the Avon Region in order to locate sites that are suitable for industrial development (Section 2.2). Four potential sites were identified at Mawson, Meenaar, Konnongorring and Inkpen (Fig. 1). Each site has between 500 and 1,000 hectares of parkland situated on primary transport routes at a distance from major towns.

Due to the excellent infrastructure (power, water, road and rail) available to Meenaar, its central location in the region and accessibility from Northam, the largest town, this site was chosen by the Foundation for initial development.

4.3 Alternative Sites in Close Proximity to Meenaar

In preparing the conceptual development plan for Meenaar the consultants were instructed to evaluate all alternative sites between Grass Valley and Meckering. Three sites with potential for development of rail service were identified and investigated intensely (Fig. 2). These sites were:

. Meenaar Estate

. North Meenaar - north of the Great Eastern Highway opposite the Meenaar site

. West Meckering - approximately 5 km west of the town of Meckering.

West Meckering Site

The West Meckering site has the potential to provide 380 ha of industrial land with a frontage onto a rail passing loop. Whilst readily serviced with water, roads and power, the difficulties associated with providing a rail balloon loop, which is likely to be required for any significant industrial site, will limit the development potential of the site. This limitation combined with its highly visible location, proximity to the Meckering fault line and town site combined to eliminate this location from further consideration in this study.

North Meenaar Site

North Meenaar was found to be very similar to Meenaar and in order to prepare a full comparison, conceptual structure plans were developed for North Meenaar.

A comparison of North Meenaar against the Meenaar site is shown in Tables 1 and 2.

The Meenaar Industrial Estate was considered marginally superior due to:

- fewer close residences
- greater ease of staging the development
- poor quality of agricultural land resulting in minimum loss of regional production
- The Avon Community Development Foundation had an option to purchase the site which the landowner was willing to sell.

Table 1 Comparison of Site Areas and Rail Construction Costs

	Meenaar	**North Meenaar**	**West Meckering**
Development Area (ha)	290	352	300
Total Site Area (ha)	639	738	380
Buffer Park Area (ha)	349	386	80
% Buffer Park Area	55	53	21
Rail Capital Cost:			
Stage 1 $M	2.4	2.4	
Full Dev. $M	6.6	6.5	

Table 2 Comparison of North Meenaar Site Relative to the Meenaar Site

	Meenaar	North Meenaar
Social impact	Further from Grass Valley	Larger number of adjacent farmhouses
Road	Existing road sufficient for initial site development	Sealed road requires significant upgrading
Rail	Shorter rail balloon loop	Can not readily stage rail development. Rail does not service additional land.
Layout	Adjacent land suitable for incorporation if required.	Stage 1 does not contribute to ultimate infrastructure. Disjointed layout exposed from Highway
Usable Land	Generally flatter slopes on industrial sites, higher % land available for industrial sites. Ready access to industrial sites.	
Water		Additional connection costs
Development Costs	Stage 1 low if rail not required	
Agriculture		More valuable agricultural land

5.0 DESCRIPTION OF THE PROPOSAL

5.1 Location

The Meenaar Industrial Park is located approximately 18 km east of Northam and 15 km west of Meckering (Fig. 2). The nearest town is Grass Valley, some 3 km west of the site with a population of between 70-100. The site is bounded to the north by the main east-west railway line and the Goldfields pipeline.

The nominated site (Fig. 6) comprises one farm plus some additional areas on two adjacent properties which need to be incorporated into the Park to optimise the potential of the development.

5.2 Overall Concept of the Proposal

The overall concept of the Meenaar industrial park is to develop a well planned environmentally acceptable industrial location which will offer an attractive and economic location for industrial development in the Avon region.

5.3 Types of Industries Planned for the Industrial Park

A variety of small to medium scale industries are expected to be established in the industrial park. Those identified as having a high potential fall mainly into the category of mineral or agricultural processing.

Agricultural Processing:

- grain processors
- flour mill
- malt
- biscuits/confectionary
- noodles/cereals
- woollen mill
- seed cleaners
- sheep skins

Minerals Processing:

- rare earths
- polishing powders
- speciality magnets
- inorganic colours
- speciality foundry
- stoneworks
- gypsum and kaolin processing

Miscellaneous:

- clothing manufacturers
- distribution centre
- agricultural chemicals distribution and batching.

More detailed data have been supplied in Appendix 2 on industries that are considered to have potential for development within the next 5-10 years.

5.4 Site Layout, Access and Road and Rail Development

A conceptual development plan (Fig. 5) has been proposed for the site.

The layout of the park is constrained by rocky outcrops and steeper slopes to the south and the pipeline, road and rail to the north.

Substantial clearing of natural vegetation for agricultural purposes has already occurred on the site, however the land is of low value in agricultural terms. Sections of natural vegetation do remain and these, together with buffer zones that will be planted around the perimeter of the site will form the basis of the parkland concept.

The area allocated for development is a broad crescent shape with from east to west mineral processing, a small utilities area, agricultural products and other industries.

Mineral Processing:

The eastern area allowed for mineral processing is 80 hectares which includes a large site for the Ashton rare earth plant. It is envisaged that industries such as downstream mineral processors and stone works will be located in this section of the park.

Agricultural Products:

The central portion of the Estate has been allocated to processors of various agricultural products with the emphasis on grains. The grain/cereal processor (flour, malt, seed cleaners) are expected to locate in this area which comprises some 60 hectares.

Other Industries:

The western area of the site has been allocated to other industries. This area is the final stage and would only be developed once the other areas were completed.

Utilities:

A small 4 hectare utilities area has been allowed between mineral and agricultural processing. This area is for amenities such as SECWA, Telecom and retail shops required to service an estate such as Meenaar. It is centrally located and is expected to be sufficient for the final development.

Roads:

The Meenaar Industrial Park is well serviced by the existing road network with the Great Eastern Highway forming the frontage to the park and Leeming Road providing an alternative access route from the south.

Principal Access:

Great Eastern Highway is a controlled access highway with a traffic volume (1990-91) of 1565 vehicles per day annual average daily traffic. The seasonal monthly peak traffic volume is approximately 1800 vehicles per day.

Two possible locations are available for an access road turnoff into the industrial park, with each location providing a minimum of 500 metres sight distance to the intersection. The most easterly intersection provides direct access to the proposed Stage 1 development area and will form the main access point to the Estate (Fig. 5). The westerly intersection will only be required when the park is close to full development.

Road intersections of the access roads with Great Eastern Highway have been located to provide ample sight distance and will be designed to Austroads Intersection Type "C" standards.

Secondary Access:

Leeming Road is an unsealed farm road providing a connection into the Grass Valley South Road, which is sealed. Leeming Road would require upgrading and sealing to provide for industrial estate traffic. This road link would provide for easy access to the agricultural regions to the south, including York and Quairading.

Internal Roads:

It is proposed that a 20 metre road reserve width be utilised throughout the Industrial Park with these road reserves also acting as primary corridors for other services. Roads will be sealed to a width of 8 metres and have 1.2 metre wide unsealed shoulders.

The basic road layout to provide an initial service spine has been provided in the conceptual structure plan (Fig. 5). Development of the road will be staged to suit the industry development.

Railway:

The main Northam to Kalgoorlie railway line runs adjacent to the northern boundary of the proposed industrial park.

Rail Service Criteria:

For small rail shipments a general freight service is operated from Perth to Kalgoorlie three times per week. This service can deliver and pick up wagons from a passing loop or yard. However for large tonnage deliveries a dedicated train service would most likely be required. A rail balloon loop to allow a train to unload without uncoupling wagons is required for this type of service.

Balloon Loop:

The terrain and railway track levels at the Meenaar site allow little flexibility in the location of a balloon loop which conforms to Westrail track design criteria. The alignment shown (Fig. 5) enters the site near the eastern boundary and sweeps in an arc to the loop around a low hill. The loop required 5.6 km of track including a short passing loop at the Ashton site. This is the shortest track length to provide a basic facility and additional parallel track will be required to service the individual requirement of the industries established in the park.

Two box cuttings are required near the entrance to the Estate to maintain workable gradients. The first cutting is approximately 5 metres deep and 400 metres long and the second 6 metres deep and 300 metres long. Apart from these cuts earthworks are expected to be minimal.

Rail construction will be staged with only the first 500 metres of track plus a 300 metre passing loop and siding being required for Stage 1 development. An alternative to this siding would be to service Stage 1 from the Grass Valley siding.

5.5 Ancillary Services

The Meenaar Industrial Park location has been chosen because of the good access to ancillary services.

Power:

There are two possible ways of supplying power to the site:

- A 66 kV power line currently runs through the area proposed for the park. In order to use this line to feed industry a new substation costing in excess of $2M would be required;

- A 22 kV power line runs from Northam to Grass Valley. This line can be upgraded and extended to the Meenaar site. The cost of this extension is estimated at $700,000 and supply capacity will be approximately 5 MW.

The 22 kV line is sufficient to supply Stage 1 of the development and SECWA has indicated that it favours this option.

The short route for the power line between Grass Valley and the Meenaar site has not been determined as yet, but the possibility exists for it to follow the route of the current 22 kV line.

Power within the estate will be reticulated to each site as required by industry. The receiving industry will be responsible for supplying its own transformer and connections from the plant side of the transformer.

Water:

Groundwater in the Meenaar area is saline and is not suitable for industrial use. Consequently it is not envisaged the park will involve the development of extraction bores.

The Water Authority of Western Australia (WAWA) will be responsible for water supply from the Goldfields and Agricultural Water Supply Scheme main pipeline which abuts the northern side of the park. This pipeline is supplied from Mundaring Weir, being pressurised by a series of major pumping stations.

Based on an estimated demand for the park of 3.7 MkL/a (BHP Engineering) WAWA consider it unlikely that the capacity of the pipeline will cause any constraint to development. Dependent upon the actual peak instantaneous and average water demands some upgrading of the pipeline may be required, both prior to the establishment of the park and as the park develops.

Gas:

Supply of gas by SECWA pipeline is not available at Meenaar. Studies on the extension of the gas pipeline from Bullsbrook to Meenaar have been costed by SECWA at $15 million. Predicted demand in the Northam region has been determined as not yet sufficient to warrant this capital outlay.

Gas requirements by industry will be met by supply of LPG by tanker from Kwinana, until sufficient demand exists to warrant installation of a pipeline.

It is not anticipated that central storage facilities will be established within the park for LPG. Each industry consuming gas will be responsible for establishing independent storage which will require approval from the EPA and the Department of Mines.

Sewerage:

Septic tanks and leach drain systems developed by the individual industries are proposed for on site sewerage. Due to the salinity of the local groundwater such disposal techniques will not adversely affect groundwater quality.

Drainage:

Drainage of stormwater from the estate is readily achieved without major disruption to the existing drainage patterns. Existing peripheral stream courses have been used with two internal drainage reserves being provided which are closely aligned to existing minor creeks. Flow to the drainage reserves will be via road side drains or overland flow. The often sandy nature of the surface soil and the natural gradient of the land will assist greatly in providing a well drained estate.

Drainage from the site flows both north and south (Fig. 7) with the southern drainage flowing to the South Mortlock River and the northern drainage to the Grass Valley Brook and then into the Mortlock River. The Mortlock River then flows into the Avon.

5.6 Waste Disposal Strategy

Introduction

In developing a new industrial site it is necessary to formulate and implement a waste disposal strategy in order to protect the surrounding environment. Such a strategy has been developed by evaluation of disposal options in terms of the following:

- current government policies towards waste management and pollution control (Appendix 3)
- minimisation of detrimental effects on public health and the environment (Section 6.0)
- control of waste management practices in terms of procedures, monitoring and community acceptance (Section 7.3, 7.4 and 7.5)
- available waste disposal methods and minimisation of waste (Section 7.3 and 7.4).

Solid Waste Disposal

The initial project proposed for the Meenaar industrial park is Ashton Mining's rare earth plant. The strategy for solid waste disposal for this project is to remove material from the site and transport it back to the Mount Weld mine.

In the case of other industries where solids can not be disposed of on site they will need to be removed to an industrial waste land fill. As such a landfill currently does not exist in the Northam area, the Department of State Development and the Industrial Lands Development Authority will work with the Meenaar park management committee, the Avon Community Development Foundation, and local councils to locate and develop an appropriate site.

Liquid Waste Disposal

Liquid waste disposal on the Meenaar site will be based on the use of evaporation ponds or possibly where nutrients are available in the waste, the use of irrigation.

It is not expected that use of evaporation ponds will have any adverse effect on the saline groundwater. The possibility of irrigation will be dependent on the individual industries and will need significant study and discussion with local landholders and the Department of Agriculture prior to application.

5.7 Buffer Zones

Buffer zones have been established both around the perimeter of the park and between industries within the park in order to ameliorate effects such as noise and air quality on the surrounding neighbours (Section 7.2).

The Meenaar Industrial Park will comprise a total area of 639 hectares, of which 349 hectares will be buffer zones inter-industry and on the perimeter of the industrial park. Land surrounding the park is zoned Rural 5. This zoning does not allow for further subdivision of the land and provides a further buffer between the park and the residences of the adjoining land owners (Section 5.10).

Inter-Industry Buffer:

Internal buffers between industries will be developed by individual industries as part of site landscaping. These buffers would integrate into the overall landscape plan for the Park and their establishment will be part of the agreement for sale of the land.

External Buffer:

External buffers have been designed to maintain the natural bushland of the site and also improve aesthetics by screening the industrial park from passing traffic and the nearest neighbours.

The external buffer consists of the large block of remnant vegetation to the south and screens of approximately 50 m on the east boundary. The northern boundary is screened by vegetated drainage areas and the road reserve, while buffers to the west are 250-300 m wide to afford a substantial barrier in the direction of Grass Valley.

5.8 Projected Lot Size and Land Tenure

To provide the greatest possible flexibility in accommodating future industries, the lots have to be sized and located to allow for either further subdivision or amalgamation as required. It is proposed that Stage 1 will include 4 x 1 hectare lots for small service industries and a large block for Ashton's rare earth plant.

The whole of the proposed Meenaar Industrial Park and surrounding lands are zoned "Rural 5" in the Shire of Northam's District Town Planning Scheme No. 2.

The Shire of Northam has indicated that once all environmental approvals have been received the land will be rezoned to suit the industrial requirement. Department of State Development /Industrial Lands Development Authority will progress the rezoning in conjunction with the Shire officers.

Land around the site will remain "Rural 5". The Council's policy for this class of land is specified in Clause 655 of the Town Planning Scheme No. 2 as follows:

" Rural 5

Having regard to the need to retain the zone as an area of agricultural importance, Council will not support further breakdown of existing lots except:

a. where subdivision is for the purpose of amalgamation with existing holdings or increase rural viability;

b. for development ancillary to the existing rural land use, or for development of community or recreational facilities. "

Permitted uses within the Rural 5 zone are specified within Table 1 of the scheme and the zoning table (Appendix IV). It should be noted however that farm holdings adjacent to the site contain a number of smaller lots. Zoning changes may be required to ensure that further homesteads are not developed on these individual titles.

5.9 Method of Transfer of Land Ownership and Associated Conditions

The Avon Community Development Foundation holds an option over the major portion of the land required. This option has been ceded to the Industrial Lands Development Authority, which will obtain ownership of the land through direct purchase or land exchange.

Land will be sold by Industrial Lands Development Authority to companies intending to locate appropriate industries within the park. Industries purchasing land in the park will need to obtain all necessary environmental and other clearances before commencing construction. They will also have to agree to adhere to rules and regulations set down by the Park's Management Committee.

5.10 Development Schedule and Project Life

Stage 1 of the park is scheduled to be developed in conjunction with Ashton's rare earth plant. This will require all necessary approvals and rezoning by December 1992 and commencement of infrastructure development in early 1993 (Fig. 3).

Industrial land has no discernible lifetime. Once infrastructure has been put in place the industrial land would have an expected life far in excess of any one operation. Industrial estates in Europe have been operating for several hundred years with industry being updated and replaced by new plants/processes as the original plants become obsolete.

6.0 EXISTING ENVIRONMENT

6.1 Social Environment

The Meenaar Industrial Park location was selected by the the Avon Community Development Foundation (Avon Community Development Foundation) as a site that could be serviced from a range of towns in the Avon region. Grass Valley, Meckering and Northam are the nearest towns to the site, but a range of other country centres are within 50 minutes' drive (Fig. 8).

Northam is the commercial and administrative centre for the Avon region which includes the Town of Northam and Shires of Northam, York, Cunderdin, Toodyay and Goomalling. The Northam region has a rural economy with wheat/barley/oats and sheep/cattle farming being the principal activities. Additional industry sectors or related facilities include flour milling, agricultural service industries, light and cottage industries and tourism.

Northam became the point of departure for the railway to the Western Australian goldfields in the 1890s and the gateway to the east with the later development of the transcontinental railway and the Great Eastern Highway.

Grass Valley, the nearest town to the proposed park, was established in the 1890s, becoming an important centre due to the railway siding which services the large hay and chaff industry. The town developed a school at the Agricultural Hall, a hotel, post office and foundry works to service the agricultural industry. Today, Grass Valley is a village of some 70-100 people with the majority of people working at Northam or in the local agricultural industry.

Population, employment, social infrastructure, tourism, transport, nearest neighbours, Grass Valley and community goals and objectives are described in more detail in Chapter 8.

6.2 Ethnographic and Archaeological Survey of the Meenaar Industrial Park Site

An anthropological survey for Aboriginal sites of significance at the proposed Meenaar Industrial Park has been completed. The ethnographic survey was carried out by Ken Macintyre and Dr Barbara Dobson in February 1992. Due to a lack of ethnohistorical information with regards to the traditional Balardong people who inhabited the Northam area, and as a result of historical circumstances and social attitudes, the Aboriginal people interviewed in the Northam and surrounding Wheatbelt area had little or no traditional or historical information on the totemic topography, ritual customs and habitational patterns of the original inhabitants. Therefore, it must be concluded that if sites existed within the boundaries of the designated Meenaar Industrial Park that all knowledge of their location and significance has been lost over time.

At the same time, and in recognition of the possible existence of archaeological sites in the proposed Meenaar Industrial Park, an archaeological survey was conducted by Jacqueline Harris for Quartermaine Consultants. Two sites of low

archaeological significance were located, one in the proposed buffer zone and the other in the possible expansion zone. These sites have been recorded in accordance with the requirements of the Department of Aboriginal Sites, Western Australian Museum.

Park planning will be modified so that both these sites will be incorporated within the buffer zone of the park in order to ensure their protection.

6.3 Physical Environment

Climate

The region around the site is characterised by a semi-arid climate with hot, dry summers and mild, wet winters.

The Bureau of Meteorology holds some climatic data for Northam, Grass Valley, Meckering, Cunderdin, York and Goomalling. The following summary of relevant aspects of the climate is derived from the data for Northam due to the geographical location of Meenaar relative to Northam and the comprehensive nature of that data. Where appropriate, the Northam data are supplemented with climatic data recorded at Grass Valley and Meckering.

Average monthly temperature, rainfall and evaporation data recorded at Northam are presented in Figure 9.

Average seasonal temperatures are as follows:

. mean summer maximum	33.5 C
. mean summer minimum	16.8 C
. mean winter maximum	17.6 C
. mean winter minimum	6.0 C

Northam has an average annual rainfall of 434 mm, while Grass Valley has 398 mm and Meckering 368 mm. Regional rainfall is markedly seasonal with all three stations recording 85% of their annual rainfall between April and October. June and July are the wettest months, representing about 38% of the annual rainfall. The highest twenty-four hour rainfall episode recorded at Northam is 126 mm (recorded on 9 March 1934), at Grass Valley 108 mm (recorded on 9 March 1934) and Meckering 96 mm (recorded on 16 February 1955).

Northam has an average annual evaporation of 2,000 mm with evaporation exceeding rainfall for all but two months of the year. Based on advice from the Bureau of Meteorology, Meenaar has an estimated annual evaporation of about 2,100 mm, resulting in a net annual evaporation rate of 1,700 mm.

This type of climate is ideal for the disposal of liquid effluent by evaporation with only the months of July and August having average rainfall slightly above evaporation.

Seasonal wind roses for Northam are provided in Figure 10. Local topography is not expected to affect wind direction significantly and, accordingly, the wind roses are considered representative of winds at Meenaar. The winds during summer are generally from the south-east in the morning, whereas winds in the afternoon are more variable, but mostly from the south-west and south-east quarters. During winter, both the morning and afternoon winds are principally from the north-west.

On this basis the predominant winds will not be blowing from the site directly to the largest area of local population at Grass Valley. An easterly wind which is the direction from the site towards Grass Valley is prevalent approximately 17% of the year.

Geology and Soils

Geology:

The site is underlain by granites which are intruded by dolerite dykes. The granites outcrop in those areas still carrying remnant vegetation. Outcrops also occur throughout the site except where it is completely obscured by the Quailing depositional sheet in the north-west.

Local relief is of the order of 40 m. The highest part of the site reaches to 270+AHD metres within the wooded area near the homestead. The railway and pipeline are about 40 metres below.

Soils:

Five principal soil types have been recognised on the site. The general profile descriptions and the drainage characteristics are shown in Appendix V. The general distribution of the soils is shown in Figure 12.

The sandplain soils are the deepest and are rapidly draining, yellow-brown sands over colluvial gravels.

The Malebelling and York surfaces are duplex soils being sands over clays on sandy clays at variable depth. The depth of the B horizon clays to rock material is dependent upon the rock type and the proximity of outcrop, soils being shallower near the outcrops. Mottling in the B horizon which suggests a tendency to waterlogging was only apparent near rocky outcrops. The York subsoils are red or brown clays. This serves to distinguish them from the Malebelling soils. The soils were, however, classified in most cases as imperfectly drained since the clays would have impeded drainage.

The Mortlock surfaces contain characteristically acid clay subsoils below grey and pale brown sands. They are waterlogged during the winter as a result of their position in the landscape.

The Rocky Outcrops carry little soil. In general a thin layer of fine sandy material occurs over fresh granitic rocks. Where dolerites are the parent material brown

sandy clays are found over the fresh rock. The rocky surfaces are also found as small inclusions within the Malebelling and York surfaces.

The existence of clayey soils in the Quailing and Malebelling surfaces indicate that these soils/landforms offer the environmental integrity required for proper management of waste water in terms of dam construction, monitoring of leachate and recovery if required (Section 7, Appendix V).

Hydrology and Hydrogeology:

Meenaar straddles the upper reaches of two catchments; one portion drains northward to the Grass Valley Brook, while the remainder drains southward to the Mortlock River. The surface drainage and catchments in the Meenaar area are shown in Figure 7.

The catchment boundary extends north-south through the site. The western portion of the site drains into the Grass Valley Brook which flows in a westerly direction north of the re-aligned Great Eastern Highway. Grass Valley Brook joins the Mortlock River about 3 km east of Northam. The eastern portion of the site is drained by tributaries of the South Mortlock River. The Mortlock River is a tributary of the Avon River, with the confluence at Northam. Drainage from the site is via weakly defined drainage lines.

Flow from the Grass Valley Brook and the Mortlock River is highly seasonal. The Water Authority maintains a recording station on the Mortlock River (Fig. 11). The highest flow is normally in winter, however heavy rains cause intermittent summer flows. Water from the Mortlock River is generally brackish or saline, with salinity levels ranging between 300 mg/L and 3,600 mg/L at times of high rainfall. No data are available for Grass Valley Brook.

Two farm dams are located at Meenaar; one is fenced within the remnant bushland and the other is in the south-east.

A hydrogeological study of the Meenaar area indicated that groundwater occurs as a thin body of fresh or brackish water lying within weathered and generally clayey soil above the fresh gneiss or quartzite bedrock (Rockwater, 1991). Groundwater is recharged from infiltration of rainfall, which moves slowly down-gradient eventually discharging as brackish or saline seeps along drainage lines. In areas of higher elevation, the underlying rocks may be unsaturated, containing no permanent groundwater. At lower elevations where the rocks are saturated, the underlying rocks are expected to have very low potential yields.

Groundwater discharges from a number of seeps at Meenaar. Analysis of groundwater indicated that salinities ranged from 4,100 mg/L to about 24,500 mg/L total soluble salts. Salinities generally increase with increasing distance down-catchment.

Consequently groundwater in the Meenaar area is unsuitable for domestic, horticultural and the majority of stock use. Theoretically some areas of

groundwater could be used for sheep, however this level of salinity is only used for sheep if other more acceptable sources of water are not available. In this case water from the Goldfields & Agricultural Water Supply Scheme pipeline is readily available.

Use	Water Quality Maximum Allowable Salinity mg/L
Domestic	500-1000
Horticulture	500-3000
Stock:	
. Cattle	3000
. Sheep	10000

This is supported by the fact that the Geological Survey of Western Australia has no records of bores or wells located at Meenaar. The nearest groundwater source is an abandoned well located 1.8 km north-east of Meenaar. Other bores and wells are more than 2 km away, and have mostly been abandoned, possibly due to low yield or high salinity.

The salinity of the groundwater resulting in the absence of use for domestic or stock watering in the area implies that there is little potential for leachate from properly managed on-site waste disposal to adversely impact on the groundwater.

Seismicity:

Meenaar is situated in a region which has been subjected to earthquake events of varying magnitudes. The most significant recorded earthquake in recent times had its epicentre near Meckering, 15 km east of Meenaar. The 1968 Meckering earthquake had a Richter magnitude of 6.8, resulting in structural damage to buildings and other infrastructure in the region.

The Australian Standard 2121-1979 classifies the area encompassing Meenaar as Zone 2 which has a return period for a ground-particle velocity of 40 cm/s of 6000 years or less. This zone stretches as far west as Wundowie.

Most of the world's earthquakes occur in narrow, continuous zones along so-called plate boundaries. The interior of the plates, which includes the whole of continental Australia, are known to have earthquakes, and sometimes large earthquakes, but at a rate of less than 5% of that along the plate boundaries. Consequently Northam, in comparison to cities such as San Francisco, California or Wellington, New Zealand, is situated in a relatively low risk area.

Although the Meenaar Park is in an area of known seismicity, engineering design of both plants and evaporation ponds can be modified as specified in Australian Standard 2121 to withstand the major predicted activity for the area of 7.3 Richter magnitude (Mundaring Observatory).

6.4 Biological Environment

The Meenaar Industrial Park contains areas cleared for agriculture, a number of small isolated patches of woodland stands and an area of approximately 80 hectares of fenced remnant bushland.

A study of vegetation and fauna in the area was commissioned by Ashton Mining Limited in October 1991 (Appendix IV). The following account of the vegetation and flora has been adapted from this study.

Flora and Vegetation:

The flora section of the report deals principally with the large vegetation remnant south of the homestead. The isolated remnants in the paddocks are principally of the E.wandoo - E.salmonophloia - E.loxophleba complex, with the exception of a notable sand plain/laterite remnant in the north-west.

The property has a large potential for conserving species and selected plant communities. A total of 68 vascular species were recorded during a one day survey on the Meenaar project area, (Appendix VI). Eight of these species were introduced.

The plant communities present were:

- herbfields on granite outcrops;
- heaths on granite outcrops;
- Eucalyptus eremophila, Eucalyptus arachnaea and Eucalyptus anceps mallet woodlands with mixtures of Eucalyptus wandoo;
- Eucalyptus astringents (Brown Mallett) woodlands;
- Eucalyptus wandoo (Wandoo) woodlands with an understorey of Santalum acuminatum;
- Eucalyptus wandoo (Wandoo) woodlands with an understorey of mixed species; and
- Eucalyptus wandoo (Wandoo) woodlands with an understorey of Melaleuca uncinata thickets and Gastrolobium spp.

All of these plant community types occurred in the fenced area of remnant vegetation. As indicated earlier, the latter range of communities is highly significant on a local and regional level, particularly as few conservation reserves occur in Northam Shire.

The combination of structural and floristic variation in the plant communities provides an opportunity for protecting a range of habitats for fauna.

The presence of a vigorous fauna in defined areas with the proposed industrial park is considered to be desirable.

The remaining stands of trees on the paddocks have the potential to be extended and improved from a structural, floristic and visual point of view. These extensions and improvements could include:

- the revegetation of corridors with native plant species linking smaller tree stands with the main area of remnant vegetation;

- the re-establishment of native sedges and shrubs near the dam to encourage greater utilisation of the artificial wetland by a wider range of species;

- the revegetation with native species of eroded gullies to halt and reverse land erosion;

- the protection of the native species in the remnant area by maintaining fencing (to exclude introduced stock and feral animals), controlling weeds (introduced plant species) and by managing fire to reduce the risk of the entire remnant being burnt in one wildfire.

These actions would enhance the biological and amenity values of the Meenaar Industrial Park, providing local native species were utilised in all revegetation programmes.

Fauna:

a. Birds

The property has the potential to provide habitat for up to 112 bird species. This number is impressive in view of the fact that the average number for conservation reserves in the wheatbelt is between 80 and 90 species.

The 80 hectares of uncleared bushland is rich in bird species, many of which have disappeared or declined from cleared land in the Wheatbelt. Because this patch of bush has been protected from grazing stock by fencing it still maintains a rich and diverse plant understorey. This provides essential habitat for the Grey Shrike-thrush, Red-capped Robin and White-browed Babbler. Birds requiring understorey shrubs have suffered massive declines throughout the wheatbelt.

The Eucalypt woodland, especially the mature Wandoo trees, provides an important resource for many birds, particularly small insectivorous birds such as the Weebill and Western Gerygone which glean small insects from leaves. Wandoo trees provide many hollow branches suitable for nesting sites and as such breeding sites are becoming very scarce throughout the wheatbelt, these remnants are increasingly important.

The small patches of woodland on rocky outcrops scattered through the property are important links between larger patches of bush. Not only to they provide perching positions for migrating birds such as Black-faced Cuckoo-shrike, White-winged Triller, Grey Fantail, Western Gerygone and other birds, they also provide many nesting and feeding resources.

The paddocks are the only habitats known in the district for Richard's Pipit, Brown Songlark and the main feeding areas for Australian Kestrels, Galahs, Twentyeights (Port Lincoln Ringnecks), Australian Magpie-larks, Australian Magpies and Australian Ravens.

The survey recorded Australian Kestrels, Twentyeights (Port Lincoln Ringnecks), Elegant Parrots, Galahs, Tree Martins, Grey Shrike-thrushes and Striated Pardalotes breeding in tree hollows in both the large uncleared bush and the smaller patches in paddocks. White-browed Babblers, Weebills, Yellow-rumped Thornbills, Australian Magpie-larks, Australian Magpies and Australian Ravens were breeding in trees and shrubs, and Willie Wagtails were breeding in farm buildings.

b. Mammals

The bushland on the proposed Industrial Park provides near-pristine habitats for native mammals. Fifteen native mammals, including bats, are expected to occur. Short-beaked Echidnas are common, judging by their numerous diggings. Signs of Grey Kangaroos were plentiful and their pathways to the dam adjacent to the bushland were well-used. Claw marks of Brush-tail Possums were noted on trees with suitable refuge hollows. Attractive marsupials such as Dunnarts and the Western Pygmy-possums are also probably present. These species no longer occur in cleared farmland.

Most small mammals in the wheatbelt have declined because of agricultural clearing. The fenced bushland on this property could be important in maintaining them in the region. One of the favoured refuge areas for the Western Pygmy-possum is in the dead skirt of the Blackboy, Xanthorrhoea reflexa. These long unburnt shrublands containing many Blackboys could maintain healthy populations of this small marsupial.

Hollow logs in the woodland and refuges among the granite boulders are excellent retreat and nesting areas for small insectivorous Dunnarts.

c. Reptiles

The bushland is likely to support between 30 and 40 reptile species.

Studies by the Western Australian Museum near Wongan Hills show that small patches of bush in farmland, if left undisturbed, continue to maintain the original reptile fauna. This highlights the value to reptiles of the bush on this property.

7.0 POTENTIAL ENVIRONMENTAL IMPACTS

7.1 Introduction

This section of the report reviews the potential environmental impacts arising from the establishment of the Meenaar Industrial Park.

Major issues discussed are noise, air quality impacts and risk analysis, liquid and solid waste disposal, run off and erosion, flora and fauna.

7.2 Noise

Noise is the "unwanted sound" which can adversely affect the health and well-being of individuals or populations. Noise is characterised in terms of sound intensity and frequency spectrum, which indicates the distribution of the total sound over high and low frequencies.

The greater potential impact of noise from an industrial area is the nuisance impact or disturbance to neighbours particularly at night. Although no noise monitoring data are available for the Meenaar area, it has been assumed that background levels are low, except due to road and rail traffic.

In the absence of detailed information on potential noise sources an overall commitment is given to maintain noise levels within limits normally set by the EPA for industrial operations:

Noise Levels:

1. The proponent shall ensure that the noise emissions from the park do not cause or contribute to noise levels in excess of:

    . 50 dB(A) slow from 7 am to 7 pm Monday to Saturday inclusive but excluding gazetted public holidays;

    . 40 dB(A) slow from 10 pm to midnight and from midnight to 7 am every day; and

    . 45 dB(A) slow at all other times:

    when measured:

    (1) at any point on or adjacent, used for residential or other noise-sensitive purposes; and

    (2) at a height between 1.2 and 1.5 metres above ground level and at a distance greater than 3.5 metres from any reflecting surface other than the ground.

2. Where the combined level of the noise emissions from the project and the normal ambient noise exceed the levels specified in condition 1, this condition shall be considered to be contravened only when the following criteria are also met at the measurement point:

   . the noise emissions from the premises are considered to be audible by the Environmental Protection Authority; and

   . the noise emissions from the premises are identifiable by the Environmental Protection Authority as emanating from the project.

3. Noise emissions shall not cause unacceptable annoyance due to tonal or impulsive components. These characteristics shall be assessed by the Environmental Protection Authority.

4. Exemption may be granted from conditions 1 and 3 in respect of any premises used for residential purposes by the negotiation of a written agreement with the occupier(s) of that premises. Such agreement shall be acceptable to the Environmental Protection Authority.

Management and Control of Noise:

Noise control is the technology of obtaining an acceptable noise environment at a receiver consistent with economic and operational considerations. Two main avenues of noise control will be applied by industry locating at Meenaar:

. noise reduction at the source
. noise control of the transmission path

Source:

Noise control at the source is the most effective means in the reduction of noise levels. The main ways of controlling noise at source are through strict equipment specifications, enclosures, use of acoustical materials to enhance absorption of sound, equipment modifications or change in operating activities.

Path:

In addition to controlling noise at the source, noise can be attenuated along the path.

The most significant attenuating factor is distance. The exact amount of reduction will depend not only on the distance but also on the meteorological conditions, in particular wind speed and direction and the characteristics of the locality, such as topography, vegetation and surrounding buildings.

The worst case conditions in regard to noise are:

Temperature	10° C
Relative humidity	90%
Wind speed	2 m/s
Vertical Temperature Gradient	2° C per 100 m

A graph illustrating noise attenuation with distance under these worst case conditions has been compiled (Fig. 12).

The closest residences to the Meenaar Industrial site are to the north, south and east, at approximately 0.5, 1.8 and 2.7 km respectively. The nearest residence 0.5 km to the north has the railway line and Great Eastern Highway as a buffer from the site. Both residences to the south and east are shielded by intervening hills. Grass Valley is approximately 3 km west of the nearest point of the site and some 5 km from Stage 1.

On this basis the noise attenuation (reduction) under wost case conditions, over the distance to the nearest neighbours would be:

Distance to Nearest Residence	**Attenuation dB(A)**	**Acceptable Noise Level Stage 1 dB(A)**
500 m	-60	100
1800 m	-81	121
2700 m	-84	124
3000 m	-85	125

Consequently in order to meet the commitments for noise, source Levels in Stage 1 must be maintained below 100 dB(A) at the park boundary.

7.3 Air Quality Impacts

Air Quality Criteria:

The types of industry proposed for Meenaar are expected to have little effect on air quality in the region. However, air quality criteria still need to be set for the site.

The basic objective of establishing air quality criteria is to restrict the concentration of pollutants in the ambient air to such levels as will not adversely affect the health, well-being or welfare of the community (NH and MRC 1986).

EPA's Approach to Atmospheric Emission Assessments:

In assessing the acceptability or otherwise of emissions to the atmosphere, the EPA uses two complementary criteria.

Firstly, the emissions (when combined with emissions from any existing or likely future sources) should not cause environmental impacts beyond environmentally acceptable limits. These environmental impacts are normally assessed via computer modelling which relies heavily on meteorological data and needs to be verified against measurements (monitoring data) of the respective air pollutants. The Authority regularly utilises the Victorian EPA guidelines as a starting point in its assessment of ambient air quality impacts.

Secondly, irrespective of the magnitude of the environmental impact, proponents of projects involving a new emission source should take all reasonable and practicable measures to prevent or minimise the discharge of waste. This criterion is provided for under the provisions of Section 51 of the Environmental Protection Act, 1986. The Environmental Protection Authority considers that the Australian and New Zealand Environment Council/National Health and Medical Research Council (ANZEC/NH&MRC) National Guidelines for the Control of Emissions of Air Pollutants from New Stationary Sources (1985) are directly applicable to this second criterion.

This second criterion is directed towards ensuring the long term protection of the environment and preventing individual emitters from unnecessarily consuming the regions's assimilative capacity to absorb pollutants. It should be noted that the unnecessary utilisation of the environment's assimilative capacity may preclude future developments which may be considered desirable by the community.

While adherence to the emission criteria at the source reduces the potential for adverse environmental impact, it is necessary to ensure that the cumulative emissions from all industrial sources do not result in exceedences of ambient air quality criteria.

In the past the Western Australian EPA has not adopted a fixed set of air quality criteria and tends to refer to criteria established by other Australian and International bodies (Table 3). However, the EPA has recently published a draft Environmental Protection Policy for Sulphur Dioxide and dust levels in the Kwinana region (Table 4). These criteria are being applied to other industrial estates in Western Australia, (advice of EPA on Industrial Sites in Kalgoorlie and Geraldton), and have been adopted by the proponent as the criteria for Meenaar. In the case of the Meenaar Park the Industrial Zone would be classed as the Park, the Air Quality Buffer Zone as the land between the Park and the nearest residents, and outside the buffer zone would be once the nearest neighbours had been reached.

These allocated standards are aimed at producing air quality better than the standard for more than 99.9% of the time, such that the limit will never be exceeded.

There is a wide range of technologies available for control of emissions from industrial processes (Appendix VII). For individual industrial proposals the EPA will carry out further assessment in order to ensure that the appropriate environmental air quality is maintained.

Where industries are proposed that may introduce other air pollutants, proposals for the development of these industries will be referred to the EPA for assessment.

TABLE 3
SUMMARY OF RELEVANT AIR QUALITY CRITERIA

Substance	Authority	Averaging Period	Groundlevel Concentration ug/m^3
Sulphur dioxide	NH&MRC	Annual	60
		1-hour	700
		10-minute	1,400
	USEPA	Annual	80
		24-hour primary (1)	365
		3-hour secondary (2)	1,300
	VEPA	24-hour acceptable (3)	171
		1-hour acceptable	486
		24-hour detrimental (4)	314
		1-hour detrimental	972
	WHO	Annual (5)	30
		24-hour (5)	100
		24-hour, primary	350
Particulate matter	NH&MRC	Annual	90
	USEPA	Annual, primary	50
		24-hour, primary	260
Nitrogen dioxide	NH&MRC	1-hour	320
	USEPA	Annual	100
	VEPA	24-hour, acceptable	123
		1-hour, acceptable	308
		24-hour, detrimental	308
		1-hour, detrimental	513
	WHO	24-hour (6)	150
		1-hour (6)	400
Carbon dioxide		No criterion set	-

Note: VEPA — Victoria Environment Protection Authority (Vic.Govt. 1981)
NH&MRC — National Health and Medical Research Council (NH&MRC, 1985)
WHO — World Health Organisation (WHO, 1987)
USEPA — United States Environmental Protection Authority (USEPA, 1977)
(1) primary, - to protect public health
(2) secondary - to protect aesthetics, property and vegetation
(3) acceptable - levels should not be exceeded for more than three days per year
(4) detrimental - levels should never be exceeded
(5) protection of sensitive ecosystems
(6) protection of sensitive asthmatics

TABLE 4

AMBIENT AIR QUALITY OBJECTIVES FOR SULPHUR DIOXIDE AND TOTAL SUSPENDED PARTICULATES

SO_2 for a 1-hour Averaging Period (ug/m^3)

Area	Standard (desirable level)	Limit (never to be exceeded)
A. Industrial	700	1,400
B. Air Quality Buffer Zone	500	1,000
C. Outside the Buffer Zone	350	700

Particulates for a 24-hour Averaging Period (ug/m^3)

Area	Standard (desirable level)	Limit (never to be exceeded)
A. Industrial	150	1,000
B. Air Quality Buffer Zone	90	260
C. Outside the Buffer Zone	90	150

Source: Draft EPP (EPA, 1989b)

7.4 Public Safety Management Criteria

Since Meenaar is being considered as a location for heavy industry, some of which could be classed as hazardous, it is necessary to address levels of risk that are acceptable in an industrial area.

Risk Criteria:

The EPA has established risk assessment criteria and processes that account for both the technical and the locational safety aspects of hazardous industry.

The term "individual risk level" refers to the frequency per year (the measure of likelihood) of death of an individual due to an accident. Individual risk levels are typically represented by a series of contours showing the risk of fatality to an individual at a certain place over a year of exposure to a particular hazard.

EPA guidelines for assessment of acceptability of risk impact of industrial installations on various land uses are:

a. A risk level in residential zones of one in a million per year or less, is so small as to be acceptable to the Environmental Protection Authority;

b. A risk level in "sensitive developments", such as hospitals, schools, childcare facilities and aged care having developments of between one half and one in a million per year is so small as to be acceptable to the Environmental Protection Authority;

c. Risk levels from industrial facilities should not exceed a target of fifty in a million per year at the site boundary for each individual industry, and the cumulative risk level imposed upon an industry should not exceed a target of one hundred in a million per year;

d. A risk level for any non-industrial activity located in buffer zones between industrial facilities and residential zones of ten in a million per year or lower, is so small as to be acceptable to the Environmental Protection Authority.

To put these criteria in perspective Fig. 13 compares the above levels with individual risk levels for selected voluntary and involuntary risks published by the Australian Bureau of Statistics.

None of the industry predicted for the Meenaar Industrial Park (Section 5.3) would be expected to be the source of significant risk. However, industry wishing to locate in the Meenaar Industrial Park that has a potential to cause risk impacts on the surrounding communities will be required to carry out a risk analysis to show that they can meet the EPA criteria. A cumulative model will be developed for the industrial park to ensure that as new industries are developed cumulative risk levels remain within EPA criteria.

As a gas pipeline does not exist, industry requiring gas will have to be supplied with LPG by truck. It is not planned that there will be a major storage depot on site, but that individual industries will receive delivery direct by truck to dedicated storage facilities. The acceptability of such storage facilities will be determined during the environmental assessment of each project. Risk footprints developed for LPG storage and transport in the Kwinana Industrial Area indicate that risk levels will be acceptable at Meenaar.

7.5 Methods of Liquid Waste Treatment and Disposal

Liquid waste will be generated by several of the proposed industries on the site. Industries producing liquid wastes will be responsible for treating the waste to a standard acceptable to the EPA.

Potential disposal methods for liquid effluent in this area are:

- reuse of waste water by industries;
- disposal to land.

Reuse of Wastewater by Industries:

Wherever possible the reuse of waste water within the operation generating the water or as the estate grows by the industries will be encouraged. Reuse in this manner is based on the cost of the water treatment required to make the water usable against the cost of new water supply.

Disposals to Land:

There are two principal processes that may be appropriate for effluent disposal by land at Meenaar:

- irrigation
- evaporation

Evaporation is considered as the preferred option for disposal at Meenaar. Irrigation is possible, however care would be needed to ensure the process did not exacerbate the salinity problems in the region.

Evaporation Ponds in the Meenaar Industrial Park:

Climate data for Meenaar as outlined in Section 6.3, clearly indicates that for 80% of the year evaporation exceeds precipitation, making disposal of liquid waste by evaporation an attractive option. In addition field examination of soil types (BHP Engineering) has indicated that soils on the site are suitable for construction of evaporation ponds (Section 6.3). Design of such ponds will be specific to individual projects, however design standards must be approved by the Environmental Protection Authority prior to construction.

As a minimum level, ponds will be required to contain an impermeable lining of clay or an artificial liner capable of reducing seepage rates to between 10^{-8} and 10^{-9} m/s. In the case of evaporation ponds general design procedures require either a scum trap or settling pond to remove any potential layer on the water prior to the evaporation pond. An overflow pond may also be required for unusual weather conditions. Monitoring bores will be required to be sited in locations strategic to the ponds to monitor any seepage that occurs and facilitate recovery if necessary.

Solids left after evaporation will either be covered over with earth once the dam is full and rehabilitated or where the long term storage of the solid residue is not considered environmentally acceptable by the EPA the residue will be recovered and removed for disposal at a suitable off-site location, suitable to relevant Government agencies (see 7.4).

Construction of walls for evaporation ponds will take into account the potential for seismic activity in the area. Construction materials will be chosen so as not to be subject to liquefaction in the case of ground movement and freeboard will be sufficient to contain wave motion. (Mines Department Appendix VIII).

Potential environmental impacts that could arise from a large area of evaporation ponds are leakage and smell.

Leakage:

As discussed previously ponds will be designed to reduce seepage rates to a level between 10^{-8} and 10^{-9} m/s. At this rate the ponds will have negligible effect on a groundwater that is already saline.

An efficient monitoring programme will be established in conjunction with the EPA, WAWA, industry and Meenaar Park Management to check for any leakage into the groundwater. Should any impact occur on the groundwater, the industry operating the pond will be required to establish a recovery programme acceptable to the EPA, WAWA and the park management.

Odour:

The normal source of smell is from anaerobic digestion ponds associated with agricultural processing where liquid has a high Biological Oxygen Demand (BOD) level. Odour is largely related to overloading of the pond with BOD causing a release of hydrogen sulphide.

In order to ensure that this type of smell is not generated within the park, the park management will ensure that all waste water treatment systems with the potential to smell are managed in a manner which makes the generation of smell unlikely. If problems with odour do arise, park management would ensure that remedial action was undertaken to eliminate the problem.

Irrigation:

The option exists for disposal of suitable waste water by irrigation. Such a disposal option would have to clearly show that no build-up of potential pollutants was occurring due to irrigation and that there was no effect on surrounding groundwater or soil salinity. This would be managed by:

- monitoring of specified elements in crops and soil;
- cropping and ultimate export from the area;
- rotation of area under irrigation.

Other Industrial Liquid Waste:

Liquid wastes that are not suitable for disposal to on site evaporation ponds or can not be treated on site to produce such a waste, may be transported off site for disposal at a facility such as the Perth Industrial Waste Treatment Facility at Forrestdale. This plant treats liquid wastes, delivered to the plant by road transport, to such a quality that it can be disposed of to a sewer. The discharge quality criteria is controlled by the Water Authority. Types of wastes accepted by Forrestdale are:

- paints and resins
- oils and emulsions
- other organic chemicals
- acids and alkalis
- neutral salts
- inorganic chemicals.

Consequently the disposal of these types of waste will not cause a problem for industries on the Meenaar site.

7.5 Solid Waste Disposal

There are various options for the disposal of solid waste from the Meenaar Industrial Park. These are most appropriately categorised according to the type of waste being considered. Each industrial proposal will have to demonstrate an appropriate waste handling and management process to the satisfaction of the relevant authorities.

Recycling:

As the number of industries on the site increase the potential arises for reuse of process waste between industries. However, the recycling of process wastes must be economically viable to the industries involved.

Non-Hazardous Waste:

A range of solid non-hazardous waste is expected to be generated within the industrial park:

- non-putrescible waste such as:
  - building construction debris
  - spent processing wastes, dusts and filtrates.
- putrescible wastes such as:
  - domestic food wastes
  - biological wastes.

Non-putrescible wastes would generally be suitable for disposal in local sanitary landfill, but some processing wastes, dusts and filtrates may not be appropriate for this type of disposal. Alternative disposal techniques such as disposal in lined landfill or removal from site to more appropriate industrial landfills will be required in such cases.

The major problem associated with putrescible wastes is odour. This will be controlled by removing such wastes on a regular basis for disposal to landfill.

The initial industry expected to establish in the park, Ashton Mining's rare earth plant, is proposing to take solid residues to the mine site at Mount Weld, east of Laverton.

Disposal methods for other industries will be dictated by the nature of the solid waste. It is the intention of the proponent to work in conjunction with the Meenaar Park Management Board, the Avon Community Development Foundation and the Local Shires to locate a site suitable for disposal of solid industrial waste, in accordance with the requirements of the relevant Government agencies. This programme will be initiated immediately environmental approval for the site has been received.

Hazardous Wastes:

Any hazardous waste generated on the sites would be transported to Mount Walton for disposal at the Government's secure storage site, or to alternative sites acceptable to the Environmental Protection Authority.

7.6 Methods of Stormwater Drainage and Erosion Control

Some sections of the drainage in the York surface on the south of the site already suffer from water erosion, the sides of the natural waterways being bared and gullied. These eroded areas will be rehabilitated and they will be excluded from site development.

The drainage system for the site has been described in Section 5.5. Increased plant coverage in buffer zones and landscaped areas will further reduce the potential for erosion. Should erosion occur areas will be rehabilitated as for areas eroded prior to development.

7.7 Groundwater Impacts

Industrial development in the study area could affect groundwater due to:

- reduced evapo-transpiration losses following removal of vegetation
- enhanced aquifer recharge from roofed and paved areas with higher run-off coefficients than cleared land
- enhanced recharge as a result of loss from scheme water reticulation system

. extraction of groundwater.

These potential effects will be addressed by:

. Wherever possible natural vegetation will be left as part of the parkland setting of the site. This will be augmented by planting of buffer zones and drainage cutaways so that the vegetation on site will be significantly enhanced.

. Industrial sites will be designed to collect run off and drainage from all roofed and paved areas. Water collected in this manner can then be used to augment plant water supply or be disposed of to evaporation ponds.

. This type of on site drainage catchment will also ensure that there is no recharge from the sites due to loss of scheme water.

. It is considered unlikely that any of the industries proposed for the site would use groundwater due to the level of salinity. Consequently no drawdown through usage of groundwater is expected.

7.8 Impact on Conservation Values on the Site

The major conservation value of the site is the 80 hectare patch of natural vegetation which is to be retained and augmented by addition of buffer zones (Fig. 14).

Land selected for industrial development is cleared agricultural land with poor yield, the groundwater is saline and the soils and climate are appropriate for establishment of evaporation ponds. Consequently this sector of the land had little conservation value and so the potential for impacts is very small provided good management practices are set in place.

7.9 Effects on the Transport Systems

The Great Eastern Highway provides the Meenaar Park with ready access to Northam, Perth and the Goldfields. Traffic volume recorded by the Main Roads Department at a site located 2.5 km east of Northam in 1990-91 was 1565 vehicles per day. Of these 65% (1017) were cars and station wagons, 23% (360) were utilities or light trucks, 8% (125) were heavy trucks and 4% (63) were semi-trailers.

During 1990-91 the average daily traffic flow varied from 954 in October to 1800 in September, December and March.

Predicted Traffic Movements:

Estimates of traffic volumes have been calculated by assuming that each employee working at Meenaar leads to two traffic movements per day. It is recognised that car pooling will occur and that the results will therefore represent the upper limit.

Predictions of the direction of traffic flow have been made based on the assumption that:

- all employee traffic enters via the main entry road;
- 80% of traffic movements originate from west of Meenaar (Grass Valley, Northam) and 20% from the east (Meckering).

At the operating peak the Meenaar Industrial Park is estimated to employ 700 people (BHP Report). This will result in a maximum of 1120 vehicle movements to the west and 280 to the east.

Construction levels are not expected to exceed the 120 predicted by Ashton Mining Limited and as such will not have a major effect on traffic flow.

Heavy traffic is more difficult to estimate until the types of industry are known. Large bulk cargoes would normally be delivered by rail and items such as spares, stores, chemicals, LPG etc. would be delivered by road. Assuming industries average 50,000 tpa in consumption of items delivered by road, this would represent 8 trucks per day (using an average load of 25 tonnes, i.e. a mixture of 20 and 40 tonne loads). Consequently over 20 industries can be established before the current level of heavy traffic is doubled.

The majority of items delivered by road would be sourced from Perth and hence would, on the current road system, pass through Northam. However, once the Northam by-pass is established (scheduled for completion by 1997, depending on funding), heavy traffic from Perth to Meenaar will no longer pass through the centre of Northam.

The existing design capacity of the Great Eastern Highway between Northam and Meenaar is capable of carrying a traffic volume in excess of 5,000 annual average daily traffic. On this basis the estimated increase in traffic associated with the Meenaar Industrial Park can be easily incorporated within the current system.

Transport of Chemicals and LPG:

The transportation of chemicals and LPG is controlled by the Dangerous Goods (Road Transport) Regulations 1983.

Traffic Noise:

The routes to Meenaar from both east and west are along the Great Eastern Highway and therefore the gradual increase in traffic associated with development of the industrial park is unlikely to lead to a major environmental impact due to noise.

The eventual installation of the Northam by-pass will reduce noise impact in the town of Northam.

7.10 Effects on Existing Contingency Planning, Safety and Emergency Services

As the industrial park is new there is no current contingency plan. Development of such a plan will be the responsibility of the Management Board in conjunction with the local safety and emergency services.

8. SOCIAL IMPACT ASSESSMENT

8.1. Regional Setting

The study area is located in the central west region which extends from the coast north of Perth to the heart of Western Australia's wheatbelt.

Northam (population 7,000) is an important centre providing administrative and commercial services to the region's eastern section with which this CER is concerned.

The growth of tourism and increasing demand for land close to Perth for intensive farming and hobby farms, have lead to growth in the population and economics of Shires on the west coast and in the Avon Valley. In the traditional agricultural areas, however, changing technology and the recent rural recession have caused a decline in some populations.

8.2 Study Area

The study area comprises the eleven municipalities within 50 minutes drive or 80 km of the proposed park. 50 minutes has been deemed the maximum distance for commuting distance to the site, based on the experience of the town of Tupelo in Lee County, Mississippi. The study area then comprises the municipalities of Northam Town, Northam Shire, York, Beverley, Quairading, Tammin, Cunderdin, Toodyay, Goomalling, Dowerin and Wyalkatchem (Fig. 8). These municipalities are also the members of the Avon Community Development Foundation, the community-based organisation that identified the site for the proposed industrial park.

It is anticipated that most local employment will come from those municipalities closest to the site, and that any incoming population would locate in municipalities closest to the site. However, it is not unlikely that farmers for example might be prepared to commute from outlying municipalities to work at the Meenaar site. The wider catchment area has been included in the demographic analysis to incorporate locals who might work at the proposed Industrial Park although the area of impact is expected to be concentrated on the municipalities closest to the site - Northam Town, Northam Shire, York, Goomalling and Cunderdin. In addition, the community of Grass Valley, nearest to the site, has been the subject of more detailed study, due to its proximity to the site.

8.3 Population

Population Estimates

The following table shows the Australian Bureau of Statistics' population estimates for each municipality forming part of the study area. The information for the municipalities located nearest to the site have been typed in bold for ease of identification.

It can be determined from this table that a general decline in population has been taking place over the last decade from a total of 24,739 in 1961, to a total of 22,256 in 1991. This decline in population can be seen as a reflection of the rural downturn. It can also be seen that while in 1960 Northam had a population of 7,200, its population estimate for 1991 was 7,059 - a minor increase over the space of thirty years. Other towns such as Goomalling in 1961 had enough social infrastructure to support a population of 1567 while in 1991 recorded a population estimate of only 1,152.

TABLE

Population Estimates by Local Government Area for the Avon Region 1961-1991

	1961	1966	1971	1976	1991	1986	1991
Beverley	1899	1773	1628	1579	1520	1502	1516
Cunderdin	**2014**	**2114**	**1752**	**1587**	**1558**	**1484**	**1437**
Dowerin	1392	1300	1071	1082	936	961	938
Goomalling	**1567**	**1567**	**1444**	**1257**	**1217**	**1206**	**1152**
Northam (S)	**793**	**2694**	**2426**	**2547**	**2598**	**2451**	**2767**
Northam (T)	**7200**	**7400**	**7117**	**6866**	**6791**	**6887**	**7059**
Quairading	1789	1687	1652	1471	1271	1243	1257
Tammin	847	828	777	631	555	550	514
Toodyay	1369	1388	1725	1140	1396	1831	2412
Wyalkatchem	1383	1252	1113	1008	871	786	712
York	**2486**	**2277**	**2044**	**1909**	**2108**	**2258**	**2492**
Total	**24739**	**24280**	**22749**	**21077**	**20821**	**21159**	**22256**

Source: Australian Bureau of Statistics

Population Projection

The Department of State Development's Regional Services branch has provided the following population projections based on the average annual growth rate of each municipality in the study area. The highest estimate for the area for the year 2001 was 31,376, the medium estimate is 26,879 and the lowest was 23,655.

Population Projections to the year 2001 for the study area (Beverley, Cunderdin, Dowerin, Goomalling, Northam (S), Northam (T), Quairading, Tammin, Toodyay, Wyalkatchem and York) are shown in Fig. 15.

The 1991 population estimate for the study area is 22,256, the 2001 estimate (median) is 26,879, an increase of only 4,623 people over ten years or 1.7% per annum. It is unlikely that the industrial park would be developed to its full potential in only 10 years, but assuming it did employ a workforce of between 550-700 people by then, only a minimal increase to the region's population projections could be expected. If 80% of the estimated 700 people are employed locally, then the incoming workforce would only amount to about 140 people at capacity. Since some towns in the region have been experiencing a decline in population, e.g. Goomalling, there is enough existing infrastructure to support a small population increase.

Any incoming population associated with the workforce of the industrial park then would only contribute to the halting of the rural decline, rather than put pressure on existing services and facilities. Any local jobs that are created through the industrial development are expected to arrest rural decline in the area, by encouraging people to stay in the region.

8.4 Employment Characteristics

Labour Force

The following table shows major occupations as a per cent of total workforce for each local government area in the wider catchment area. The high incidence of managers and administrators can be interpreted as a reflection of the many self-employed workers in the region and the high number of public servants. Other features of the workforce are a slightly lower proportion of tradespeople, than the Perth statistical division and comparatively low proportion of professionals. (BHP Report.)

Occupation of Workforce within Catchment of Meenaar Industrial Park, 1986 Census

	Managers & Admins %	Professionals %	Tradespersons %	Plant and Machinists %	Labourers %
Northam (T)	**7.8**	**7.8**	**16.7**	**13.0**	**19.1**
Northam (S)	**31.9**	**7.3**	**13.3**	**8.3**	**17.5**
York	**34.8**	**7.0**	**15.1**	**6.2**	**13.7**
Beverley	29.8	3.9	10.2	17.6	22.1
Quairading	47.7	3.3	8.3	7.2	12.5
Tammin	59.4	1.6	6.0	7.2	15.1
Cunderdin	**43.9**	**6.3**	**9.6**	**6.7**	**14.5**
Toodyay	27.8	7.4	13.1	10.8	14.0
Goomalling	**50.0**	**3.0**	**10.0**	**5.7**	**13.2**
Dowerin	59.8	2.7	4.9	5.8	11.1
Wyalkatchem	46.7	5.8	8.1	6.3	13.2
Perth Stat.	8.8	12.2	16.0	6.5	13.8
Western Aust.	12.1	10.8	15.9	7.8	14.8

Source ABS: BHP Preliminary Study

Employment

The following table is a summary of selected population and labour force statistics for the 11 local government areas in 1986.

Selected Statistics for Local Government Areas within Catchment of Meenaar Industrial Park, 1986 Census

	Res Pop.	Employed	Unemployed Labour Force	Total
Northam (T)	**6634**	**1592**	**141**	**1733**
Northam (S)	**2366**	**601**	**83**	**684**
York	**2180**	**533**	**73**	**606**
Beverley	1453	403	35	438
Quairading	1182	329	33	362
Tammin	534	156	13	169
Cunderdin	**1433**	**413**	**28**	**441**
Toodyay	1772	437	52	489
Goomalling	**1169**	**327**	**23**	**350**
Dowerin	935	267	11	278
Wyalkatchem	759	244	18	26
Total	**18287**	**5302**	**510**	**512**

Source ABS: BHP Preliminary Report

The table shows that the population of the eleven local government areas was 18,287, with a total labour force of 5,812. Although these are 1986 census figures, the labour force itself is not expected to have changed markedly due to the overall stability of the region.

The estimated workforce at the Meenaar Industrial Park of 550-700 persons represents approximately ten to twelve per cent of the existing workforce (1986). Considering that the park would take several if not many years to reach its ultimate capacity and would, to some extent, induce local population and workforce growth, the district should have no difficulty in supplying a permanent workforce in terms of total numbers. (BHP Report.)

Unemployment/Under Employment

In order to more accurately gauge the potential for local employment from the proposed industrial park, the Northam CES Office has provided an analysis of the current unemployment situation in the region, using the 80 km/50 minute driving distance criteria as a basis for the catchment area.

- There are approximately 1,000 persons currently unemployed within reasonable daily travelling distance of the proposed Meenaar Industrial Park.

- The skills of the unemployed fall approximately into the following occupational groups:

. Managerial and Administrative	0.7%
. Professional and Related Occupations	1.7%
. Artistic, Literary and Sporting	0.2%
. Clerical, Sales and Service	30.0%
. Primary Production	20.0%
. Manufacturing and Construction	20.0%
. Materials and Transport Handling	8.0%
. Basic Manual	15.0%
. Other	4.4%

- There is also an unknown number of discouraged workers (i.e. would like a job but have not bothered to register) who are mostly females performing home duties, the semi-retired, and students who are at school rather than being unemployed.

- Should training be required to fill any jobs, the current policy is that JOBTRAIN money would be made available to give the appropriate training to the eligible unemployed (approximately half of the total unemployed would be eligible for training). Wage subsidies to specific employers for on-the-job training under JOBSTART may also be available.

With the above in mind, it is believed that it will be feasible to fill the majority of new jobs that become available as a result of the development of the Meenaar Industrial Park. There will of course be some specific skill shortages associated with industry, but it is anticipated that people with these skills can be attracted to the area without too much difficulty as it is well serviced and an attractive place to live.

8.5 Social Infrastructure

Education

- **TAFE**

Technical and further education has a major role in the region, with a 1992 enrolment figure of approximately 2,000. Of this enrolment figure, about 150 students are enrolled full-time on campus.

The Northam TAFE centre runs full-time courses in basic industrial skills, business study programmes, office and secretarial studies, and community skills programmes.

The TAFE extension service runs short vocational training courses and there is a large demand for community Adult Education courses as well as a number of part-time certificate courses.

The regional TAFE campus plans to introduce the picture-tel system which is linked to other programmes in education centres at Midland and Curtin University in 1993.

The capacity to provide flexible training programmes to the workforces of new industries locating in the region then is great and it is anticipated that TAFE will be able to provide courses that suit the skill requirements of industries that may locate at the proposed Meenaar Industrial Park. Physical capacity is limited at present, but is expected to be able to meet the bulk of the foreseeable future requirements (Personal communication, Northam TAFE).

. **Primary and Secondary Education**

Educational facilities in the region consist of:

- numerous pre-primary schools;
- primary schools at Avondale, Bakers Hill, Meckering, Northam, York, West Northam and Wundowie;
- district high schools at York and Cunderdin;
- Northam Senior High School;

The Ministry of Education has indicated that most of the schools in the study area would be able to take quite an increase in numbers without requiring more permanent facilities.

. **Other Educational Facilities:**

- Cunderdin Agricultural College and the Muresk Institute of Agriculture provide tertiary education services to the region.

. **Health**

Most of the municipalities in the region have sufficient infrastructure to cater for any foreseeable population increases, partly because the rural decline has left many towns in the position where they have an over-supply of infrastructure to meet the needs of their current population. Extra staff may be required to cater for natural population increases, but it is not expected that more infrastructure will be required in the near future.

. A new regional hospital is being planned to cater for the current needs of the area. Although current needs reflect an ageing and declining population, the tender for the design of the new hospital will include a flexible model to enable easy addition of further facilities for acute care if required. Any pressure placed on hospital services in the Northam area will be catered for in the design of the new regional hospital (Personal communication, Regional Health Services, Northam).

. **Accommodation**

Additional land for new housing has been catered for in Northam by the creation of a number of subdivisions. According to the Northam Town

Council there are 328 lots of vacant residential land, a number of rural residential lots and 43 Special residential lots which have been given final approval for sub-division with a further 79 lots that are correctly zoned and awaiting final subdivisional approval. In addition there is a further development subject to rezoning and subdivision which will provide a further 78 lots creating a total of over 500 lots in Northam alone.

There is a high local demand for such land from existing residents, creating vacant dwellings. It can be seen from the above information that there is ample land available for a small number of incoming workers.

8.7 Tourism

Although the central west region attracts many tourists along the western border by the sea, the Avon sub-region with which this study is concerned has tourist potential of its own.

In particular, the historic towns of York and Toodyay have buildings of architectural interest.

Several events attracting tourists to the area are held during the year: the Dowerin Field Day, the York Fair and Flying 50 Road Race, the Toodyay Folk Festival and the Avon Descent. Other specific attractions are the York Motor Museum, the Beverley Aeronautical Museum, Balladong Farm at York, the Museum at Cunderdin and hot-air ballooning at Northam.

It is evident from the above list of tourist attractions to the area that the tourist industry is not dependent on "scenic" surroundings. Thus, although the project area will be visible from the roadside, this is not expected to have a negative impact on the tourism industry.

8.8 Transport

The major transport route to and from the site is the Great Eastern Highway which currently passes through the town of Northam. According to figures provided by the Main Roads Department, the annual average daily traffic flow of traffic on Great Eastern Highway at a site 2.5 km east of Northam, during 1990-91 was 1565 vehicles annual average daily traffic.

Vehicle Type	Daily Number	% of Total
Cars & Station Wagons	1017	65%
Utilities & Light Trucks	360	23%
Heavy Trucks	125	8%
Semi Trailers	63	4%
	1565	100%

The flow of heavy traffic along the highway is expected to increase as the industrial site develops, but not at a rate that will significantly impact on the road usage in the short term (Section 7.9).

The Main Roads Department has plans for a by-pass of the Northam town site. Depending on the availability of funding and other government processes, construction of the by-pass could begin as early as 1994-95. Construction of this by-pass will alleviate the added pressure of through traffic on Northam townsite that might result from the development of the Industrial Park.

8.9 Nearest Neighbours

Nuisance Effects

Seven nearest neighbours were identified as being potentially impacted by the development of the industrial park. The nearest neighbours were identified as such if they owned land adjoining the site, or lived in residences less than two kilometres from the proposed industrial area.

Without substantial knowledge of what industries will locate at the Meenaar Park, it is difficult to predict what nuisance effects may result. Each new project will need to assess nuisance effects on nearest neighbours as they locate at the site. Common nuisance effects are noise, dust, lights at night and odour. It is anticipated that the industries nominated as likely to locate at the park will not produce unacceptable levels of any of the effects named above.

The two neighbours nearest to the park boundary are only half a kilometre distant, however one homestead is situated behind the outcrop of remnant vegetation that will be retained and maintained as a buffer zone. Thus, this homestead is actually located between 1½-2 km from the nearest industry site, with undulating bushland in between. The buffer zone is expected to ameliorate any potential nuisance effects from the industry site.

The other nearest neighbour is situated on the highway opposite the site. The homestead is approximately ½ km distant from the boundary of the park and the nearest industry, which will be the Ashton rare earths processing plant. Nuisance effects are not expected to impact on the residents as the homestead is separated from the nearest industry by the Great Eastern Highway. The park will be visible from the homestead which may disturb the rural atmosphere enjoyed by its residents, however this is already significantly diminished by the presence of the Great Eastern Highway, so it could be argued that an industrial park will only add to existing disturbance, not create a new problem.

Other nearest neighbours are unlikely to be exposed to nuisance effects from the industrial park because of their distance from the park and the planting of trees to act as a screen in the buffer zone.

Compatibility with Goals and Objectives

Five of the neighbours interviewed were long term residents in the area with family histories dating back to the 1800s and early 1900s.

The land has been used for farming purposes since European settlement and all five farmers articulated plans for continued farming or expansion. Not unexpectedly, the farmers held expectations of passing their land on to future generations. Tree planting programmes were being carried out by all of the farm owners interviewed in an effort to maintain and improve the land's long term farming potential.

The need for industry and the expectation of jobs for the local community were identified by all of the farmers interviewed. One farmer objected outright to the development of the park and the other four indicated that it would be acceptable, provided the appropriate environmental safeguards were put in place, and that the nominated industries were not changed at a later date.

The rural atmosphere of the area is likely to be disturbed by the presence of an industrial park since industry is not usually compatible with rural lifestyle. However, the significance of the impact of the Industrial Park on the rural atmosphere is expected to be reduced by the location of the workforce away from the park.

The owners of two smaller holdings are located near to the park. Future plans for the owners of these hobby farms were for organically grown farm produce, including the export of chemical-free wool to Europe.

Property Values

Of the seven nearest neighbours to the project site, five are family owned farm businesses with a large farming area that is either adjacent to or very near the site boundary. The homesteads are a significant distance from the Industrial Park boundary and are therefore not expected to experience any nuisance effects from the Park. Since no workforce is expected to locate at or near the site, the rural atmosphere will largely be protected. The property values of the large farms then are not expected to be impacted by the proposed industrial park. For the two nearest neighbours who own small parcels of land directly opposite the site however, the proximity of the site could make the properties difficult to sell.

Groundwater

It is not anticipated that groundwater will be affected by the development of the proposed Industrial Park. This is discussed in more detail in section 6.3.

8.10 Grass Valley

Grass Valley is a small community located approximately 2 km from the Industrial Park boundary (Town boundary to Park boundary).

Originally an agricultural centre based around the railway siding, the community is now a dormitory suburb of Northam with a large portion of its residents commuting to Northam to work.

The Grass Valley Tavern is the only business in the township, providing a focus for local farmers and community residents.

Both the Grass Valley Progress Association and the Northam Shire Council estimate the township's population to be between 70 and 100 people. There are about 30 garbage services to the township which confirms the Progress Association estimate of about 30 houses in the community.

From discussions with the Grass Valley Progress Association, it appears that the majority of Grass Valley residents have moved to the township as a lifestyle choice.

The land is generally cheaper to buy than land near one of the major centres such as Northam, and a township like Grass Valley offers a unique opportunity to enjoy a rural lifestyle, without investing in a large property.

Grass Valley is generally described as a community-spirited and close-knit community (Grass Valley Progress Association, Northam Shire, State Development Regional Office). A significant increase in population could be expected to impact upon the community cohesion of the township as it would be difficult to integrate a large number of people into such a small community.

Development of the proposed Meenaar Industrial Park is not expected to significantly impact on the Grass Valley community. Although Grass Valley is very close to the proposed industrial park, it is not considered likely that a significant number of any incoming workforce would locate there, since the larger towns such as Northam and York are within convenient driving distance, and the Grass Valley township has little to offer in terms of services and facilities.

However, it is possible that some relocation to the Grass Valley township may result from the development of the Park. According to the Northam Shire there are about 15-25 serviced blocks that may become available if demand for land in the area significantly increased. As well as these lots, there are a number of 2 ha lots just outside the townships that are serviced with electricity and water that could be sub-divided at a later date if necessary.

While the development of the proposed Meenaar Industrial Park may increase the number of visitors to the town and the amount of through traffic the township is expected to continue developing at a consistent rate and any small increase in population is not expected to impact on community cohesion.

It is anticipated that a representative from Grass Valley will be selected for the management committee to ensure that the lifestyle of Grass Valley residents is protected.

8.11 Compatibility with Community Goals and Objectives

A number of strategies were used to gather information about the compatibility of the proposed industrial park with community goals and objectives.

A survey of community attitudes to industry in the area was undertaken in September of 1991. A sample of 250 people from Northam, Bakers Hill, Wundowie, Clackline, Spencer's Brook, Grass Valley, Southern Brook and Meckering were interviewed by telephone.

The following table shows a summary of the benefits and disadvantages identified with the development of new industry in the area.

Benefits of New Industry		Disadvantages of New Industry	
New jobs	81%	Environmental impact/pollution	52%
Flow on employment for existing business	31%	Water pollution	11%
Increased population	29%	Unattractive appearance	9%
More money into community	26%	Too many trucks/traffic	7%
Make region better place to live	12%	Increased population	6%
Better health facilities, schools	8%	Change in lifestyle	4%
Enable children to stay in region	7%	Changed population	4%
Other	9%	Other	20%
No benefits	6%	No disadvantages	27%

The table shows the emphasis placed on employment by the community and community expectation that industry will bring new jobs to the region.

Community leaders were interviewed about the proposed industrial park and representatives from the regional agencies of Government departments were asked to contribute regionally specific information.

Community groups approached were:

. Wheatbelt Aboriginal Corporation - Trevor Bourne/Bob Breyze

. Avon Community Development Foundation - Jim Lee

. Grass Valley Progress Association - Committee

. Max Trenorden, MLA - Member for Avon

Contact was made with the Inkpen Action Group, a local group concerned about industrial development at Inkpen, a site closer to Perth and environmental groups were contacted by telephone.

Both the Wheatbelt Aboriginal Corporation and the Avon Community Development Foundation stated that the creation of local employment was a major objective for their organisations, and the Grass Valley Progress Association viewed a growing community as one of its goals.

All of the representatives spoken to stressed community ownership and community control of the industrial park as an important aspect of the development.

The importance of growth and development in the region is most strongly reflected in the Avon Community Development Foundation which has a membership including the municipalities identified in the study area.

It is likely that the development of the proposed Meenaar Industrial Park is compatible with the goals of employment and development expressed by the community groups interviewed.

8.12 Public Participation

A number of strategies were used to involve local communities in the development of plans for the proposed Meenaar Industrial Park.

The level of knowledge of the project proposal was high, due to a number of press releases and community discussion by the Avon Community Development Foundation prior to the Government's decision to go ahead with the feasibility studies for the project.

Apart from more generalised media reports, the level of knowledge about the project was raised and the opportunity for the community to provide feedback to the project was provided at an open day on 19 February 1992.

Approximately 130 people visited the displays at the open day which was held jointly with the Ashton project. Displays included an aerial photograph of the site, information about the types of industries likely to locate at the site, information about the approvals process, and Ashton's display showing details of rare earths processing.

The following list of issues was developed from comments and questions received at the open day. These issues have been addressed in the body of the CER.

ISSUES RAISED AT PUBLIC OPEN DAY FOR THE PROPOSED MEENAAR INDUSTRIAL PARK

Types of Industries (cement)
Emissions
Nearest Neighbours
Employment Opportunities
Radiation Questions
Transport
Groundwater
Contents of Evaporation Ponds
Use of Buffer Zone and Remnant Bushland
Lights at Night
Water Catchment
Dust on Organic Gardens
Monitoring Arrangement/Policy
Management of Industrial Park (local control?)
Flora and Fauna on Remnant Bushland
Use of Water
Waste Disposal - Residue
Occupational Safety Procedure
Property values in Northam

Along with the open day a two page spread describing the project was distributed in the local newspaper the Avon Advocate.

Structured interviews were conducted with the project's seven nearest neighbours after a project briefing and a summary of the project approvals process.

Interviews were also conducted with regional officers from various government authorities in Northam to gain demographic information and an appreciation of local conditions.

A survey of community attitudes towards industrial development was sponsored by State Development in September 1991 (see Section 8.11) to gauge the acceptability of industry in the region.

Community representatives and community leaders were also interviewed to gauge some understanding of community goals and objectives. The Avon Community Development Foundation was the major source of information for this section of the study.

List of Consulted Groups and Organisations

	Telephone	Personal Contact
Wheatbelt Aboriginal Corporation		X
Avon Community Development Foundation	X	
Grass Valley Progress Association		X
Max Trenorden, MLA, Member for Avon		X
Inkpen Action Group	X	
Department of Community Service, Northam	X	
Commonwealth Employment Service, Northam	X	
Technical & Further Education, Northam	X	
Main Roads Department, Northam	X	
Homeswest, Northam		X
Education Department, Northam	X	
Regional Health, Northam	X	
Shire of Northam		X
Town of Northam		X
Northam Environmental Society	X	
Toodyay Naturalists Club	X	
Northam Land Conservation District C'tee	X	

It is expected that the management committee for the proposed Meenaar Industrial Park will be responsible for ongoing consultation with the community.

8.13 Construction Work Force

Temporary or short term accommodation is provided by a number of motels, hotels, hostels, guesthouses, caravan parks. Excluding youth hostels, Northam alone has about 225 rooms, York 155 and Toodyay 94 (Ashton Mining PER). The annual average occupancy rate for the region is about 43% (Ashton PER).

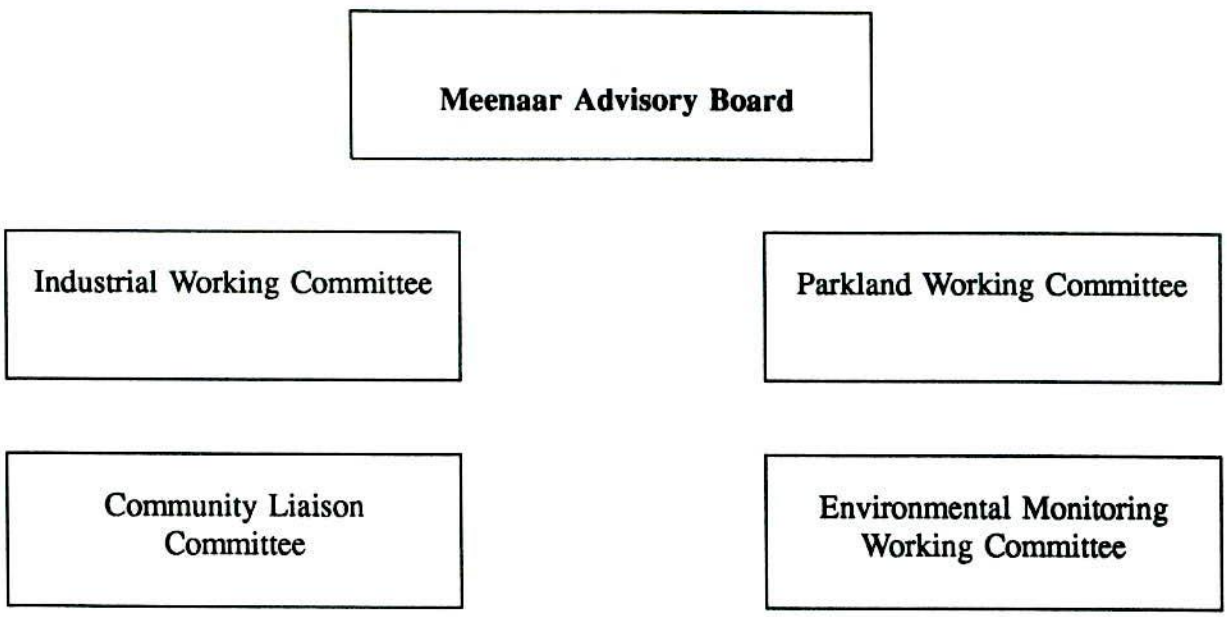
If the Ashton construction workforce of 120 people is used as a basis for average construction workforce numbers then it is unlikely that temporary accommodation in the area would be adversely affected if existing accommodation is used.

It is, however, more likely that construction workforces will locate at an existing caravan park in Northam and commute to the site.

Management and location of construction workforces will be one of the terms of reference of the Meenaar Industrial Park Management Committee.

8.14 Management Committee

It is proposed that a committee will be responsible for the management of the Industrial Park. Based on the structure of the Kemerton Industrial Park Management Committee, it is proposed that the management committee be structured along the lines of the diagram shown below:



It is proposed that the Advisory Board would be made up of representatives from the State Government, the Avon Community Development Foundation and other community representatives (e.g. Grass Valley residents and nearest neighbours).

By ensuring adequate community representation on the management board, the development of the industrial park will remain compatible with community goals and objectives.

Suggested Terms of Reference for the Advisory Board would be similar to those of Kemerton.

The main responsibilities of the Advisory Board will be to:

1. The Advisory Board formulates the overall policy for the Industrial Park.

2. The Advisory Board is charged with the implementation of the Concept Plan.

3. The Advisory Board provides direction to the working committees within the context of the developmental policies for the Industrial Park.

4. The Advisory Board advises the State Government through the Minister for State Development or the Minister for Lands on the development of the Industrial Park.

Within the Terms of Reference it would be expected that issues affecting the development of the Industrial Park would be addressed, e.g.:

- local employment
- buffer zones
- construction workforces
- impact on tourism
- environmental monitoring
- community consultation

8.15 Social Commitments:

1. The proponent will establish a management committee for the Industrial Park made up of representatives from the Avon Community Development Foundation, Government agencies, community representatives (including Grass Valley) and other appropriate agencies (i.e. workers, industry).

2. Ongoing community consultation will be one of the tasks of the management committee.

3. The development of local employment strategies will be one of the tasks of the management committee.

   The committee will also ensure that strategies to encourage local employment from all of the regions are identified.

4. Monitoring of the impact of the Industrial Park property values in the area will be one of the tasks of the management committee.

5. The management committee will ensure environmental and social assessment of industries proposing to locate in the Park.

9.0 MANAGEMENT

9.1 Management of the Industrial Park

To ensure the smooth development of the Park, it is proposed to set up a Management Board. This Board will be called the Meenaar Advisory Board. Responsibilities of the board have been discussed in Section 8.14.

9.2 Responsibility of Site Management for Environmental Management of the Park

As discussed in Section 9.1 the Meenaar Advisory Board will be responsible for the management of the park. Individual industries will be required to obtain environmental approval for projects from the Minister for the Environment, through the environmental assessment process. The individual companies will then be responsible for operating in an environmentally acceptable manner as specified in the environmental conditions set, on the park and on individual industries in the park, by the Minister for the Environment, the Works Approval and Licence issued by the Pollution Control Division of the Environmental Protection Authority and any other licences.

9.3 Mechanism to Pass on Commitments of Approval to the Future Owners and Operators of the Land

When selling land in the Meenaar Industrial Park, Industrial Lands Development Authority will ensure that the purchasers are aware of the commitments made in this document and that these commitments apply to all operations within the park boundaries.

The commitments made in this document prepared as part of the Environmental process will be applied by the EPA in assessing the environmental acceptability of a new proposal.

9.4 Monitoring

In order to assess charges on the site due to industry background data will be developed on:

- groundwater, salinity, nutrients
- air quality
- noise levels

The programmes will be initiated by the Meenaar Industrial Park Board prior to the commencement of industrial operations.

Monitoring programmes will also be established by individual industries as agreed with the responsible authorities (EPA, WAWA). Results of these monitoring programmes will be reported to the relevant authorities with copies to the Park Management Board.

9.5 Procedures in Case of an Unplanned Environmental Impact

Should an unplanned environmental impact occur, the incident will be reported to the EPA and other responsible authorities and remedial action taken by the responsible industry to rectify the impact. Remedial action will be overseen by the Park Board.

Potential unplanned environmental impacts are:

Breakdown in Effluent Disposal System:

Any industry incurring such a breakdown will be required to cease operation until the system is operable or an alternative disposal system acceptable to the EPA has been developed.

Pollution Being Detected Outside the Park:

Should levels of air emissions exceed the parameters laid out in Section 7.2 then the industry responsible for the emission will be required to cease operations until the emission can be brought within acceptable levels.

Underground Leakage:

On-site evaporation or effluent ponds will be monitored by surveillance bores located in positions agreed by the company with the EPA and WAWA.

Should any sign of unacceptable environmental impact due to leakage be detected in the bores the company operating the ponds will be responsible for developing a programme to stop leakage and recover any leachate from the groundwater.

Excessive Soil Erosion on Site:

Should soil erosion occur within the park the areas will be rehabilitated, revegetated with native species, and fenced off until the area has been stabilised.

9.6 Proposed Ecological Improvements for the Site

A general description of the flora and fauna within the park area has been given in Section 6.3.

The following management programme is proposed to maintain and enhance the high quality bushland on the site:

- The uncleared land should remain fenced to prevent domestic grazing stock from affecting the understorey plants. The fence should not preclude movement of kangaroos as their genetic diversity can only be maintained by movement between this bushland and others in the region.

- The protection of the native species in the remnant area by maintaining fencing (to exclude introduced stock and feral animals), controlling weeds (introduced plant species) and by managing fire to reduce the risk of the entire remnant being burnt in one wildfire;

- The dam adjacent to the bushland should be maintained as a watering point for native animals coming out of the bushland to drink. It also provides essential drinking water for all of the parrots and pigeons which need to drink daily. In addition many birds which do not normally drink need access to water during very hot weather. The dam also provides the only habitat on the property for many waterfowl and wading birds. The re-establishment of native sedges and shrubs near the dam should be undertaken to encourage greater utilisation of the artificial wetland by a wider range of species.

- Eroded gullies will be revegetated with local native plants to halt and reverse land degradation in the catchment area. Seeds for germination will be obtained from trees and shrubs growing on the property to ensure that local genetic diversity is retained. This will ensure that native insects flourish to provide food for birds and to act as plant pollinators. These revegetated gullies should be planned to provide corridor links between the bushland on this property and other bushland in the region, particularly the Meenaar Conservation Reserve. This will enable bird and mammal movement through the region;

- The revegetation of corridors along ridges and between outcrops with native plant species will be undertaken to link smaller tree stands with the main area of remnant vegetation.

- A fire management plan will be established for the site to reduce the possibility of wildfire burning out the entire remnant.

- It is not in the best interests of the land use to plant the whole of the sand plain north of the water pipeline to screening vegetation. The Quailing unit is an excellent site for building and road construction. A screen about 50 m wide along the road/railway boundary should be sufficient and will leave a usable area for site development.

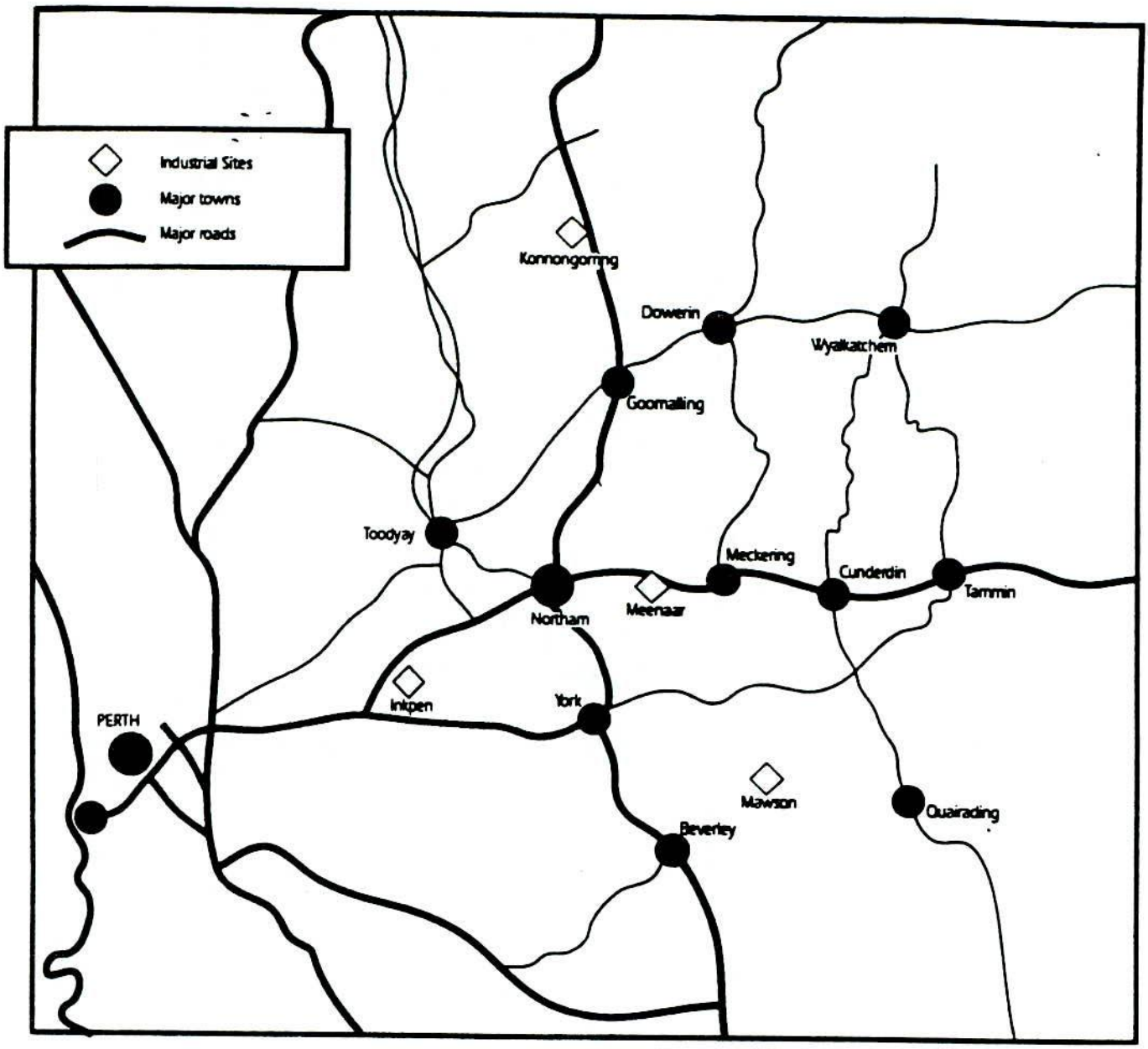
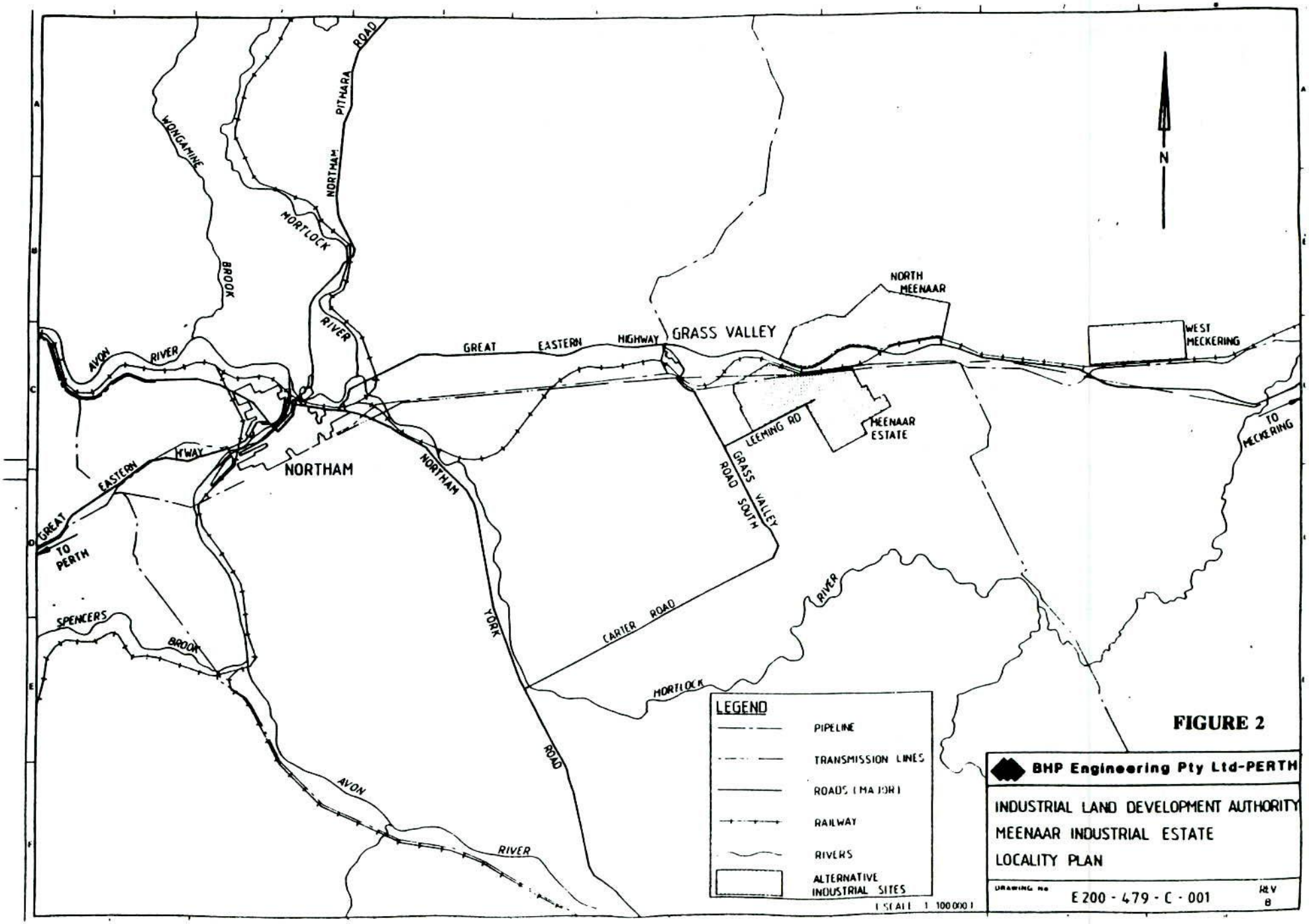


FIGURE 1 Industrial Sites in the Avon Region identified by the Avon Community Development Foundation


WONGAMINE BROOK
NORTHAM PITHARA ROAD
MORTLOCK RIVER
AVON RIVER
GREAT EASTERN HIGHWAY
GRASS VALLEY
NORTH MEENAAR
WEST MECKERING
TO MECKERING
LEEMING RD
MEENAAR ESTATE
GRASS VALLEY ROAD SOUTH
NORTHAM
EASTERN HWAY
GREAT
TO PERTH
NORTHAM YORK ROAD
CARTER ROAD
SPENCERS BROOK
AVON RIVER
MORTLOCK RIVER
N
LEGEND
PIPELINE
TRANSMISSION LINES
ROADS (MAJOR)
RAILWAY
RIVERS
ALTERNATIVE INDUSTRIAL SITES
SCALE 1:100000
FIGURE 2
BHP Engineering Pty Ltd-PERTH
INDUSTRIAL LAND DEVELOPMENT AUTHORITY
MEENAAR INDUSTRIAL ESTATE
LOCALITY PLAN
DRAWING No
E 200 - 479 - C - 001
REV
B

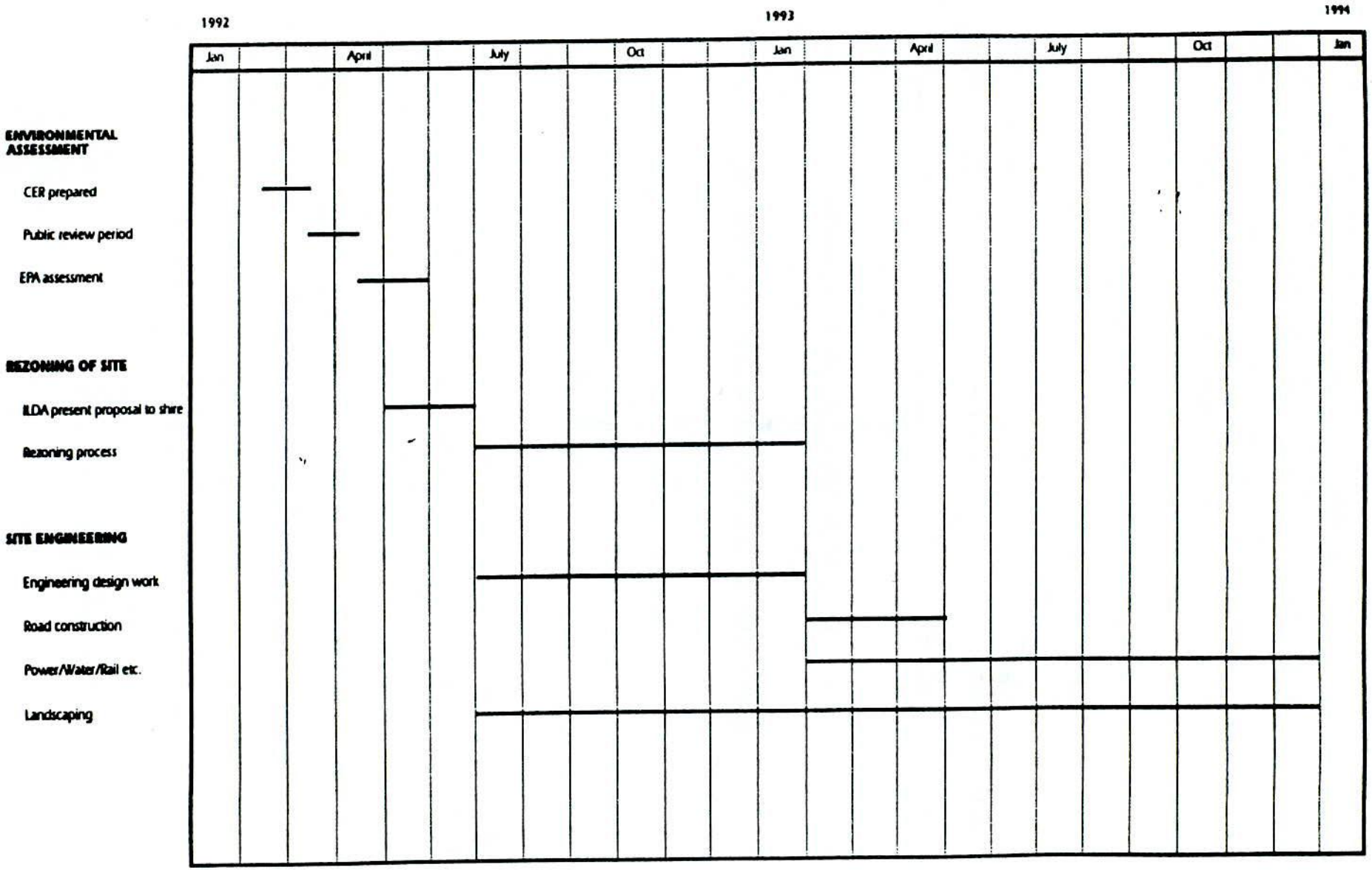


FIGURE 3 Meenaar Industrial Site - Project Timing

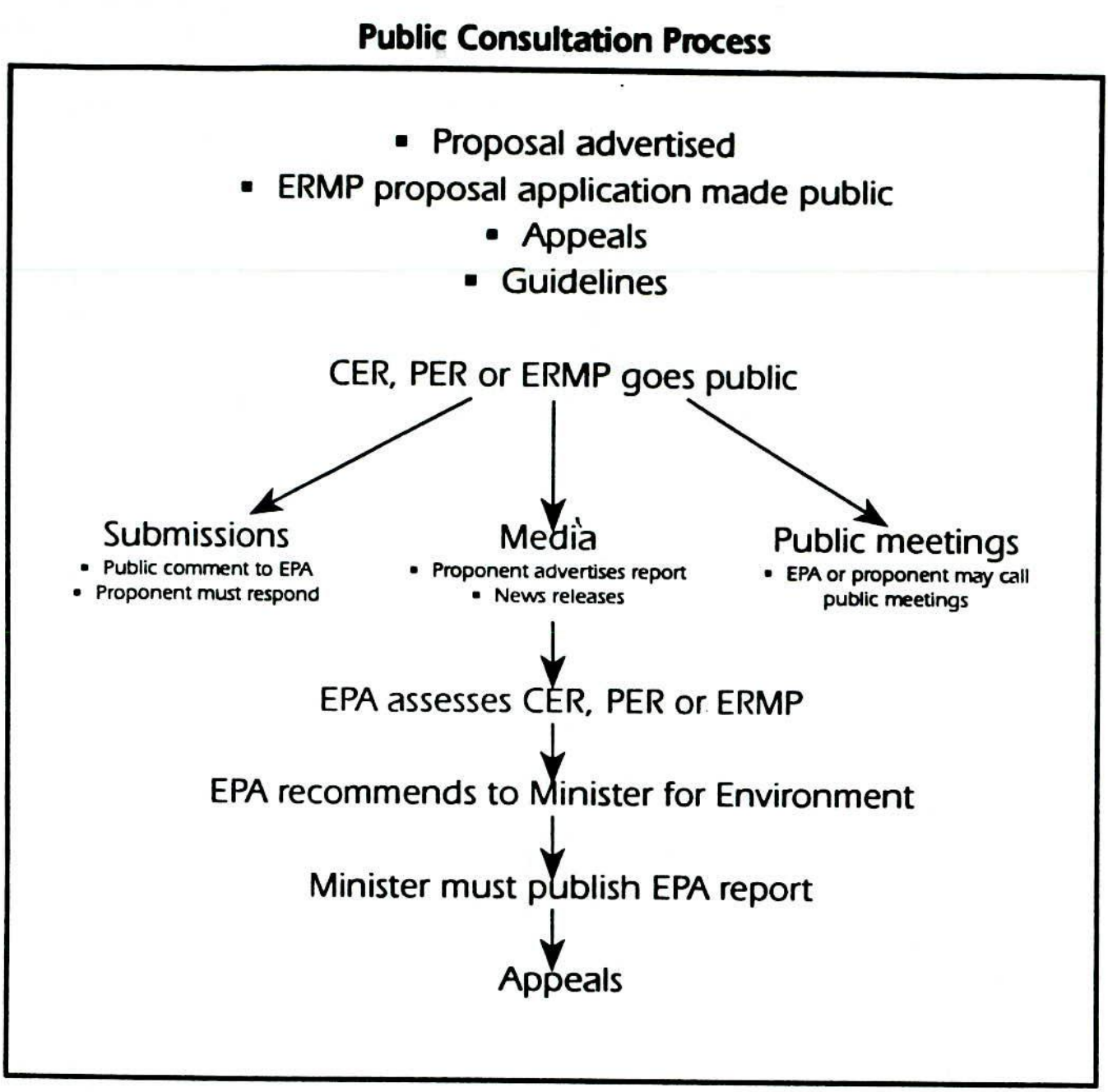


FIGURE 4 Environmental Assessment Process

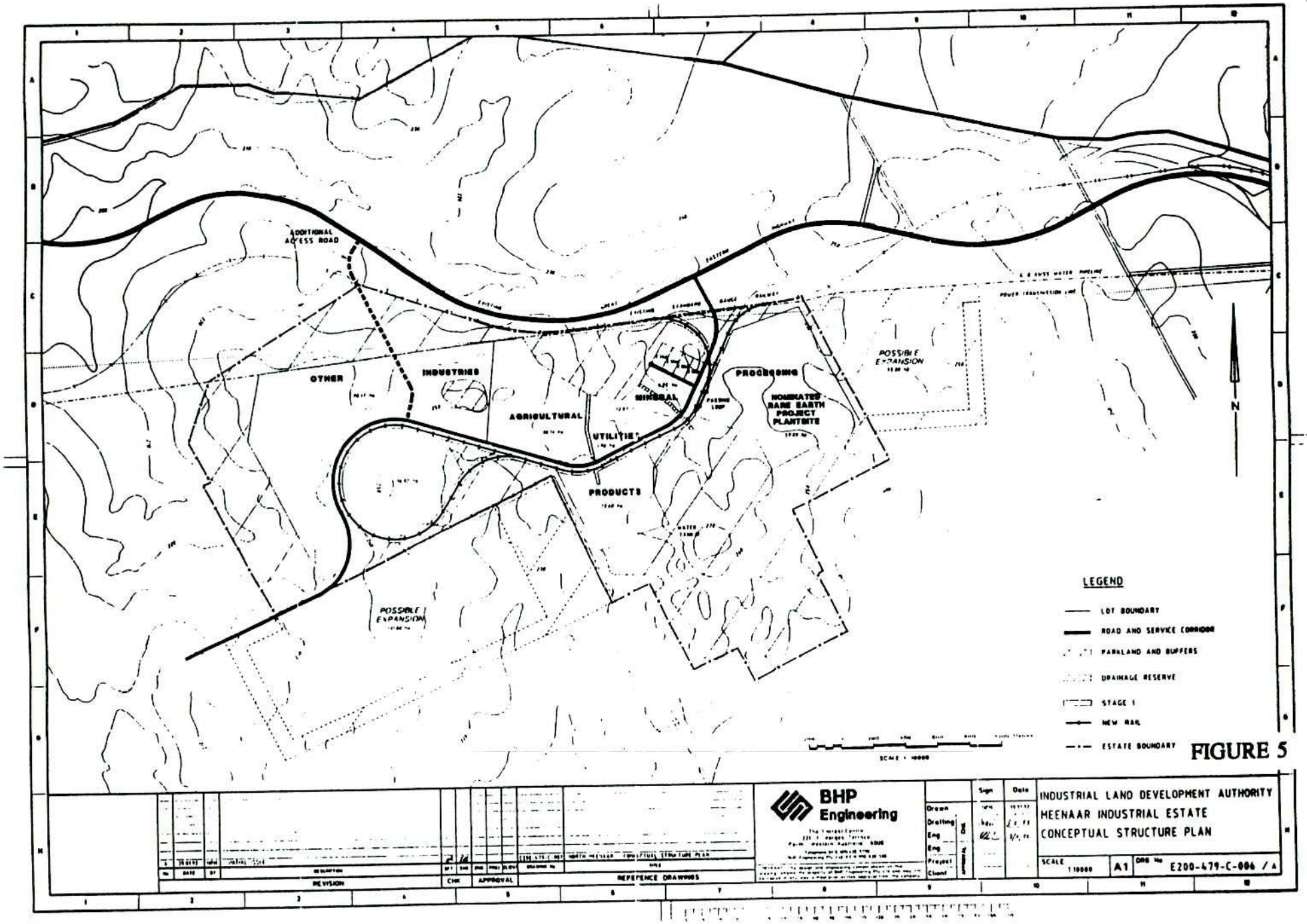

ADDITIONAL ACCESS ROAD
OTHER
INDUSTRIES
AGRICULTURAL
MINERAL
UTILITIES
PROCESSING
NOMINATED RARE EARTH PROJECT PLANTSITE
POSSIBLE EXPANSION
PRODUCTS
POSSIBLE EXPANSION
N
LEGEND
LOT BOUNDARY
ROAD AND SERVICE CORRIDOR
PARKLAND AND BUFFERS
DRAINAGE RESERVE
STAGE 1
NEW RAIL
ESTATE BOUNDARY
SCALE 1:10000
BHP Engineering
INDUSTRIAL LAND DEVELOPMENT AUTHORITY
MEENAAR INDUSTRIAL ESTATE
CONCEPTUAL STRUCTURE PLAN
SCALE 1:10000
A1
DRG No E200-479-C-006 / A
REVISION
APPROVAL
REFERENCE DRAWINGS

FIGURE 5

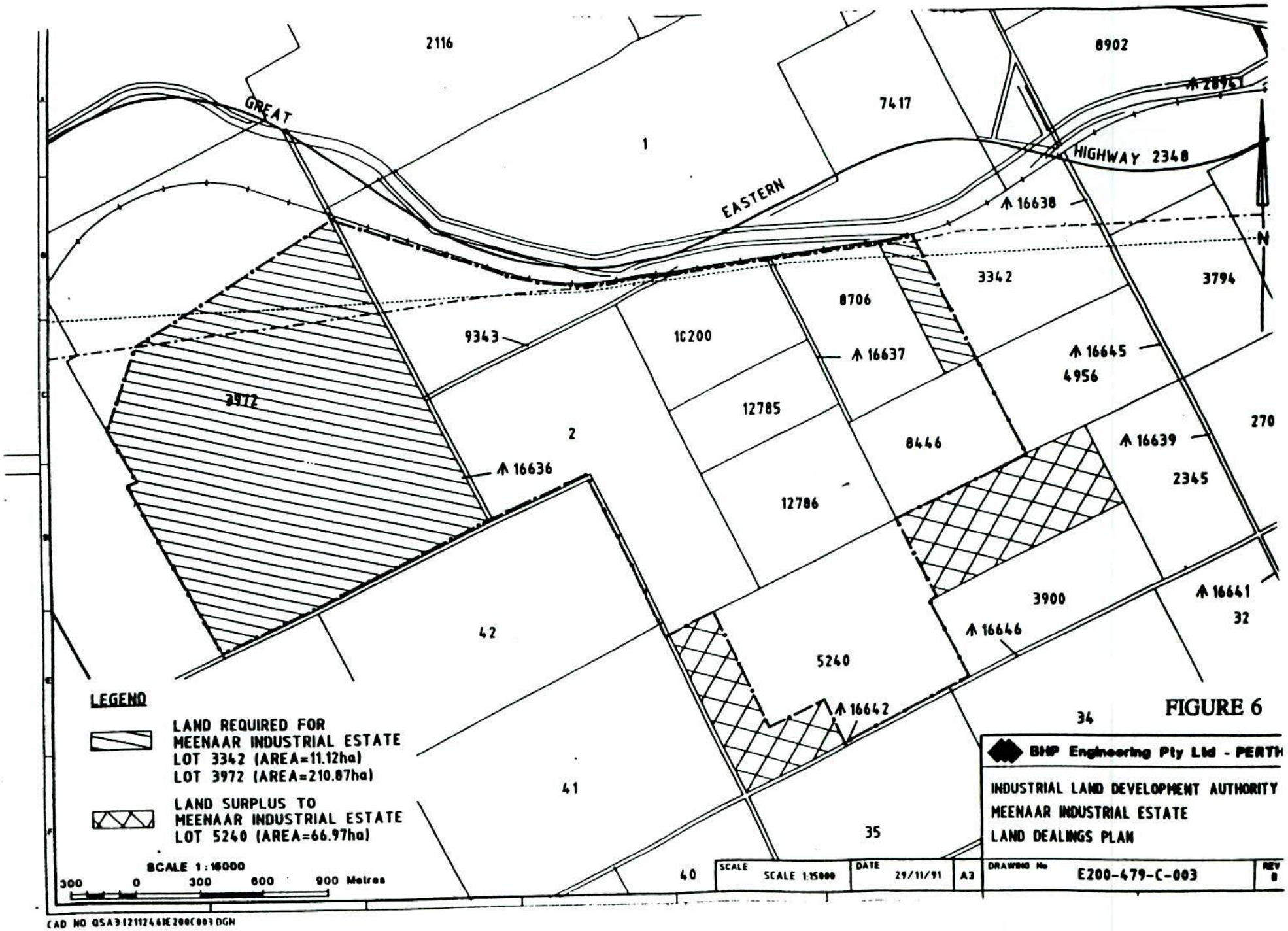
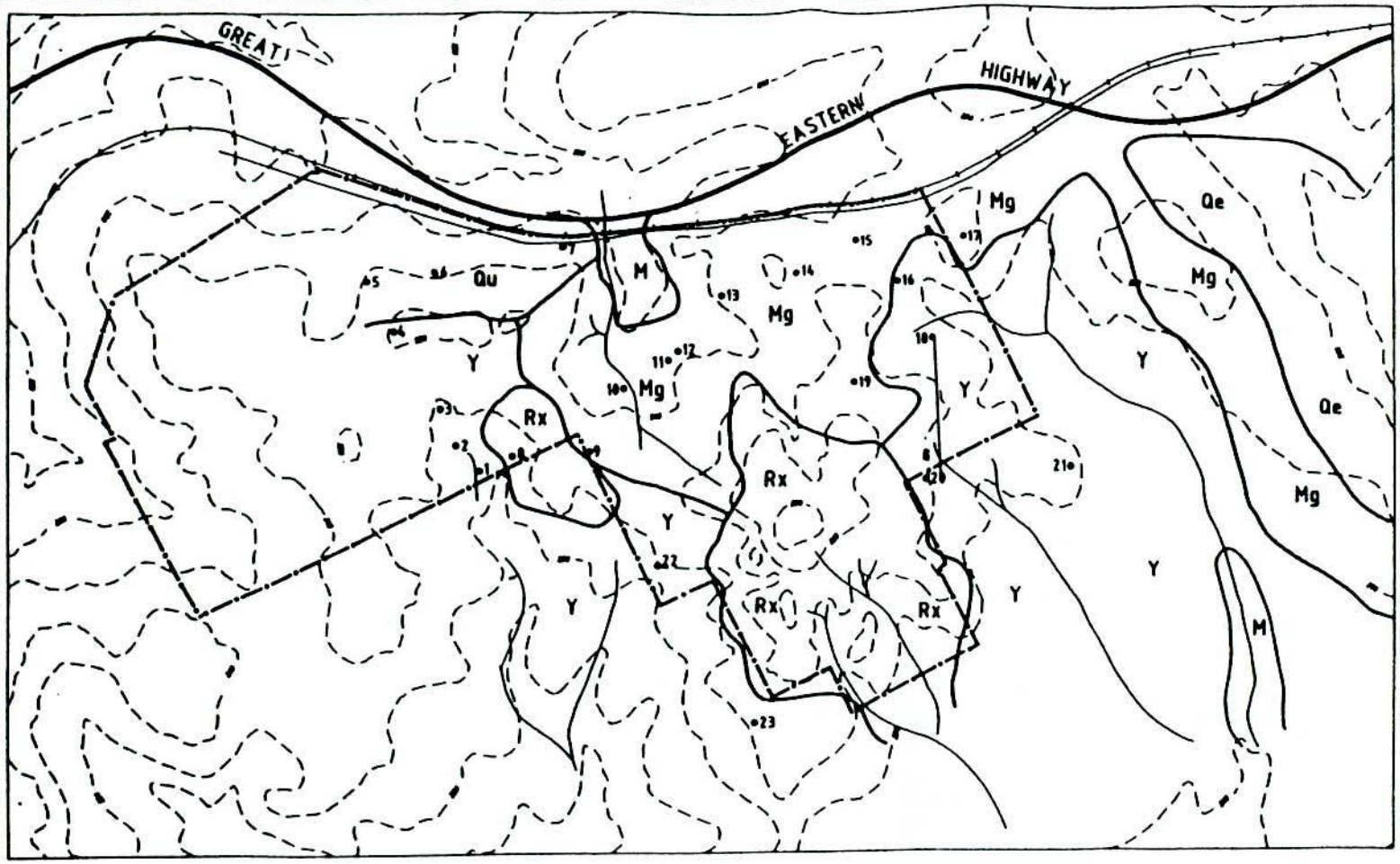

2116
8902
GREAT
EASTERN
HIGHWAY 2348
7417
1
16638
N
3342
3794
8706
9343
10200
16637
16645
4956
3972
12785
2
270
8446
16639
16636
2345
12786
3900
16641
32
16646
42
5240
16642
34
41
35
40
LEGEND
LAND REQUIRED FOR MEENAAR INDUSTRIAL ESTATE
LOT 3342 (AREA=11.12ha)
LOT 3972 (AREA=210.87ha)
LAND SURPLUS TO MEENAAR INDUSTRIAL ESTATE
LOT 5240 (AREA=66.97ha)
SCALE 1:16000
300 0 300 600 900 Metres
BHP Engineering Pty Ltd - PERTH
INDUSTRIAL LAND DEVELOPMENT AUTHORITY
MEENAAR INDUSTRIAL ESTATE
LAND DEALINGS PLAN
SCALE SCALE 1:15000
DATE 29/11/91
A3
DRAWING No E200-479-C-003
REV B
CAD NO QSA3(211246)E200C003.DGN

FIGURE 6



LEGEND

	SYMBOL	SOIL	DESCRIPTION
No. OF OUTCROPS	Qe	QUARLING	EROSIONAL WITH LATERITE
	Qu	QUARLING	SAND PLAINS DEPOSITIONAL
FREQUENT OUTCROPS	Y	YORK	RED & BROWN DUPLEX SOILS
	M	MORTLOCK	DRAINAGE AND ALLUVIALTRACT
	Mg	MABELLING	GREY & GRITTY DUPLEX SOILS
	Rx	ROCKY OUTCROPS	SHALLOW SKELETAL SOILS
	•S		SOIL SAMPLE SITE

EXISTING CONTOURS

SITE BOUNDARY

400 0 400 800 1200 Metres

SCALE 1:20000

FIGURE 7

BHP Engineering Pty Ltd - PERTH

INDUSTRIAL LAND DEVELOPMENT AUTHORITY
MEENAAR INDUSTRIAL ESTATE
SOIL SURFACES AND DRAINAGE PLAN

SCALE	DATE		DRAWING No	REV
SCALE 1:20000	29/11/91	A3	E200-479-C-005	0

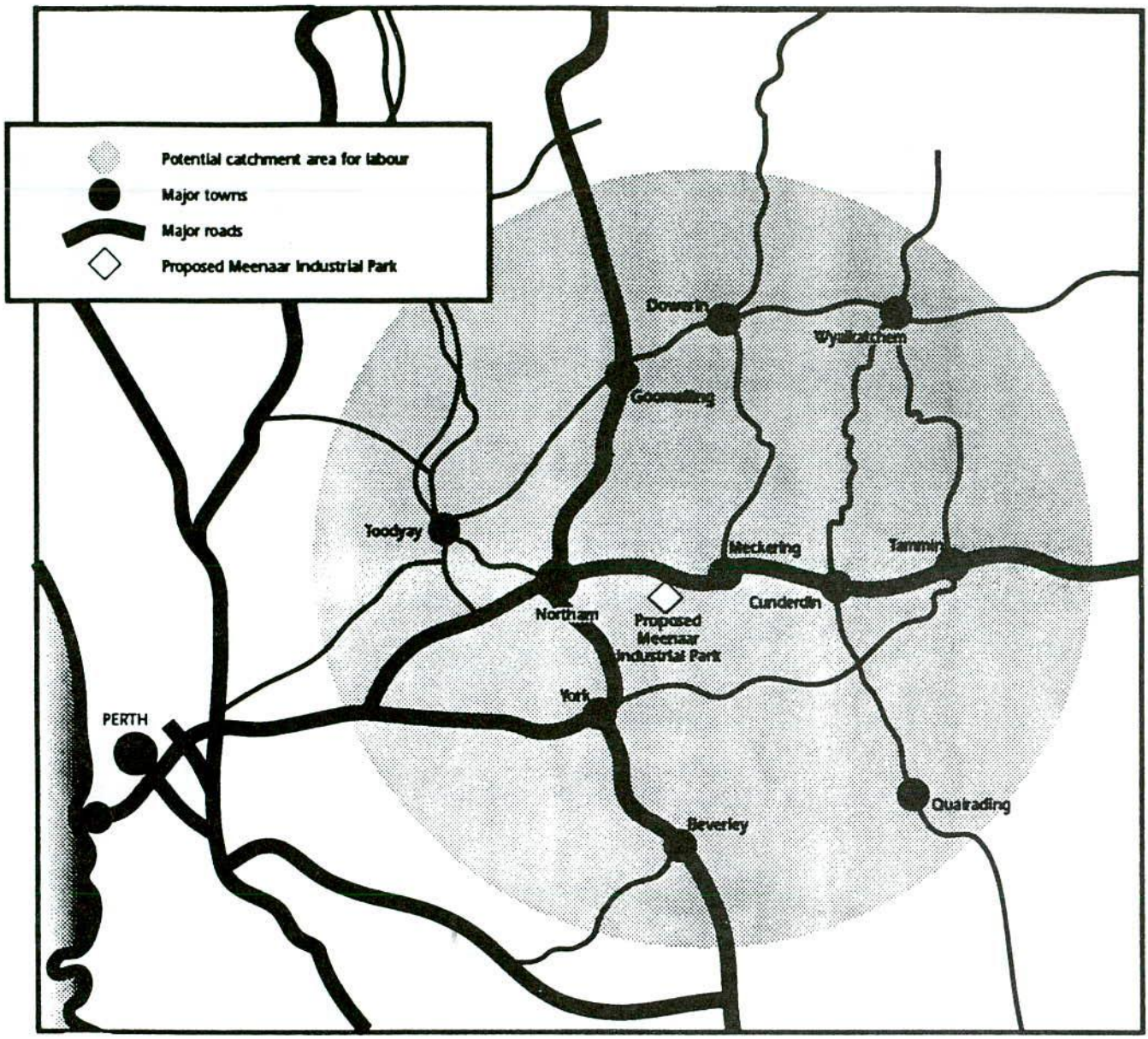
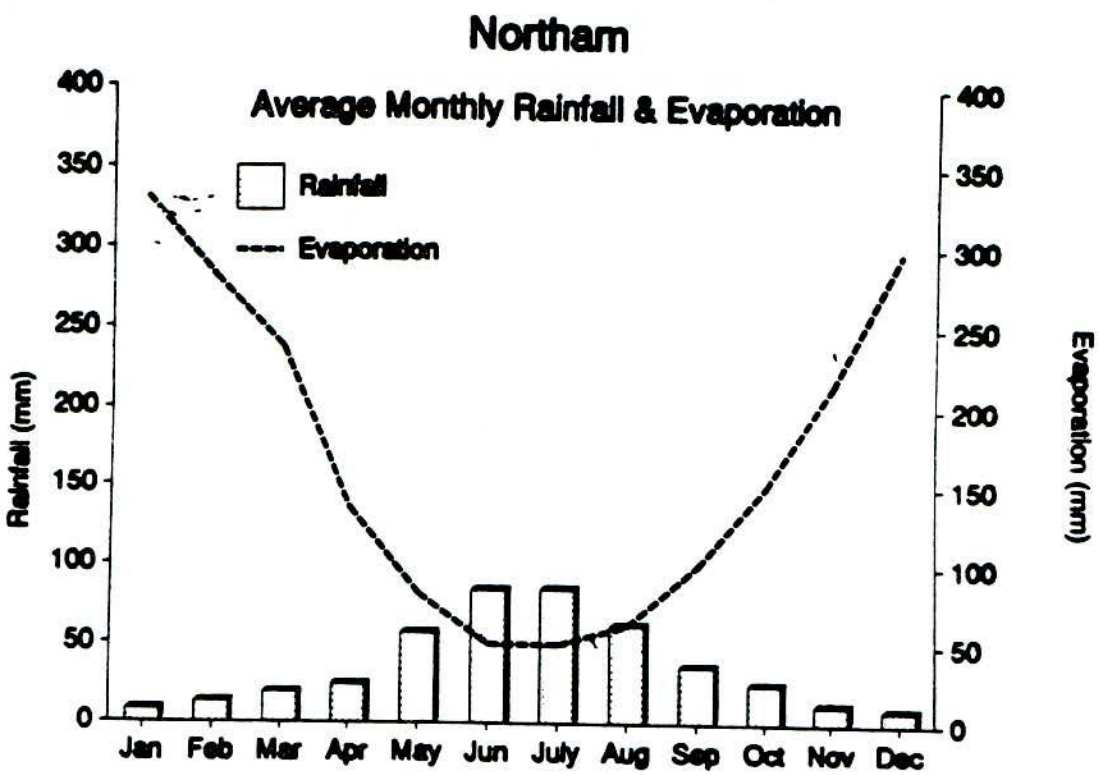


FIGURE 8 Potential Catchment Area for Labour



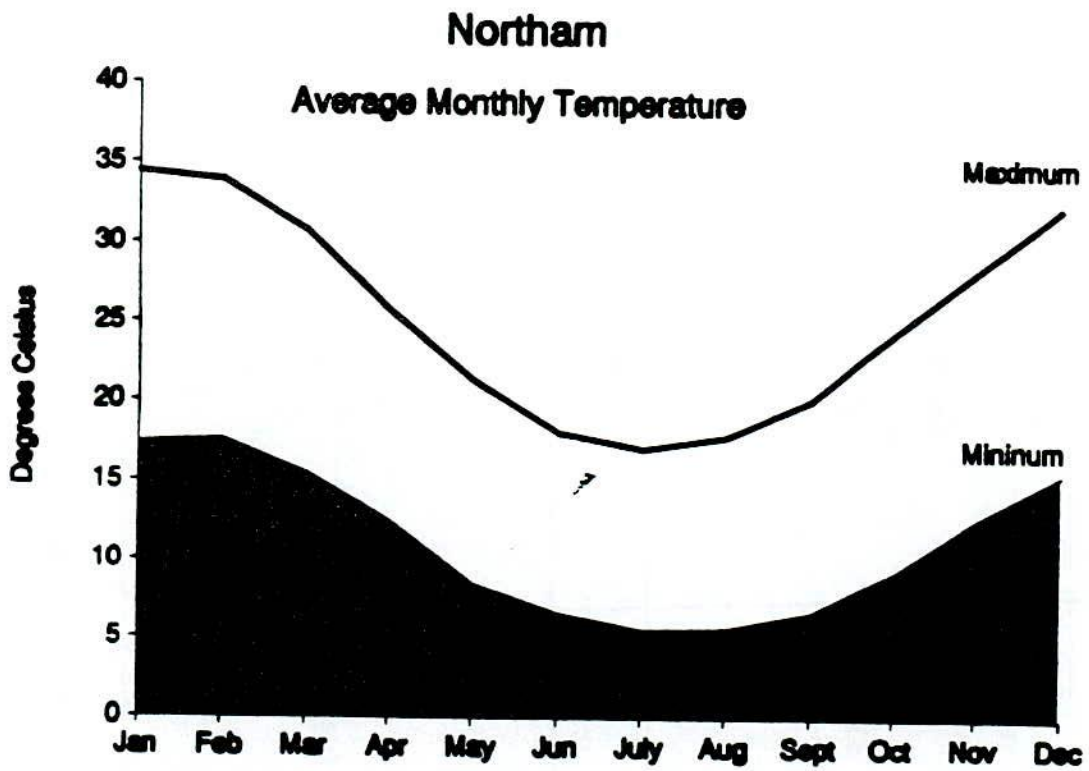
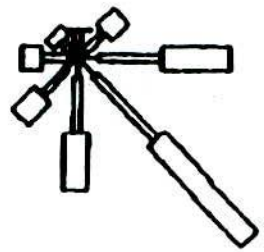
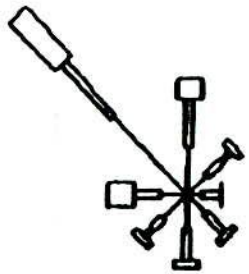
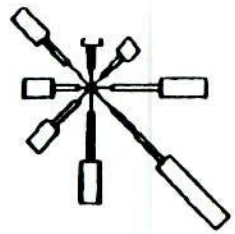
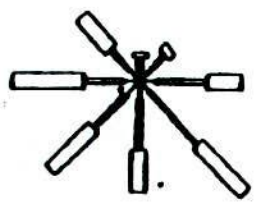
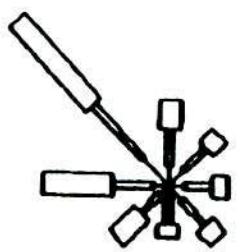
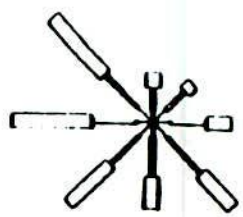
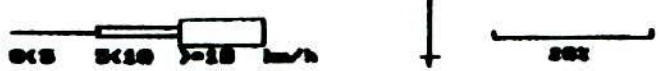


FIGURE 9 Average Monthly Rainfall Evaporation and Temperature Data for Northam

FIGURE 10 Seasonal Windrows, Northam

	Summer	Winter	Annual
a.m.			
	Calm 12%	Calm 61%	Calm 33%
p.m.			
	Calm 8%	Calm 17%	Calm 12%

Scale



MORTLOCK RIVER		O'DRISCOLL'S FARM
Sample Time		**Cond. Lab. Uncomp. (M.SIE/M)**
08:40:00	26.01.1990	562.0
13:30:00	29.01.1990	562.0
08:50:00	06.03.1990	3610.0
09:47:00	01.05.1990	3290.0
09:57:00	21.06.1990	319.0
09:49:00	08.08.1990	3060.0
13:42:00	28.06.1991	2220.0

MORTLOCK RIVER		O'DRISCOLL'S FARM
Sample Time		**Derived Flow Rate (M^3/Sec)**
08:40:00	26.01.1990	41.393
13:30:00	29.01.1990	24.050
08:50:00	06.03.1990	0.029
09:47:00	01.05.1990	0.030
09:57:00	21.06.1990	0.075
09:49:00	08.08.1990	0.682
10:45:00	10.09.1990	0.116
13:42:00	28.06.1991	1.463

FIGURE 11 Mortlock River, Seasonal Flow and Salinity Data

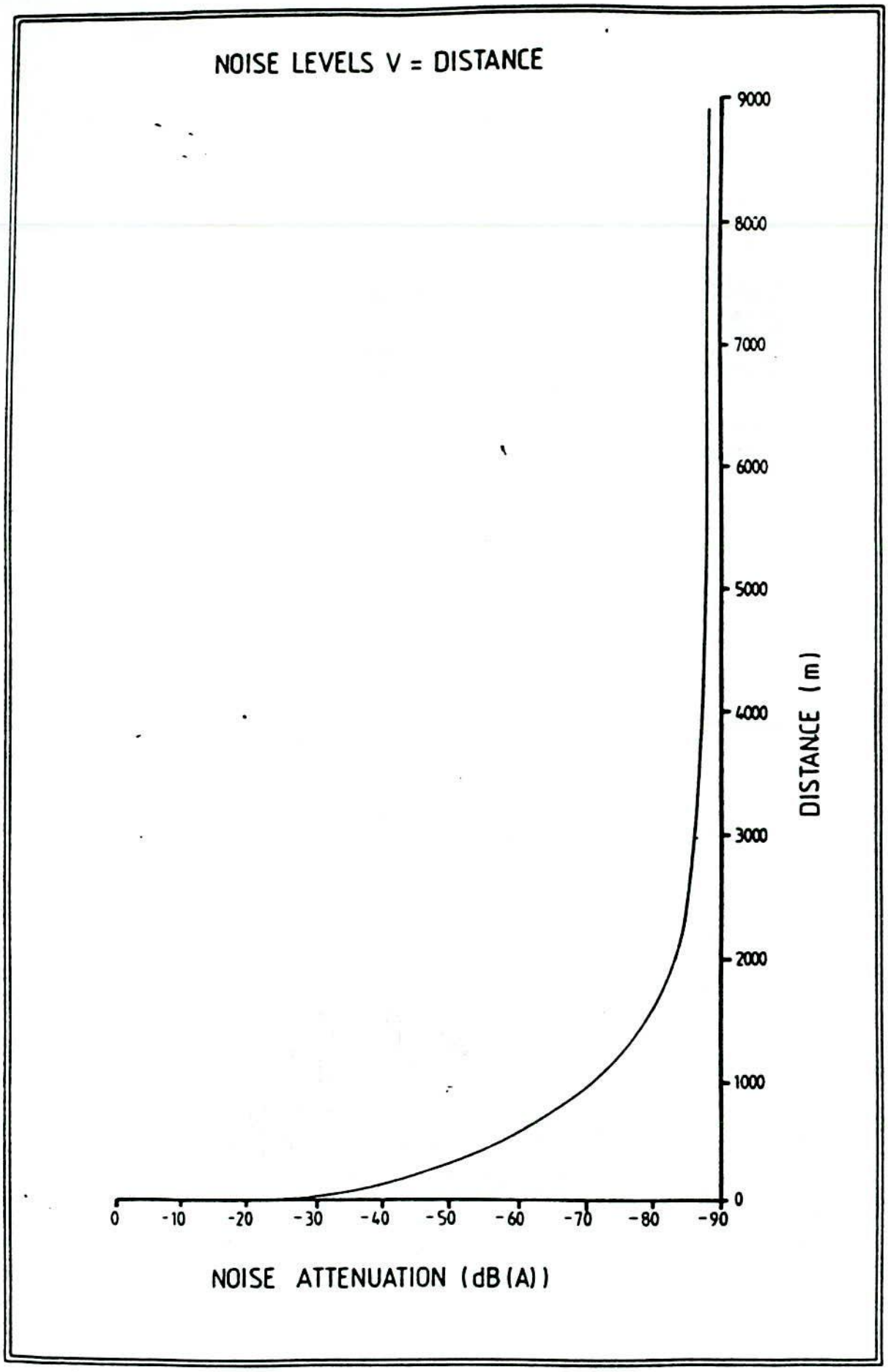


FIGURE 12 Noise Attenuation with Respect to Distance

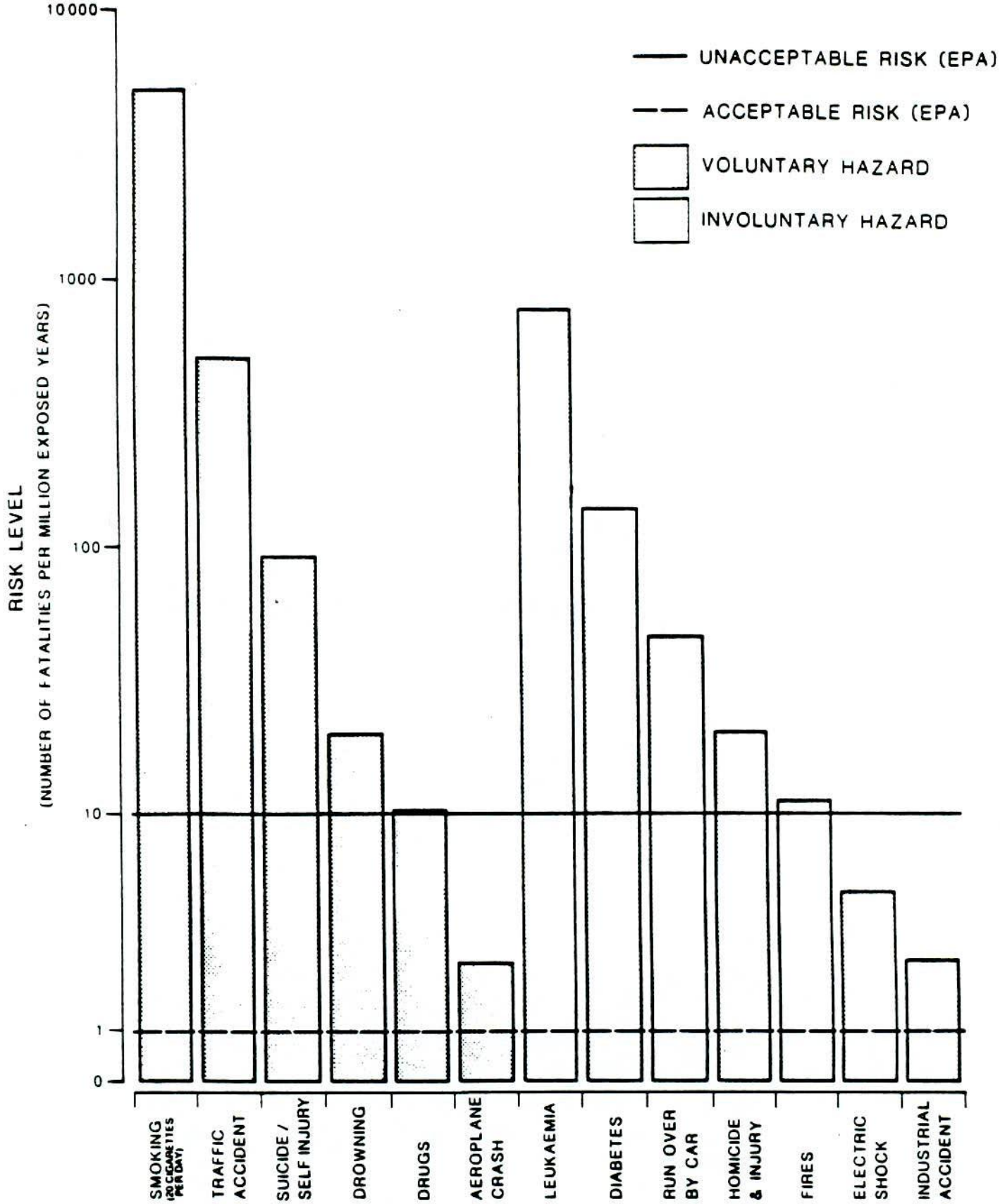


FIGURE 13 Individual Risk Levels for Selected Voluntary and Involuntary Hazards

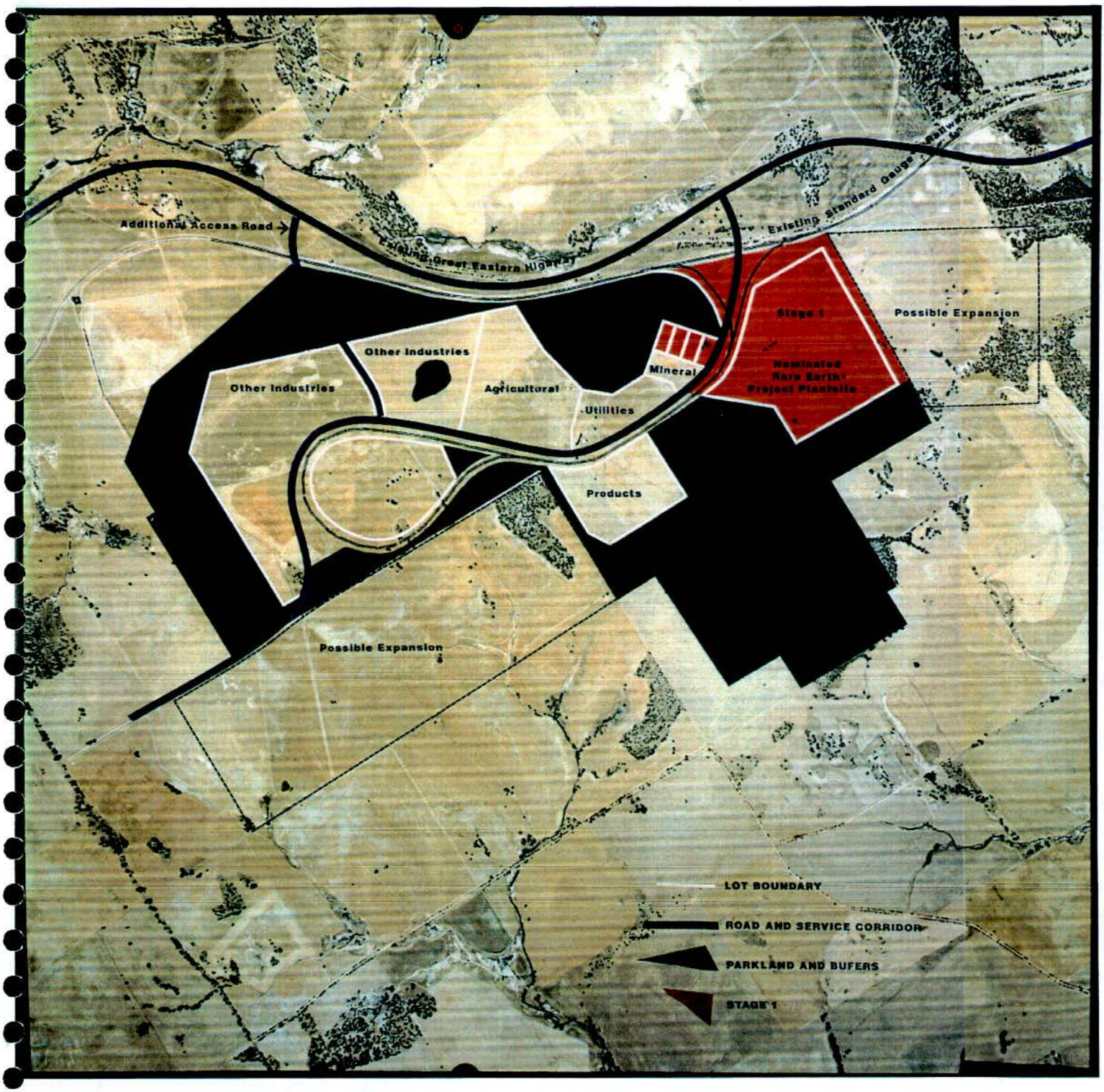


Figure 14. Aerial View of Meenar Industrial Park Layout.

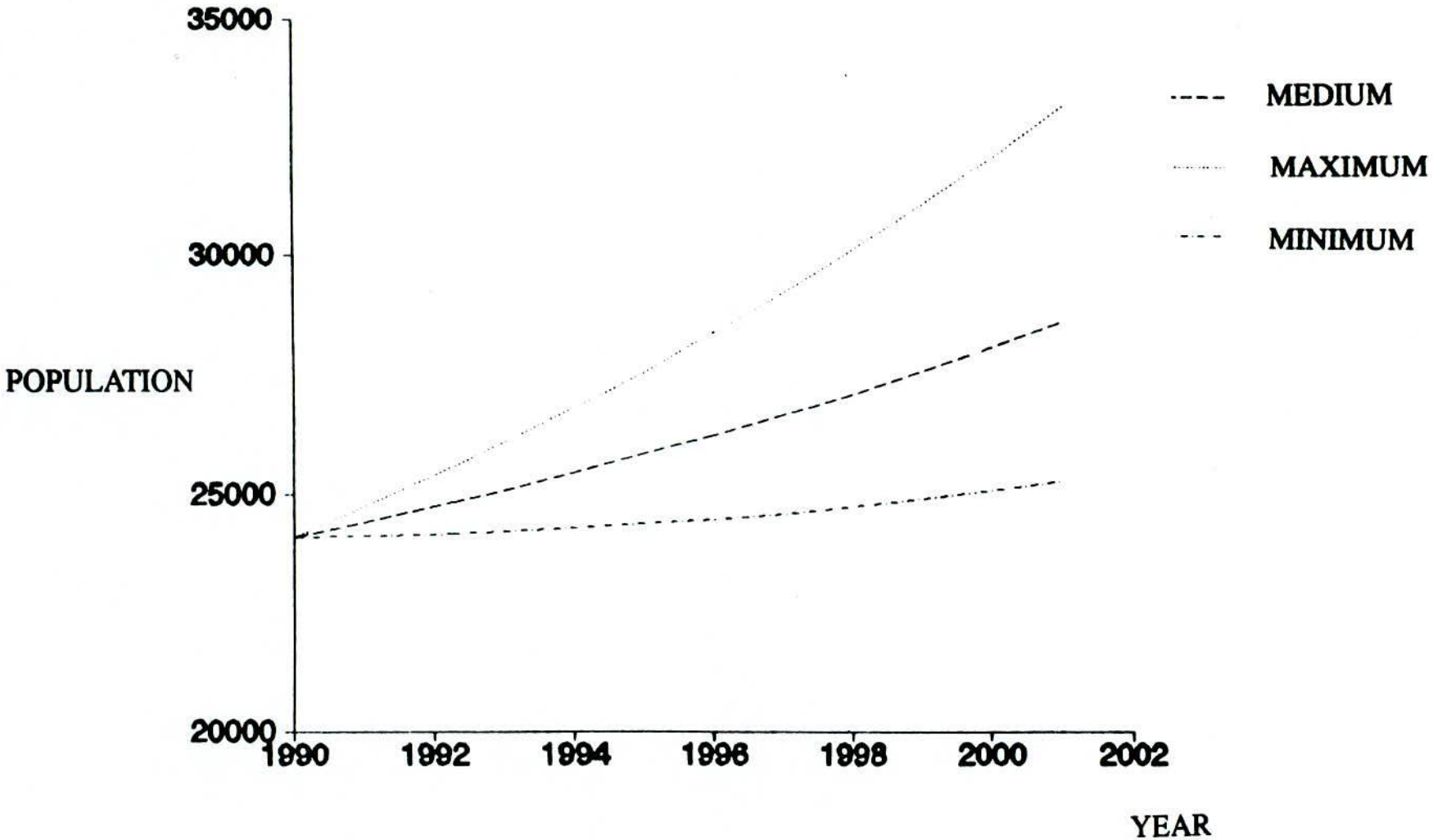


FIGURE 15 Population Projections for the Avon Region

APPENDIX I

ENVIRONMENTAL COMMITMENTS

General Commitments

The Proponents will adhere to the proposal as assessed by the Environmental Protection Authority and will fulfil the commitments made below.

The Park will be developed according to all relevant Government statutes and agency requirements, and to the satisfaction of the Environmental Protection Authority.

Waste Management Commitments

Waste water treatment and disposal systems built within the park will be designed and installed by a recognised water/wastewater treatment contractor to the satisfaction of the Environmental Protection Authority.

Prior to construction of such waste water treatment facilities each industry will be required to supply details of location and design to both the Meenaar Industrial Park Management Committee and the Environmental Protection Authority and obtain approval of these prior to commencing construction.

In the event of leakage from the ponds causing an environmental impact, as defined by the EPA, immediate action will be taken to stop the leakage so that the environmental impact is rectified to the satisfaction of the EPA.

Solid waste will be disposed of in a manner satisfactory to the Environmental Protection Authority.

The proponents will initiate a study incorporating the Avon Community Development Foundation and local shires to locate a suitable industrial waste site as soon as environmental approval for the Meenaar site has been received from the Minister for the Environment.

Disposal methods for solids remaining in evaporation ponds will be approved by the EPA.

Noise

The proponent will ensure that noise emissions from the industrial park will meet the following criteria:

1. The proponent shall ensure that the noise emissions from the park do not cause or contribute to noise levels in excess of:

- 50 dB(A) slow from 7 am to 7 pm Monday to Saturday inclusive but excluding gazetted public holidays;

- 40 dB(A) slow from 10 pm to midnight and from midnight to 7 am every day; and

- 45 dB(A) slow at all other times:

when measured:

(1) at any point on or adjacent, used for residential or other noise-sensitive purposes; and

(2) at a height between 1.2 and 1.5 metres above ground level and at a distance greater than 3.5 metres from any reflecting surface other than the ground.

2. Where the combined level of the noise emissions from the project and the normal ambient noise exceed the levels specified in condition 1, this condition shall be considered to be contravened only when the following criteria are also met at the measurement point:

   - the noise emissions from the premises are considered to be audible by the Environmental Protection Authority; and

   - the noise emissions from the premises are identifiable by the Environmental Protection Authority as emanating from the project.

3. Noise emissions shall not cause unacceptable annoyance due to tonal or impulsive components. These characteristics shall be assessed by the Environmental Protection Authority.

4. Exemption may be granted from conditions 1 and 3 in respect of any premises used for residential purposes by the negotiation of a written agreement with the occupier(s) of that premises. Such agreement shall be acceptable to the Environmental Protection Authority.

Emissions

Sulphur Dioxide

The proponent will ensure that 1-hour average sulphur dioxide levels at the nearest residence will be less than 350 micrograms per cubic metre for almost all of the time (99.9%) and should never exceed 700 micrograms per cubic metre.

Dust

The proponent will ensure that concentration of airborne dust contributed by any premises within the park shall not exceed the acute impact level of 1,000 micrograms per cubic metre averaged over 15 minutes at the boundary of the premises. For the longer term, at residences an annual mean of 90 micrograms per cubic metre, measured over 24 hour periods, will not be exceeded.

Risks and Hazards

The proponent will ensure that individual risk levels are maintained within the guidelines established by the Environmental Protection Authority in Bulletin 611.

A cumulative model of risk levels on the site will be generated to ensure this commitment is met.

APPENDIX II

Description of Industries with

Potential for Development at Meenaar

within 5 to 10 Years

APPENDIX II

Description of Industries with Potential for Development at Meenaar within 5 to 10 Years

AGRICULTURAL PROCESSING

Malt

Malt is used in the manufacture of beer and is mainly manufactured from barley. Plentiful supplies of Western Australian grown barley suitable for malting coupled with the increasing demand for beer throughout Asia represents an opportunity for expansion of the State's malting operations.

Malt manufacture requires the grain to be soaked, layered in beds and rapidly germinated so that starches are converted into fermentable sugars.

Estimated project parameters are:

. plant capacity	50,000 tpa
. capital investment	A$15-20M
. employment	10-12

Noodles

Noodles can be produced from either wheat or rice. A white noodle which is the major noodle type consumed throughout the Asian region is produced from wheat.

Western Australia produces ideal wheat for noodle manufacture. This, together with proximity to the South East Asian markets opens up a significant opportunity.

Ingredients used in the production of noodles include salt, water and flour. The process involves kneading, pressing, cutting, drying and packaging of the dough mix. Estimated project parameters are:

. plant capacity	1-2,000 tpa
. capital investment	A$2.5-3M
. employment	8

Oats Processing

Oaten bran is becoming well recognised as a major source of dietary fibre. Milling capacity in Australia currently consists of 7 plants producing a total of 60,000 tonnes of rolled oats per annum for the domestic market.

Western Australia currently produces many varieties of premium grade oats which are required for processing. Export markets are developing in both USA and South East Asia.

The production of rolled oats, oat bran and other oat products requires de-hulling the raw oats to produce a "groat" and then processing through a rolling mill to produce the finished product which is graded according to flake thickness. The traditional rolled oat consists of a flake sized from 1/50 to 2/50 inch which accounts for 65% of oats products for human consumption such as porridge, muesli bars and biscuits. The second major product is "cut groat" with a flake size of 1/100 to 1/50 inch and is used for producing quick cooking oats, flour and oat bran. Estimated project parameters are:

- plant capacity 10,000 tpa
- capital investment A$7-8M
- estimated employment 25-30

Lupin Extracts

Lupins are emerging as a potential alternative to, or substitute for, soya beans in the production of a number of foods and food ingredients.

Western Australia is the only exporter of lupins in the world. Over 50% of the State's production is exported.

There is a market swing towards vegetable protein for human consumption. Australia currently imports most of its requirements. Four products have been identified for which potential domestic or export markets exist. These comprise hydrolised proteins, a lupin-based source, lupin protein isolates and dietary fibre preparations.

The processes involved are expected to be:

- Hydrolised vegetable protein - typically made by acid hydrolysis of a freely-milled flour, protein concentrate or isolate with subsequent neutralisation.

- Lupin-based sauces - fermented sauces made by fermenting the legume seed and a cereal grain with fungi such as Aspergillus oryzae for up to 18 months.

- Lupin protein isolates - vegetable protein isolates are typically made by solubilising the protein from a finely milled flour and thus removing the protein by iso-electric precipitation or various filtration methods.

- Dietary fibre - approximately 50% of the hulls of lupin seed are fibre, much of which is soluble with similar properties to oat bran.

Wool Processing

There is increased demand from European and Asian woollen mills for scoured wool. Australia has the advantage of having a ready supply of raw materials, competitive energy and labour costs, abundant land and water for processing facilities.

Processing to a top making stage includes scouring, blending, carding, combing and top making. The De Siret process which incorporates solvent scouring techniques is considered a superior method to the traditional methods allowing better retrieval of lanolin by-products and causes less matting of the woollen fibres. Estimated project parameters are:

- plant capacity 25,000 tpa (140,000 bales)
- capital investment A$20-25M
- estimated employment 20-40

MINERAL PROCESSING

Rare Earths

Ashton Mining Limited (1991) has discovered a high grade deposit of rare earth minerals at Mount Weld east of Laverton. It is proposed to concentrate the run of mine ore on site at Mount Weld and then transport the rare earth to Meenaar for further processing.

The process will involve cracking of the rare earths with caustic soda and then further processing with acids, ammonia, and solvents to produce the individual rare earths. The majority of the rare earth products will be exported to markets in Japan, Asia and Europe.

Estimated project parameters (Meenaar) are:

- plant capacity 10,000 tpa
- capital investment $50M
- employment 40-50

Polishing Powder

Cerium oxide, a product from the proposed rare earth plant, has been used in glass polishing since the 1930s. The majority of cerium based polishes contain around 45-50% CeO_2 with other materials being mainly rare earth oxides or chlorides. However, high quality cerium polishes can contain as much as 70-80% CeO_2. Polishes are made by calcining cerium hydroxide. Estimated project parameters are:

- plant capacity 100-200 tpa
- capital investment $5-7M
- employment 7-10

Speciality Magnets

Since 1970 permanent magnets have provided a major expanding market for high purity, separated rare earths. Initially samarium-cobalt alloys and then in the mid-1980s neodymium-iron-boron magnets were developed.

Both samarium and neodymium are rare earths which can be produced by the Ashton rare earth plant. Estimated project parameters are:

. capital investment	$10-15M
. employment	10-15

Inorganic Colours:

Inorganic colours are made from the base raw materials of zirconia and zircon, both of which are available in Western Australia. These colours are used in colouring ceramic tiles, pottery, enamelling, sinks and basins.

Various colours are obtained from the addition of small quantities of "stains" to the zirconia base. The rare earths praseodymium, yttrium and neodymium can be used to produce yellow, orange and light purple respectively. Blue is based on vanadium additive and red on iron oxides.

The process combines the materials together by mixing and then through a furnace to produce the colours.

Markets for the products would be Australian and South East Asian ceramic tile manufacturers. Estimated project parameters are:

. plant capacity	yellow 400 tpa blue 200 tpa pink 100 tpa
. capital investment	$6-8M
. employment	15-20

APPENDIX III

Government Legislation Regarding

Waste Disposal

APPENDIX III

Government Legislation Regarding Waste Disposal

Current Government Policies

The following contain provisions and policies which are applicable to management of solid and liquid wastes in the proposed industrial park:

- The Environmental Protection Act (1986) and Regulations (1987)
- Health Act (1911) including:
  - Health (Licensing of Liquid Waste) Regulations 1987
  - Septic Tank Regulations and Amendments
- The Water Authority of Western Australia Act (1984)
- The Waterways Conservation Act (1976)
- Draft Avon River System Management Strategy
- Health Department - Discussion Paper on Industrial Waste Disposal
- Dangerous Goods (Road Transport) Regulations 1983

The major policies applying to waste disposal on the Meenaar site are:

Environmental Protection Act and Regulations:

The Environmental Protection Act is the pre-eminent environmental legislation in Western Australia and provides protection to all facets of the environment, including the discharge of waste. The Act and Regulations are administered by the EPA and all waste discharges to the environment from prescribed premises are subject to licensing. If discharge of waste does not comply with licence conditions or an approved policy, the EPA can serve a Pollution Abatement Notice on the owner and/or occupier of the premises. This notice requires the owner and/or occupier to prevent, control or abate the discharge of waste in accordance with the conditions specified in the notice. The EPA also sets the discharge standards for industrial areas.

Health Act and Regulations:

The Act and Regulations are administered by the Health Department of Western Australia which is responsible for the control of transport and disposal of solid, liquid and hazardous wastes. Through local authority health surveyors, it also issues approvals for septic tank disposal systems.

Water Authority Act (1984):

The Water Authority is charged with management and conservation of the State's water resources. Management includes protection from contamination which poses a threat to beneficial use of the resources. The Water Authority also provides advice to the EPA on groundwater contamination matters with respect to pollution licences under the EPA Act.

APPENDIX IV

Zoning Table

NORTHAM TPS 2

TABLE 1

ZONING TABLE

ZONES / USE CLASSES	RESIDENTIAL	COMMERCIAL	INDUSTRIAL	COMMUNITY	RURAL 1	RURAL 2	RURAL 3	RURAL 4	RURAL 5	SPECIAL RURAL	SPECIAL SITES	TOURIST ZONE
Abattoir							SA		SA		USE AND CONDITIONS OF USE RESTRICTED TO THOSE SHOWN IN SCHEDULE 3	USE AND CONDITIONS OF USE RESTRICTED TO THOSE SHOWN IN SCHEDULE 4
Additional Accommodation	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA		
Aged Persons Dwelling	AA			AA	AA	AA						
Airfield					SA				AA			
Animal Housing	AA				AA	P	P	P	P	AA		
Art Gallery	AA	P				AA						
Art & Craft Studio & Sales	AA	P				AA		AA				
Builders Storage Yard		AA	P		SA							
Caretaker's Dwelling		IP	IP	IP	IP							
Car Park		P	P	P	AA							
Civic Building	P	P		P	AA	P	P	P	P	P		
Civic Use	P	P		P	AA	P	P	P	P	P		
Club Premises	SA	P		P	AA	AA			AA			
Consulting Rooms	AA	P		AA								
Consulting Rooms Group	AA	P		AA								
Convenience Store	SA	P			AA	AA						
Day Care Centre-Kindergarten	AA	AA		P								
Dog Kennels-Cattery					AA	AA	AA	AA	AA			
Drive-In Theatre				AA	AA							
Drycleaning Premises/												
Laundromat		P	P		AA							
Educational Establishment				P	AA							
Equestrian Centre					P	P	P	P	P			
Factory Unit Building			P									
Family Care Centre	AA	AA	P									
Fast Food Outlet		P			SA							
Fuel Depot			P		AA	AA	AA	AA	AA			
Funeral Parlour		P										
Health Studio	SA	P		P	SA	AA						
Holiday Accommodation &												
Tourist Uses		AA			AA	AA	AA	AA	AA			
Home Occupation	AA	AA			AA	AA	AA	AA	AA	AA		
Hospital				P	AA							
Hospital - Special Purposes				AA	AA	AA						
Hotel		P		P	SA	AA						
Industry												
Cottage	AA	AA	AA		AA	AA	AA	AA	AA	AA		
Extractive					AA	AA	AA	AA	AA			
General			P			AA						
Hazardous			SA			SA						
Light			P			AA						
Noxious			SA			SA			AA			
Rural			P		AA	AA			AA			
Service		AA	P		SA	AA						
Liquor Store		P			SA	SA						

NORTHAM TPS 2

TABLE 1

ZONING TABLE (Contd)

ZONES / USE CLASSES	RESIDENTIAL	COMMERCIAL	INDUSTRIAL	COMMUNITY	RURAL 1	RURAL 2	RURAL 3	RURAL 4	RURAL 5	SPECIAL RURAL	SPECIAL SITES	TOURIST ZONE
Marine Collectors Yard			P		SA	AA					USE AND CONDITIONS OF USE RESTRICTED TO THOSE SHOWN IN SCHEDULE 3	USE AND CONDITIONS OF USE RESTRICTED TO THOSE SHOWN IN SCHEDULE 4
Market		P			AA	AA						
Medical Centre	SA	P		P								
Milk Depot			P									
Motel		P			SA	AA						
Motor Vehicle & Marine												
Sales Premises		P	P									
Motor Vehicle Repair Station			P									
Motor Vehicle Wrecking												
Premises			P									
Office	SA	P	P	AA								
Park Home					AA	AA	AA	AA				
Park Home Park					AA	AA	AA	AA				
Plant Nursery	AA	P			AA	AA						
Private Recreation				AA	AA	AA	AA	AA	AA			
Produce Store		P	IP		SA	AA	AA	AA	AA			
Public Amusement		P		P	SA	AA	AA					
Public Recreation	P	P	P	P	P	P	P	P	P	P		
Pubic Utility	P	P	P	P	P	P	P	P	P	P		
Public Worship - Place Of	SA	P		P	AA	AA						
Radio & TV Installation		AA	P	AA	AA							
Reception Centre	SA	P		P	AA	AA						
Residential												
Single House	P	P		AA	P	P	P	P	P	P		
Attached House	P	P		AA								
Grouped Dwelling	P	P		AA								
Residential Building	SA	AA		P	AA	AA						
Restaurant		P		P		AA	AA					
Restricted Premises		SA	AA									
Restricted Rural Use						AA	AA	AA	AA			
Rural Use					P	P	P	P	P	P		
Salvage Yard			P		AA	AA						
Service Station		P	P		SA	AA	AA		AA			
Shop		P										
Showroom		P	P									
Tavern		P				SA						
Trade Display		AA	P									
Transport Depot			P		AA	AA			AA			
Veterinary Consulting Rooms		AA		SA	AA	AA						
Veterinary Hospital					AA	AA						
Warehouse		AA	P									
Wayside Stall					SA	SA	SA					

APPENDIX V

Soil Data

Description

Characteristics

TYPICAL SOIL DESCRIPTIONS FOR EACH MAPPING UNIT

Soil Surface	Description
Quailing:	Yellow to brown sands, deeper than 1 metre, sometimes with lateritic gravel present below 80 cm.
Malebelling:	Gritty, grey, loamy sands on grey and brown, faintly mottled sandy clay at about 30 cms; the map unit includes brown surfaced soils where basic rocks (dolerite dykes) are present as well as gritty sands on shallow rocks; rock outcrops are common.
York:	Grey loamy sand over red to brown clay at depths vary from 10 to 45 cms, the map unit includes small areas of red surface clay, of brown gradational soils and of gritty soils on shallow rocks; rock outcrops are common.
Mortlock:	Grey to pale brown sand over red and grey mottled acid clay at about 40 cm.
Rock Outcrops:	Skeletal soils in shallow rocks including some fine grey sands.

Soil Surface	Soil Description	Drainage Characteristics	
Quailing (Qu)	Yellow to brown sand to 1m; occasionally with gravel at 80cm.	Highly permeable	Rapidly drained
Malabelling (Mg)	Gritty, 'grey', loamy sands in sandy clay at 30cm.	Moderately permeable	Moderately well to imperfectly drained
York (Y)	Grey, loamy sand over red to brown clay at 10–45 cm	Moderately permeable	Poorly drained to moderately well drained dependent upon position.
Mortlock (M)	Grey and pale brown sand over mottled acid clay at 40cm	Moderately permeable	Imperfectly drained
Rock Outcrops (Rx)	Light sands and other skeletal soils on shallow rocks	Poorly permeable, high run–off	Imperfectly drained, though soils are shallow.

CHARACTERISTICS OF THE LANDFORMS

	Topography Slope %	Local Relief	Erosion	Existing Vegetation	Land Use	Outcrop	Constraint
Quailing	1–2	10	None	Cropland minor remnants	Crop	None	Wind erosion
Malebelling	2–3 rarely 10	20	None	Remnant Wandoo – salmon gum with Hakea and Acacia.	Pasture Frequent and crop in places		Shallow rock winter water–logging in local depressions
York	2–5 up to 10% in places	30	On sides of drainage lines	Remnant Wandoo with York gum and Acacia	Pasture	Frequent	As above and water erosion risk
Mortlock	3–5 on the side slopes <1 on the floors	<5	Salinity problems	Pasture and bare	None		Salinity and waterlogging
Rock Outcrop with Skeletal Soils	10% overall, locally greater.	40	None	Wandoo and salmon gum	Remnant vegetation	Abundant	Shallow rocks and outcrop

SOIL AND DRAINAGE CHARACTERISTICS FOR THE SOIL SURFACES

Soil Surface	Soil Description	Drainage Characteristics	
Quailing (Qu)	Yellow to brown sand to 1m; occasionally with gravel at 80cm.	Highly permeable	Rapidly drained
Malabelling (Mg)	Gritty, 'grey', loamy sands in sandy clay at 30cm.	Moderately permeable	Moderately well to imperfectly drained
York (Y)	Grey, loamy sand over red to brown clay at 10–45 cm	Moderately permeable	Poorly drained to moderately well drained dependent upon position.
Mortlock (M)	Grey and pale brown sand over mottled acid clay at 40cm	Moderately permeable	Imperfectly drained
Rock Outcrops (Rx)	Light sands and other skeletal soils on shallow rocks	Poorly permeable, high run–off	Imperfectly drained, though soils are shallow.

LAND QUALITY VALUES FOR THE MAPPED UNITS

Land Qualities	Quailing	Malebelling	York	Mortlock	Rock outcrop
Water erosion risk	Very low	Moderate – high. Slope dependant	Moderate – high. Slope dependant	Low	Moderate to high when not vegetated
Wind erosion risk	Moderate	Low	Low	Low	Nil
Microbial Purification ability	Moderate	Moderate	Moderate	Low – Moderate	Low
Water Pollution Risk:					
(a) overland flow	Very Low	Low	Low	Moderate	Moderate – high when not vegetated
(b) sub surface drainage	Moderate	Moderate	Moderate	Moderate	
Ease of Excavation	High	Low	Low	Moderate	Low
Waterlogging risk	Nil	Low	Low	Moderate	High when not vegetated

LAND QUALITY VALUES FOR THE MAPPED UNITS

Land Qualities	Quailing	Malebelling	York	Mortlock	Rock outcrop
Foundation soundness	Good	Fair	Fair	Fair	Fair
Soil absorption ability	High	Low	Low	Low	Very low
Subsoil retention ability	Low	High	High	N/A	Low
Salinity Risk	Not suscep-tible	Not suscep-tible	Not suscep-tible	Highly suscep-tible	Not suscep-tible
Slope instability	Nil	Very low	Very low - low	Very low - low	Variable
Flood risk	Nil	Low	Low	Moderate	N/A

LAND CAPABILITY OF THE MAPPED UNITS TO SUPPORT ROAD, UTILITY AND BUILDING CONSTRUCTION

Land Unit	Capability Class	Comment
Quailing	II	High capability with some physical limitations, in particular a potential for wind erosion.
Malebelling	II	High capability with some physical limitations, in particular, erosion risk on steep slopes, minor problems with excavation around doleritic intrusives; locally slopes may be steep and cause problems in construction, and with road building and utility installation.
York	II	As above with the addition of greater precautions when the land is steep.
Mortlock	IV	Low capability; a high degree of physical limitation occasioned by flooding which may be reduced by providing better water control at the northern boundary or by reductions in overland flow on the land to the south.
Rock Outcrops	III–IV	Moderate capability to very low capability depending upon site; water erosion and waterlogging can occur on slopes with shallow soils above rocks. Doleritic intrusions may cause local instability.

LAND CAPABILITY OF THE MAPPED UNITS TO SUPPORT WATER POLLUTION HAZARDS

Land Unit	Capability Class	Comments
Quailing	III	Fair capability because of the potential for sub–surface drainage to lower land.
Malebelling	III	As above
York	III	As above
Mortlock	III	As above
Rock outcrop	IV	Low capability because of surface run–off and sub–surface drainage.

LAND UNIT CAPABILITY FOR ON-SITE EFFLUENT DISPOSAL

Land Unit	Capability Class	Comments
Quailing	II	High capability; excessive concentration of disposal units on the sands is not encouraged.
Malebelling	III	Moderate capability, in some instances excavation may be difficult; soil depth may be limiting locally.
York	III	Moderate capability; as above
Mortlock	IV	Low capability; flood hazard
Rocky outcrops	IV	Low capability; some sites have insufficient soil depth to support on-site effluent disposal.

APPENDIX VI

Species of Flora Identified in

Natural Vegetation at Meenaar

LIST OF VASCULAR PLANT SPECIES RECORDED ON THE MEENAR PROPOSED INDUSTRIAL PARK

* = denotes introduced species

CUPRESSACEAE
- Callitris drummondii

POACEAE
- Neurachne alopecuroidea
- *Avena Fatua
- *Briza maxima
- *Briza minor
- *Hordeum leporinum

CYPERACEAE
- Schoenus sp.

DASYPOGONACEAE
- Lomandra sp.

XANTHORRHOEACEAE
- Xanthorrhoea gracilis
- Xanthorrhoea preissii
- Xanthorrhoea reflexa

PHORMIACEAE
- Dianella revoluta

ANTHERICACEAE
- Arthropodium capillipes
- Borya sphaerocephala
- Sowerbaea laxiflora

IRIDACEAE
- *Romulea rosea

ORCHIDACEAE
- Caladenia ?deformis
- Diuris sp.
- Elythranthera brunonis
- Prasophyllum macrostachyum
- Pterostylis nana
- Thelymitra sp.

CASUARINACEAE
- Allocasuarina campestris
- Allocasuarina huegelii

PROTEACEAE
- Dryandra armata
- Hakea sp.
- Isopogon divergens

SANTALACEAE	Santalum acuminatum
CHENOPODIACEAE	Enchylaena tomentosa
	Rhagodia preissii
DROSERACEAE	Drosera pallida
MIMOSACEAE	Acacia ?divergens
	Acacia browniana
	Acacia sp. 024
	Acacia ?crassiuscula
PAPILIONACEAE	Gastrolobium parviflorum
	Gastrolobium rotundifolium
	Gastrolobium trilobum
	Jacksonia restioides
	Mirbelia aff. dilatata
GERANIACEAE	*Erodium moschatum
SAPINDACEAE	Dodonaea ?ceratocarpa
STERCULIACEAE	Lasiopetalum floribundum
MYRTACEAE	Calytrix strigosa
	Eucalyptus anceps
	Eucalyptus astringens
	Eucalyptus eremophila ssp. eremophila
	Eucalyptus salmonophloia
	Eucalyptus wandoo
	Eucalyptus ?arachnaea
	Eucalyptus loxophleba
	Hypocalymma robustum
	Melaleuca adnata
	Melaleuca aff. sclerophylla
	Melaleuca cymbifolio
	Melaleuca spicigera
	Melaleuca uncinata
	Melaleuca undulatum
	Verticordia sp.

HALORAGACEAE	Glishrocaryon aureum
PRIMULACEAE	*Anagallis arvensis
MYOPORACEAE	Eremophila lehmanniana
GOODENIACEAE	Dampiera alata Dampiera sp. Dampiera teres
STYLIDIACEAE	Stylidium ?junceum
ASTERACEAE	Waitzia aurea *Arctotheca calendula

APPENDIX VII

Technology for Controlling Emissions

APPENDIX VII

Technology for Controlling Emissions:

Control of Sulphur Dioxide Emissions

Various measures are available to control sulphur dioxide emissions at source, including use of low sulphur fuels, combustion control, and flue gas desulphurisation. These measures are outlined below:

- Low Sulphur Fuels - Sulphur emission levels can be reduced by using low sulphur fuels such as natural gas and low sulphur crudes, although the use of gas contributes significantly to emissions of nitrogen oxides.

- Combustion Control - Sulphur dioxide reduction through combustion control is still at the research and development stage. One method, termed Furnace Sorbent Injection (FSI), injects a sorbent (usually lime or hydrated lime) into the boiler where the sorbent reacts with sulphur to form solid particles. These particles can then be collected by conventional particulate control devices (OECD, 1988).

- Flue Gas Desulphurisation - Flue gas desulphurisation (FGD) refers to the installation of sulphur control devices fitted to the back-end of the combustion process at the point of flue gas emission. The FGD system uses a sorbent (such as lime or limestone) to react with and scrub sulphur directly from the flue gas. The by-product is usually calcium sulphate (gypsum), although this depends upon which process is chosen as the scrubbing system. Desulphurisation processes are costly and waste disposal is an additional cost burden unless cost credits can be applied through identifying viable markets for the waste by-products.

- Control of Particulate Emissions:

Control methods for particulate emissions from stacks are well established. The two standard control methods are electrostatic precipitation (ESP) and filtering through baghouse fabric filters. These methods can provide over 99.5% reduction in particulate emissions (OECD, 1988).

Electrostatic precipitators collect ash particles in the flue gas by electrical attractions to a collector plate. Baghouses contain banks of filter bags through which the flue gas stream passes, and the particulates accumulate on the fabric filters. The selection of technology for each industry depends upon the size of particulates and the required collection efficiency.

Wind erosion largely influences the level of pollution from fugitive dust emissions. There are several methods for controlling fugitive dust emissions, depending upon the source, including:

- application of water sprays to stockpiles or materials handling systems by water truck or reticulated sprinkler system;
- application of chemical wetting agents to stockpiles;
- blanketing of stockpiles; and
- storage of materials within enclosed bunkers.

Control of Oxides of Nitrogen Emissions

Technology for controlling emissions of nitrogen oxides include combustion modification systems, selective catalytic and non-catalytic reduction systems, and flue gas denitrification systems, as outlined below:

- Combustion Modification Techniques - The formation of nitrogen oxides is dependent on the temperature of combustion, and therefore combustion modification techniques can result in direct reductions of emissions. These techniques are directed towards lowering the flame temperature, residence time and oxygen concentration during combustion, so as to inhibit the formation of nitrogen oxides.

- Selective Catalytic and Non-Catalytic Reduction - Selective Catalytic Reduction (SCR) is a new flue gas treatment control technology for nitrogen oxides. SCR uses ammonia to reduce nitrogen oxides to nitrogen and water in the presence of a catalyst. A major disadvantage with the system appears to be the high operating and capital costs compared with combustion modification techniques.

  Selective Non-Catalytic Reduction (SNCR) injects ammonia into the flue gas, and nitrogen oxides reduction takes place without the use of a catalyst. The problem with this method is that the process can release ammonia and also produces ammonium sulphate as a by-product (OECD, 1988).

- Combined Sulphur Dioxide and Nitrogen Oxides Control - Flue gas desulphurisation (FGD) technology is discussed in Section ..... Similar technology also applies for flue gas denitrification. Studies have been conducted on combining the FGD systems to reduce emissions of both sulphur dioxide and nitrogen oxides in flue gas. The advantage of this sort of system is that there is a combined lower average cost compared with those for separate control systems with comparable reduction levels.

Control of Odours

The goal in controlling odours is to eliminate community annoyance. The best way to control odours is by preventing their release. This can be achieved by upgrading technology used in the industrial processes, especially in emissions control.

The most common odour control technologies are:

- process design;
- combustion;
- absorption;
- adsorption;
- masking; or
- a combination of two or more of the above methods.

Process Design

Simple process design modifications or improved operation of a process may be sufficient to control odour emissions. Process design parameters which should be reviewed include temperature, pressure and volume of the gas produced. Other process modifications could involve process chemistry and raw material segregation.

Odours from wastewater treatment plants are due to gases and vapours such as hydrogen sulphide and other malodorous compounds given off during anaerobic decay. Anaerobic decay takes place once all dissolved oxygen is depleted, therefore if the levels of dissolved oxygen are retained, the anaerobic decay process would not occur. A properly designed wastewater treatment plant would ensure that all decay processes take place within closed systems.

Combustion:

Complete combustion has been generally accepted as the best way to deodorise malodorous gases, however it may not be the most economical. There are three techniques for ensuring complete combustion: thermal oxidation (after burning); direct combustion (flaring); and catalytic oxidation.

- In thermal oxidation the odoriferous gas is preheated and passed into a combustion chamber. This method is suited for controlling emissions of organic aerosols, mists or droplets.

- The most effective technique for controlling high concentration of odours in low volumes of air is direct combustion or flaring. This method is best suited to combustible gases, although an auxiliary fuel is often needed to initiate and maintain a stable flame.

- Odour control by catalytic oxidation has the advantage of operating at lower temperatures than thermal combustion. Catalytic combustion offers virtually complete odour elimination, if sufficient catalyst area and contact time are provided, so long as the temperature remains above the catalyst ignition point. Odours arising from the production of phenol, phthalic anhydrides, and their derivatives can be effectively controlled by this method.

Absorption

Washing, absorption and reactive scrubbing all involve gas-liquid diffusion for removal of odoriferous components from the vapour phase. This technique is used when the gas has a high moisture content and can handle large volumes of gas economically.

Adsorption

Adsorption can be an effective and economical control method for emissions with low concentrations of odorous compounds. Adsorption is a physical process in which molecules from the gas phase are captured by and retained upon the surface of a solid. The primary use of adsorption is the concentration of highly dilute odours from enclosed atmospheres for subsequent destruction or recovery.

Masking

Masking agents orodour counter-acts can also be used to address specific odour problems.

APPENDIX VIII

Study on Seismicity in Northam Area

DEPARTMENT OF MINES

GEOLOGICAL SURVEY
OF WESTERN AUSTRALIA

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Your Ref:
Our Ref: GS 58/90 GOODALL
Enquiries to: C F Swindells
Telephone: 222 3597

Department of State Development
170 St Georges Terrace
PERTH WA 6000

Attention: Mr N Goodall

SEISMIC RISK - PROPOSED MEENAAR INDUSTRIAL ESTATE

Officers of the Geological Survey of Western Australia have performed a brief desk-top review of the seismic risk in relation to the design of evaporation ponds at the proposed Meenaar Industrial Estate, Northam.

The attached notes summarize conclusions arising from the review. Should you require additional assistance with this matter, please contact Dr C F Swindells (direct line 222 3597) or Mr I H Lewis (direct line 222 3213).

P E Playford
DIRECTOR

Attach

3 March 1992

NOTES ON SEISMIC RISK IN RELATION TO PROPOSED EVAPORATION PONDS, MEENAAR INDUSTRIAL ESTATE

1. INTRODUCTION

At the request of the Department of State Development officers of the Geological Survey of Western Australia have prepared these notes summarising a preliminary assessment of the seismic risk in relation to the proposed construction of evaporation ponds at the Meenaar Industrial Estate near Northam.

At the time of preparing these notes, no detailed information is available in relation to the size, design, or geometry of the proposed evaporation ponds. Discussion in respect of the likely risk of damage from seismic activity is therefore generalized.

2. BACKGROUND INFORMATION

The proposed Meenaar Industrial Estate is located 12 km west of Meckering where in 1968 a major earthquake (Richter magnitude ML = 6.8) resulted in a major fault scarp 37 km long with a maximum vertical displacement of 2 m and a horizontal displacement of 1.5 m. The main fault scarp was associated with numerous minor tension fractures throughout the general area of Meckering. The Meckering Fault System and locations of the epicentres of the main earthquakes recorded between 1968 and 1990 are shown in Figure 1. A significant number of minor (ML >4.0) seismic events have been recorded within a 25 km radius of Meckering. The most significant of these events, the earthquake of ML 5.5 of January 1990 indicates that the present phase of relatively intense seismic activity is continuing. This event, while resulting in some minor damage to building structures, did not result in any reactivation of the fault scarps formed during the 1968 earthquake, or the creation of any new faults.

3. ESTIMATE OF EARTHQUAKE RISK

Gaull and Michael-Leiba (1987) have published the most up-to-date earthquake risk map of the southern part of Western Australia. This work produced a series of maps of intensity, peak ground velocity, and peak ground acceleration that correspond to a 10 per cent probability of being exceeded over a 50 year period. These maps, reproduced in Figure 2, show the following risks for the Meckering area:

- a peak intensity of VII (Modified Mercalli)
- a peak ground velocity of 160 mms^{-1}
- a peak ground acceleration of 1.6 ms^{-2}

Based on the 50-year time period being generally acceptable as a typical life-span of a civil engineering structure, these values could be used as a basis to estimate an acceptable earthquake risk.

4. IMPACT OF SEISMIC ACTIVITY ON EVAPORATION POND DESIGN AND OPERATION

Experience of the damage to earth embankment dams during seismic activity suggests that the impact of a significant earthquake could result in one or more of the following:

- slope failure of the embankment due to deformation by shaking, leading to loss of freeboard and/or overtopping;
- piping through cracks in the embankment by faulting or shaking;
- overtopping of the embankment due to seismic-induced waves or landslides into the reservoir area;
- disruption due to major fault movement in the foundation leading to loss of freeboard and/or overtopping;
- failure of the embankment by sliding along a weak layer in the foundation material.

The recent history of the Meckering area has shown that fault scarps with the potential for significant disruption to the operation of an evaporation pond can occur and resulted from the 1968 ML 6.8 event.

The design of the evaporation ponds should be such that:

- the embankment design should be stable if subjected to the accelerations and/or velocities arising from the estimated 50-year recurrence intervals given in Gaull and Michael-Leiba (1987);

- the effect of a worst case earthquake (estimated at ML 7.3 by the Mundaring Geophysical Observatory) on embankment stability is assessed and documented; appropriate emergency procedures should also be defined;

- provision is made in the design of the embankment and for the lining of the ponds to take account of the potential for the development of faults as a result of seismic activity;

- sufficient freeboard is maintained to prevent overtopping of the embankment from seismically induced wave action;

- the shape of the overall impoundment area and any subsidiary cells within the impoundment should be optimized to take account of the likely orientation of any seismically induced faults;

- the structural designs for the plant site should be in accordance with AS 2121-1979 - the SAA Earthquake Code and AS 1170.4 the Draft of the revised Earthquake Code.

Once the conceptual layout of the proposed industrial area is finalized, particularly the location of the rare earth plant and evaporation ponds, a detailed field investigation of the geological and geotechnical conditions of the site should be carried out. These investigations should address the following:

- surface and sub-surface geology of the site area;

- the availability and suitability of materials for embankment and lining construction;

- specific measures to control seepage losses from the ponds;

- design criteria for the embankment construction, including specifications on compaction control for the earth embankments during construction;

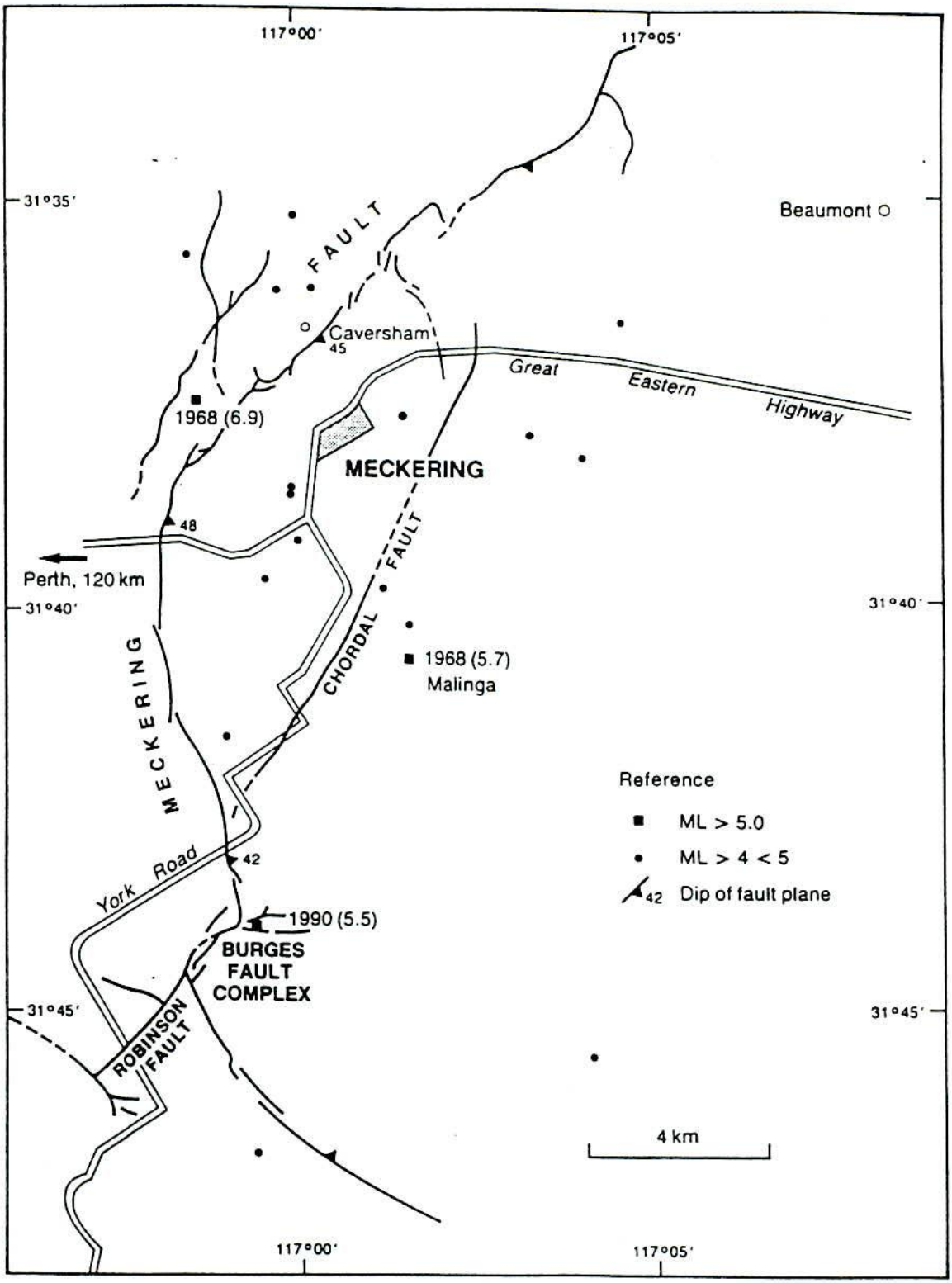
- analyses of the stability of the embankment and the ponds under the range of conditions discussed above;

- recommendations for on-going monitoring and inspection of the evaporation ponds;

- an emergency action plan to be followed should seismically induced damage occur to the evaporation ponds.

5. REFERENCE

Gaull, B.A. and Michael-Leiba, M.O., 1987, Probabilistic earthquake risk maps of southwest Western Australia: BMR J. of Australian Geol. and Geophys. 10, p. 145-151.



GEOLOGICAL SURVEY OF WESTERN AUSTRALIA

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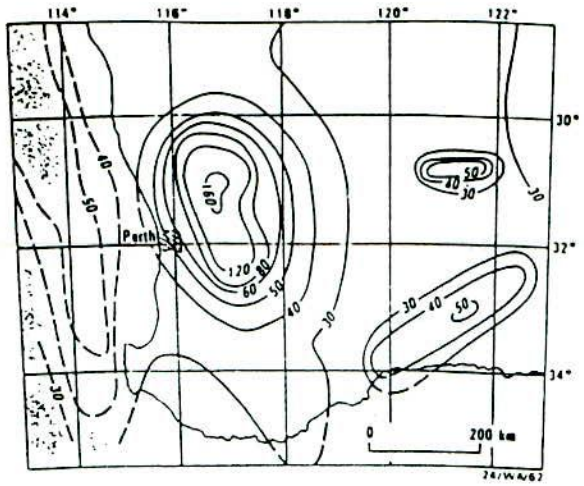
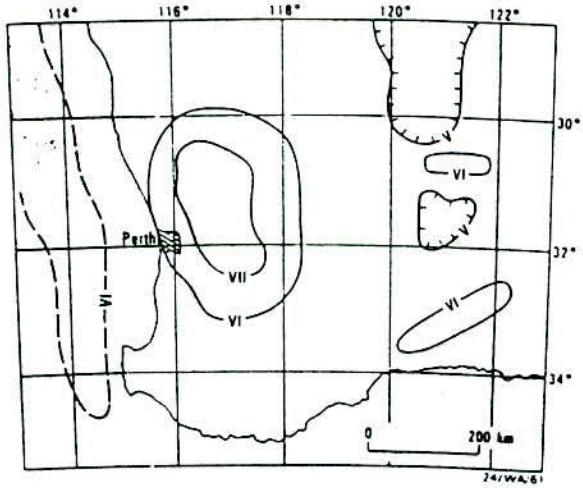
Figure 1: Meckering Fault System and epicentres of major earthquakes (1968-1990)

MAP INDEX

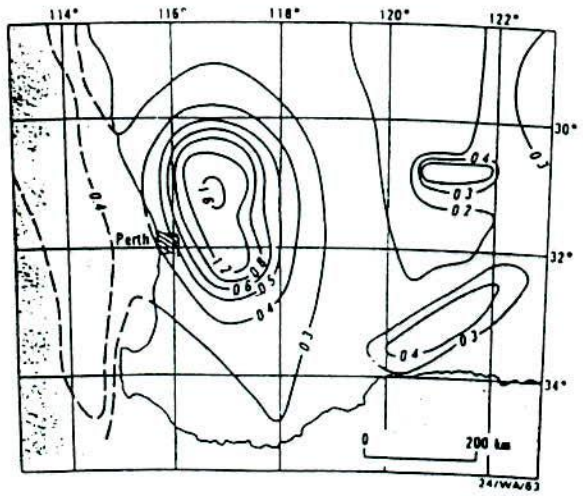
TO ACCOMPANY



Contours of peak ground velocity in $mm.s^{-1}$ with a 10 per cent probability of being exceeded in a 50 year period.



Contours of Modified Mercalli intensity with a 10 per cent probability of being exceeded in a 50 year period.



Contours of peak ground acceleration in $m.s^{-2}$ with a 10 per cent probability of being exceeded in a 50 year period.

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Figure 2: Seismic risk maps; southwestern Western Australia, after Gaull and Michael-Lieba (1987)

MAP INDEX

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