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CONSULTATIVE ENVIRONMENTAL REVIEW

MUNGARI INDUSTRIAL PARK

LANDCORP

1992

ACKNOWLEDGEMENT

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

Kalgoorlie Industrial Sites Study

CCD Australia

Flora and Fauna Survey

Ecologia Environmental

Consultants

Mungari Industrial Estate

Preliminary Layout (Looton

Kendall)

Copies of these reports are available for perusal at the offices of:

Department of State Development 8th Floor (Library) SGIO Atrium 170 St Georges Tce PERTH WA 6000

Environmental Protection Authority 8th Floor Westralia House 28 Mounts Bay Road PERTH WA 6000

Goldfields Esperance Development Authority 20 Boulder Road KALGOORLIE WA 6430

Other sources of information were supplied by the Department of Agriculture, Water Authority of Western Australia, SECWA, Goldfields Esperance Development Authority, Department of Minerals and Energy, Quilty Environmental Engineers, Department of State Development.

MUNGARI 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 Mungari Industrial Park has been prepared by the Department of State Development on behalf of Landcorp in accordance with Western Australian Government procedures. The report will be available for comment for 4 weeks:

- beginning Monday, 16 November 1992
- finishing Monday, 14 December 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 discussed in the CER or with specific proposals. It helps if you give reasons for your conclusions, supported by relevant data.

You may make an important contribution by suggesting ways to make the proposal 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: 14 December 1992

SUBMISSIONS SHOULD BE ADDRESSED TO:

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

Attention: Mr Shane Sadleir

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SUMMARY

Landcorp is the proponent for the development of a heavy industrial estate at Mungari located between Kalgoorlie and Coolgardie on 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.

An assessment of the Kalgoorlie region was initiated by Landcorp in conjunction with the Goldfields Esperance Development Authority and several potential sites were identified. After a more detailed study of these sites, Mungari was chosen as it was removed from population centres, has ready access to necessary infrastructure and has a significant (785 hectare) area that is considered to be low in mineral prospectivity due to the presence of 'monzogranites'.

The land proposed for the industrial park is on the boundary of two station properties, although the land is considered to be of poor quality for grazing.

Mungari's climate is arid with hot summers and mild winters. Rain patterns are bimodal being associated with either deluges from remnants of tropical cyclones (summer) or frontal activity (winter). Extremely high evaporation rates together with clay in the soils make the site suitable for disposal of wastewater in evaporation ponds.

An anthropological survey of the site has been carried out by the Aboriginal group Wati Yinangu Tjutgurdpa Mirl Mirl Association Inc. Findings of the survey are that the site did not have any traditional or historical significance for the traditional groups in the area.

The types of industry proposed for the site are mainly based around the mining industry either adding value to resources already produced within the region or manufacturing products for consumption by the industry. Potential impacts from noise, air emissions, odour, leachates, risks and hazards and groundwater drawdown have been assessed and control limits and 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 skills exist in the region to fill the workforce requirements for potential industries at the site. As part of this assessment report, concerned local people were interviewed and an open day was held on the site.

It is likely that development of an industrial park will meet community goals to expand the employment base in the region and reduce the dependency on gold and nickel mining. During the open day no major areas of concern

were raised by visitors to the site. In discussions with the nearest station owners and the local Karrawang community, concerns were raised in regard to:

- property devaluation
- noise, dust, lights at night, sirens
- explosions
- · activity in the buffer zone
- chemicals affecting the groundwater
- · employment, training
- long term health effects of noxious industries
- concern for rural amenity of the area
- airborne emissions
- road access to the quarry.

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 1).

2.0 INTRODUCTION

2.1 Identification of Proponent

The proponent for the development of the Mungari Industrial Park is Landcorp.

It is intended that an advisory board (The Mungari Industrial Park Advisory Board) will be formed by the State Government to oversee the development of the Mungari Industrial Park (Section 9) and may ultimately become the proponent.

2.2 Background and Objective of the Proposal

Background

The site for the Mungari Industrial Park (Figures 1 and 2) was identified after detailed investigations into potential heavy industrial sites in the Kalgoorlie region.

Investigations of potential sites in the Kalgoorlie region were initiated by the Kalgoorlie Development Corporation in the mid-1980's and followed up by Landcorp (formerly Industrial Lands Development Authority) in 1990. These studies culminated in detailed investigations of two sites: Gidji, 15 kilometres north of Kalgoorlie and Hampton, 25 kilometres south of Kalgoorlie.

The outcome of this investigation was the release in July 1991 of a report, for public comment, recommending Gidji as the preferred site for development of an industrial estate. Seven submissions were received on this report, two of which raised serious objections to the Gidji site based on the mineral prospectivity of the area.

As a result of these objections, Landcorp requested the Geological Survey Branch of the Department of Minerals and Energy to review known data on the Kalgoorlie region, and identify sites of low prospectivity. This review resulted in a report completed in January 1992 that identified five sites of low to moderate prospectivity.

Investigations were then carried out on the sites to determine:

- distance from nearest neighbours and community;
- infrastructure availability;
- land ownership and value for other uses;
- landform and vegetation;
- mineral tenements and prospectivity;
- impact of SO₂ emissions from Gidji Gold Roaster and Kalgoorlie Nickel Smelter.

From these investigations Mungari was selected by the proponent as the preferred site for development.

Landcorp referred its proposal to the Environmental Protection Authority which determined that the project required assessment as a Consultative Environmental Review (CER).

A range of detailed flora and fauna, ethnographic, archaeological, social impact, soil sampling and engineering studies have since been carried out on the area. This document has been prepared using data generated in these and other studies to meet the EPA's requirement.

Open days and public interaction are being used in conjunction with the CER document to ensure that interested individuals and groups are aware of the proposal and are in a position to contribute to the development of the site.

Objective of the Proposal

The objective of developing the Mungari Industrial Park is to ensure that the Kalgoorlie/Boulder region has a heavy industrial site that is environmentally and socially acceptable and offers industry a viable and approved location on which to develop. This is seen as a vital factor in enhancing the economy of the region through various industrial activities including downstream processing of minerals extracted in the region.

2.3 Details of Scope and Timing of the Proposal

Development of the Mungari Industrial Park is proposed to take place in a number of stages. A conceptional development plan for the park is detailed in Figure 3.

It is anticipated that the necessary State and local government approval processes will be completed by January 1993. Infrastructure for Stage 1 can proceed once these approvals are in place.

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 currently nominated capacity of 785 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 (Figure 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 Mungari Industrial Park the EPA set the level of assessment at CER, requiring four 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 comments received from interested parties, the EPA prepares 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 (CER) is to inform interested parties of the concept of a heavy industrial park at Mungari and seek environmental approval of that concept from the Minister for the Environment.

Such approval is for the concept of the industrial park only, any proposal by future proponents wishing to establish within the industrial park will need to undergo a separate environmental assessment.

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 ethnographic and archaeological factors, odour and noise control, social impact, air emissions, impact on Gidji Gold Roaster and Kalgoorlie Nickel Smelter, and the 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 have heavy industrial sites. Consequently, although a range of raw materials may be generated in these regions the lack of designated industrial areas can result in them being processed elsewhere causing loss of employment opportunities in the region of origin.

The Government has consequently committed to the development of regional heavy industrial sites.

Establishment of such industrial estates requires the identification of sites that are suitable for industrial development. A site at Northam has recently received environmental approval and sites in Geraldton, Kalgoorlie, Collie, Bunbury and the Pilbara are scheduled to obtain development approvals by December 1993.

3.2 Benefits at Local and Regional Level

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

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 will commence with the provision of road access, water from the main Goldfields supply system conduit and power from Kalgoorlie West. The estimated cost of this development is \$2.5 million.

Rail access would initially be via the Kalgoorlie sidings and a rail spur would only be installed as warranted by industry requiring bulk cargo services.

Future expansion of the industrial land in the park will be developed in discrete stages depending on demand from industry. As currently envisaged (Figure 3) the final layout plan for the park will cost in the vicinity of \$20 million.

Much of this development expenditure will benefit the local and regional economies as will construction of the new industries.

Industrial operations locating at the park are expected to source the majority of the workforce from the local community with only a small number of specialist personnel being relocated into the region.

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 business, such as:

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

Employment will also be created through the multiplier effects 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 Kalgoorlie/Boulder/Coolgardie region.

Availability of high quality, serviced and competitively priced industrial land will open up the potential for processing of the locally generated mineral resources and the local production of materials servicing the mining industry.

Such developments have the potential to be of significant benefit to both the State and Federal economies. Increased investment, development of jobs, increased value exports and import replacement will all have positive effects on the economy.

3.3 Consequences of Not Implementing the Proposal

Should the Mungari industrial park not proceed, an alternative location would have to be found in order to service industries wishing to locate in the Kalgoorlie/Boulder region.

In the event that no alternate suitable area could be located in the region then the economy would remain dependent on the international commodity markets and the wide range of benefits described in Section 3.2 would be lost to the region.

4.0 EVALUATION OF ALTERNATIVE INDUSTRIAL SITES IN THE KALGOORLIE/BOULDER REGION

4.1 Introduction

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

4.2 Location of Sites in the Kalgoorlie/Boulder Region

Significant evaluation has been carried out in order to locate sites that are suitable for industrial development (Section 2.2).

Initial studies carried out by the Kalgoorlie Development Corporation (KDC) considered 14 sites which were narrowed down to six on the basis of environmental issues, infrastructure, economics and mineral prospectivity.

A further study commissioned by the Industrial Lands Development Authority (now Landcorp) in March 1990 further considered four of the sites:

Hampton Gidji Karrawang Bonnie Vale

and concluded that Hampton and Gidji warranted closest appraisal.

Karrawang was considered untenable because of the proximity to Karrawang townsite and Bonnie Vale was considered to have high mineral prospectivity.

A detailed investigation of both Hampton and Gidji was then carried out. This study concluded that Gidji was the preferred site on the basis of observations summarised in the following table:

Criterion	Favoured Site		
	Gidji	Hampton	
Geotechnical conditions	/		
Flora	/		
Fauna	/		
Waste Disposal	/		
Hydrology	✓		
Water Supply	/		
Road Access	/		
Rail Access	Same	Same	
Power	/		
Drainage	Same	Same	
Waste Water	Same	Same	
Gas	Same	Same	
Air Transport	Same	Same	
Air quality	/		
Noise		/	
Risks and Hazards		/	
Social Impacts	Same	Same	
✓ Indicates favoured site			

This study was released for public comment in regard to the suitability of Gidji as the location of a heavy industrial park.

Seven submissions were received on the report, two of which raised serious objections to the Gidji site based on the mineral prospectivity of the area.

As a result of these objections, Landcorp requested the Geological Survey Division of the Department of Minerals and Energy (DOME) to review known data on the Kalgoorlie region and identify sites of low prospectivity.

DOME assessed eight sites (Figure 5):

Gidji
Gidji East
White Dam North
White Dam Karrawang
Mungari
Hampton West
Hampton
Depot Rocks

This study showed that on a prospectivity basis Depot Rocks, Hampton West, White Dam Karrawang and White Dam North were the preferred sites. Further work also indicated that an area of the Mungari site had low prospectivity.

Further assessment of each of these sites indicated that problems existed for:

- Depot Rocks and Hampton West in the provision of infrastructure due to the distance from power, water and railway lines.
- White Dam Karrawang and White Dam North due to drainage and proximity to settlements.

The Mungari site is well drained, is 6.5 km from the nearest settlement at Karrawang and is bounded on the North by the rail and main power line and on the south by the Goldfields water pipeline. The Great Eastern Highway is approximately 1 km south of the site.

Consequently Mungari was selected as the preferred site for development of a heavy industrial park in the Kalgoorlie/Boulder region.

5.0 DESCRIPTION OF THE PROPOSAL

5.1 Location

The Mungari Industrial Park is located approximately 26 km south-west of Kalgoorlie and 13 km north-east of Coolgardie. The nearest settlement is the Kurrawang Aboriginal community some 6.5 km north-east of the site with a population of between 80 and 100 people. The site is bounded to the north by the main Kalgoorlie-Perth railway line, to the south by the Goldfields water pipeline and the Great Eastern Highway.

The nominated site (Figure 6) includes portions of two pastoral leases. About half the site comprising the north-west sector falls within Mount Burges Station, with the balance in the east and south falling within Mungari Station.

5.2 Overall Concept of the Proposal

The overall concept of the Mungari Industrial Park is to develop a well planned environmentally acceptable industrial site that will offer an attractive and economic location for industrial development in the Kalgoorlie/Boulder region.

5.3 Types of Industries Planned for the Industrial Park

The types of industry that might locate in the industrial park could include producers of:

- flotation reagents
- surfactants
- hydrated lime
- sodium cyanide
- calcined gypsum
- titanium dioxide
- acids
- agricultural fertilisers (phosphates)
- general chemicals
- explosives
- rare earths.

Most of these industries relate either to raw materials extracted in the region or to products consumed by the local mining industry. More detailed data has been supplied (Appendix 2) on industries that are considered to have potential for development within 5-10 years.

5.4 Site Layout, Access and Road and Rail Development

A conceptual layout plan (Figure 3) has been proposed for the site. The overall site area is approximately 785ha and the area available for development by industry is 550ha. As a general principle service corridors

have been located around the perimeter of the site to avoid inhibiting site development proposals by industry.

Highway Access

An access road approximately 1.6km long connects the site with the Great Eastern Highway. The proposed connection point is on a straight section of highway which affords approximately 1.5km sight distance in either direction (Figure 3). This is of importance because of the likelihood of heavy vehicles accessing the site.

Road intersections of the access roads with Great Eastern Highway will be designed to Austroads Intersection Type "C" Standards.

Railway

The Perth to Kalgoorlie standard gauge rail line runs along the northern boundary of the site. The most economical railway siding is a spur immediately adjacent to and parallel to the main track and the topography of the site would allow a parallel spur of approximately 1.5km length in this location (to comply with Westrail maximum gradient requirements). However, the configuration of the site combined with the position of the power line and Telecom cable across the north-west corner, will probably dictate spurs within the site, as indicated on the conceptual layout. To maximise site usage (and flexibility of use) railway spurs would ideally run along the western boundary of the site. However, grades of approximately 1 in 150 along the boundary, whilst satisfactory for rail access, are far too steep for loading spurs. Nonetheless a reserve of sufficient width will be provided along the full length of the western boundary to keep open options for rail access.

5.5 Ancillary Services

The Mungari Industrial Park location has excellent access to the ancillary services with rail, road and the water pipeline all passing adjacent to the site.

Power

The 220 kV power line from Muja to Kalgoorlie passes through the north west corner of the proposed park. A 33kV line, supplying power from Boulder Substation to Coolgardie, passes along the southern boundary.

The Muja transmission line has present capacity to supply 150 MW to Kalgoorlie. Gas turbines at West Kalgoorlie provide backup generation.

The city load is approximately 20 MW and the mining load is about 110 MW, giving a total demand of 130 MW. This leaves some capacity on the transmission line to service new industry.

Initially, the park would be supplied from the Coolgardie 33kV power line. A load over 20 MW would require either new transmission works or continuous operation of the gas turbines.

Water

Groundwater in the Mungari region is hypersaline and as such is not suitable for industrial use. Consequently it is not envisaged that 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 Water Supply Scheme main pipeline which is located along the southern boundary of the park. This pipeline is supplied from Mundaring Weir and is pressurised by a series of major pumping stations. Overall supply to Kalgoorlie peaks during summer at 39-40 ML/day.

Based on estimated demand for the initial stage of the park of 1 ML/day WAWA considers it unlikely that the capacity of the pipeline will cause any constraint to development of Stage 1. Wherever possible industries within the park will recycle water in order to reduce overall demand.

As the park develops past the initial stage some upgrading of the system may be required. This would involve duplication of the line in some parts and improvement of hydraulic efficiency in other parts. Such an upgrade would require a lead time of between 18-30 months depending on requirements for pump station upgrades.

Gas

Supply of gas by SECWA pipeline is not available to the Goldfield region. Gas requirements of industry will be met by supply of LPG from Kwinana until sufficient demand exists to warrant installation of a pipeline.

Transport will probably be by rail to Kalgoorlie West siding and from there by truck to Mungari. Once a railspur is installed then delivery by rail will be possible directly to the industrial park.

It is not envisaged that a central storage facility will be established within the park for LPG. Each industry requiring gas will be responsible for establishing independent storage which will require approval from the EPA and the Department of Minerals and Energy.

Sewerage

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

Telecom

An optic fibre cable runs through the north-west corner of the site on the same alignment as the Muja-Kalgoorlie powerline. Telecom advises that if it does not prove feasible to connect into this cable the communications can be provided by a digital radio link to Kalgoorlie.

Drainage

Natural drainage from the industrial park is through drainage channels to the east and west. These channels drain northwards under the railway line and into salt lakes. One stockwatering dam is included in the eastern drainage pattern and consequently it must be ensured that runoff from the park does not contain contaminants that could harm stock.

A comprehensive drainage system will be developed for the site including stormwater retention and pollution control basins, flood limiting systems and some interceptor drainage channels along the eastern and northern perimeters. After treatment water will either be recycled or discharged into the natural drainage to the western side of the site.

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:

- 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

Where solid wastes cannot be recycled or disposed of on-site they will need to be removed to an industrial waste landfill. As such a landfill currently does not exist in the Kalgoorlie region, Landcorp and the Department of State Development will work with the Mungari Park Management Committee, the Goldfields Esperance Development Authority and local councils to locate and develop an appropriate site.

If solid waste is produced that is not suitable for disposal in a standard industrial waste disposal site, then an alternative location for disposal is the Mt Walton hazardous disposal site.

Liquid Waste Disposal

Wherever economically viable waste water will be processed and recirculated for use by industry.

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

An area has been set aside at the northern end of the site to provide for a waste water treatment plant if required.

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

5.7 Buffer Zones

Buffer zones will be established both around the Park (Figure 6) and between industries within the Park in order to ameliorate effects such as noise and air quality on the nearest neighbours.

Inter Industry Buffer

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

External Buffer

Land around the site is currently zoned rural. As part of the rezoning of the industrial area a buffer of 1km will be placed around the site within which no residential development will be allowed.

5.8 Projected Lot Size and Land Tenure

To provide the greatest possible flexibility in accommodating future industries, no lot sizes have been specified. It is expected that Stage 1 will be developed in the SE corner of the Park in accordance with plant requirements.

5.9 Method of Transfer of Land Ownership and Associated Conditions

Landcorp will negotiate with the landowners in order to obtain ownership of the industrial park through direct purchase.

Land will be sold by Landcorp 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 approvals 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

Schedule for development of the Mungari Industrial Park allows for completion of environmental assessment by January 1993, rezoning completion following soon after with the completion of infrastructure to meet industry requirements.

Overall life of the park once infrastructure has been put in place far exceeds the expected life of any one industry. Industrial estates in Europe have been operating for several hundred years with original plants/processes being updated and replaced as they become obsolete by new plants/processes

6.0 EXISTING ENVIRONMENT

6.1 Social Environment

The Mungari Industrial Park which is located within the Shire of Coolgardie is the site selected to service the Kalgoorlie/Boulder region. Kalgoorlie, Coolgardie and Kambalda are the nearest major towns to the site while Karrawang, though small, is the nearest population centre.

Kalgoorlie is the major urban centre within the region which includes the towns of Kambalda, Coolgardie, plus several other small communities/mining settlements including Karrawang, Ora Banda, Nepean, Bullabulling and Broad Arrow.

Kurrawang was established in the early 1950's as a location for care of a community of some 300 "Wongi" people. Today Karrawang runs a 'Family Care Programme' incorporating some 20-30 family groups. Total population in the town is approximately 80-100 permanent residents and between 30-60 visitors at any time. The community also operates a small emu farm rearing and selling the emus, plus carved emu eggs on a commercial scale.

The Kalgoorlie/Boulder region has a mining based economy with the mining industry employing 32% of the workforce in the region and the wholesale/retail sector supporting a further 13.5% (Figure 7).

Gold and nickel are the major commodities produced representing 96% of the one billion dollars plus mineral production from the region (Figure 7).

While the mining industry dominates the Goldfields economy, greater emphasis is being placed on developing a wider economic base and a more stable social environment. To this extent the contribution of relatively minor sectors of the economy such as agricultural and pastoral industries, tourism and manufacturing are being afforded a higher priority by the local shires.

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

6.2 Ethnographic and Archaeological Survey of the Mungari Industrial Site

An initial anthropological survey for Aboriginal sites of significance at the proposed Mungari Industrial Park has been completed. The survey was carried out by the Aboriginal group Wati Yinangu Tjutgurdpa Mirl Mirl Association Inc. who are the spiritual leaders in the area.

The finding of this survey was that the site did not have any traditional or historical significance for the traditional groups in the area.

Consultants have now been employed by Watu Yinangi Tjutgurdpa Mirl Mirl Association Inc. to formally report on the findings of the study.

6.3 Physical Environment

Climate

The region's climate is classified as arid (rainfall of less than 350 mm per annum). The area is one of the driest portions of Western Australia (Figure 8).

Average seasonal temperatures are as follows:

•	mean summer maximum	36°C
•	mean summer minimum	21°C
•	mean winter maximum	18°C
•	mean winter minimum	6°C
•	mean annual temperature	18.4°C

Kalgoorlie/Boulder has an average annual rainfall of 252mm (Figure 9) with an average of 63 rainy days in the year.

Although on average the majority of the rain falls during the summer period, rainfall is infrequent and unpredictable. It is bimodal being associated with either deluges from remnants of tropical cyclones, (summer) or frontal activity (winter).

The highest twenty-four hour rainfall recorded at Kalgoorlie is 177.8mm (recorded on 22 February 1948). Kalgoorlie has an average annual evaporation rate of 2436 mm with evaporation exceeding rainfall for all months of the year. On this basis the Mungari site will have a net evaporation rate of 2184mm.

This type of climate is ideal for the disposal of liquid effluent by evaporation with all months of the year having average evaporation rates above rainfall.

Seasonal wind roses for Kalgoorlie/Boulder 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 Mungari. There is little variation in wind direction readings for 0900 and 1500 hours. The average annual wind rose (Figure 10) shows the predominance of winds from the east through to the south. This is dominated by summer winds that are predominantly south easterly to easterly whilst the winter winds are north westerly.

On this basis the predominant winds will not be blowing from the site directly towards the local areas of population at Karrawang, Coolgardie and Kalgoorlie. A westerly wind which is the direction from the site towards Karrawang is only prevalent approximately 5% of the year.

Geology

The proposed Mungari Industrial Park is underlain by the Mungari Monzogranite which outcrops in several area of the site (Figure 11). In places the granite is overlain by quartzo-feldspathic sand, sand and lateritic gravel. The boundaries of the granite are not exposed but have been interpreted from aeromagnetic data. This data shows that the granite has been subjected to intense deformation resulting in numerous north-south trending structures.

The granite intrudes a north-west trending sequence of folded and metamorphosed volcanic and sedimentary rocks comprising parts of the Ora Banda and Coolgardie greenstone belts. However there is no evidence that these rock types occur within the site area.

Local relief is in the order of 360-400 metres AHD. The highest elevation (400 metres) occurs within the south-west section of the site and the lowest elevation (360 metres) occurs at the site's north-west perimeter.

Mineral Prospectivity

The geology is generally typical of the Goldfields. The most prospective rocks for gold (and nickel) are the "greenstones", in particular the sheared and metamorphosed basic and ultramafic igneous rocks. Gold has been found in other rock types in other areas of the Goldfields. Gold can occur in granite but is generally confined to sheared and altered granite margins. Gold mineralisation in the Mungari area is largely confined to 3 major shear zones, the Kunanalling Shear Zone and associated greenstones to the west of the Monzogranite, an unnamed shear zone which defines the south-west margin of the Monzogranite and the Mungari Shear located 3km east of the Monzogranite.

There are no producing gold mines in the Mungari area. Several occurrences or prospects have been tested extensively but to date there has been only limited production. One small resource has been reported. Exploration is continuing - the entire area is covered by Mining Act tenements, and other targets including the Monzogranite are being tested. Results to date tend to support the traditional mineralization model i.e. gold anomalies (geochemical concentrations of gold) and associated gold prospects are confined to the major shear zones within the greenstone belts.

Another important mineral commodity in the Mungari area is granite for dimension stone. At least 3 companies with tenements over the western portion of the Monzogranite are attempting to develop this potential resource. One of these companies (Stone Industries) has applied for a Notice of Intent and this has recently been approved.

Gold Prospects

There are at least 7 separate prospects in the Mungari area where gold has been located and mined on a small scale. There are no gold prospects within the area of the proposed industrial site.

Dryden's Find (Gold Mining Lease 15/6788 and Mining Lease 15/229). This prospect is located west of the Monzogranite and is situated within the Kunanalling Shear Zone. Within GML 15/6788 sheared, altered and locally mineralized greenstones are exposed in a series of shafts and costeans. In the adjacent mining lease gold occurs in shallow alluvial soils and is worked intermittently using a mechanised dryblower.

Rajah Prospect (Mining Lease 15/312) is located on a north-west trending shear zone developed in felsic volcanics close to the southern margin of the Monzogranite. Anomalous concentrations of gold (15-42ppb) in soil samples have been reported by Noranda from their adjacent Exploration Licence 15/74 (E 15/74 is now covered by Afmeoo's E15/197).

The Mungari mining centre includes at least 4 prospects (Washington's Luck, Washington Consuls, Maggie Miller and Sweet Nell) located on the north-noth-west trending Mungari Shear Zone. Recorded production from these prospects is 12.78kg gold from 889.5 tonnes of ore, i.e. an average grade of 14.37g/t.

Washington's Luck and Washington Consuls Prospects (Mining Lease 15/533) are located 3km east of the Monzogranite. The mining lease is owned by Coolgardie Gold. This company has announced a small resource amounting to 40,000 tonnes at 3.6g/t.

Sweet Nell and Maggie Miller Prospects (former Mining Lease 15/555) are located in felsic volcanics on the inferred northern extension of the Mungari Shear Zone. Sweet Nell has been the lasrgest producer from the Mungari mining centre with a recorded production of 5.77kg gold from 377 tonnes of ore, i.e. an average grade of 15.31g/t.

Unnamed Prospect (former GML 15/6957) is located 2km north-west of the Sweet Nell Prospect within an overturned syncline comprising metamorphosed dolerite interbedded with felsic volcanics.

Gold Exploration: Results from company reports held on open file by the Department of Minerals and Energy are summarised by Figure 11. This work has consisted mainly of soil sampling using either the Bulk Leach Extraction method or the more conventional analysis of the -80 mesh fraction. Locations from which anomalous results were obtained are annotated with a letter (A). For Bulk Leach samples, gold values greater than 5ppb are considered anomalous. For -80 mesh samples values greater than 15ppb are considered anomalous.

Results from the Delta Gold work east of Dryden's Find and from Noranda's surveys in the southern and eastern margins of the Monzogranite have confirmed that the most prospective areas correspond to shear zones developed in folded mafic volcanics or located within metamorphosed sedimentary rocks and felsic volcanics at sheared granite margins.

No anomalous results were obtained from the area of the proposed industrial park.

Granite for dimension stone: Companies with tenements in the Mungari area include Dodsley Pty Ltd (P 15/3019 and P15/3020); Readymix (M15/24) and the Stone Industries (M15/465). The Stone Industries mining lease is shown on Figure 11. The company has lodged a Notice of Intent (NOI) to extract dimension stone. The NOI was approved on 15 July 1991.

Regolith-landforms

The Mungari Industrial Park is located in an area characterized by an interior drainage system. The region is one of gently undulating, subdued relief broken by greenstone hills, granite mounds and low breakaways.

Seven regolith-landform units have been identified on the site, the distribution of which is shown in Figure 13. The basic mapping unit is one where there is a recurring pattern of landform, bedrock geology, regolith materials and vegetation.

Alluvial deposits of the Stacks Dam Formation (Qsa) occur along drainage channels traversing the eastern half of the area. Materials include Archaean basement rock fragment and quartz gravels and sands, silts and clays.

The Somerville Formation (Qcs) is distributed as colluvial outwash draping valley sides. Materials include dark to bright brown, poorly sorted, fine to medium grained quartz sand coated with clay minerals and iron oxide. A ubiquitous feature of this material is the abundance of epigenetic carbonate nodules in the subsurface.

Quartzo-feldspathic sand containing kaolinized granite fragments of the Mindjuring Member of the Mount Burges Formation (Qbm) is seen to overlie and be derived by mechanical breakdown of fresh granitic rock and saprolite of the Caenyie Rock Landforms.

The Stewart Formation (Ts) is a product of lateritic weathering of the granitic rocks of the Caenyie Rock Landforms. Subsequent aeolian activity has produced a wind-blown surface to the unit. It occurs as a patchwork of sand sheets on interfluve areas and valley sides. The dominant material is a medium-to-coarse-grained yellowish brown quartz sand coated with clay and iron oxide and containing fine-grained kaolin spherites.

A small patch of proximal colluvial outwash material of the Fly Flat Member of the Peters Hill Formation (Tpf) is seen around the headwaters of one of the drainage channels. The material consists of abundant pisolithic and nodular lateritic gravel with some greenstone bedrock fragments in a poorly sorted sand matrix.

Outcrops of granitic rock of the Caenyie Rock Landforms (Tcd) occur throughout the site as nascent domes. The landforms have bare, exfoliating surfaces. Similar material occurs at depth throughout much of the site overlain by the residual materials of the Stewart Formation, Mindjuring Member of the Mount Burges formation, and the colluvial material of the Somerville Formation and Fly Flat Member of the Peters Hill Formation.

Gentle domes of the Emu Hill Landforms (Ted) which consist of weathered greenstone lithologies are seen in the north-eastern part of the site.

Hydrology and Hydrogeology

The Goldfields region is one of the driest regions within Western Australia (Section 6.3). The whole region is relatively flat, between 450 and 600 metres above sea level. With low intermittent rainfall and low relief the region is one of uncoordinated drainage. Streams are seldom of any length and only flow after heavy rains, disappearing into flat lands or shallow lakes.

Mungari Industrial Park drains to the east and west into streams that run north passing under the railway line and dissipating in flats and salt lakes a few kilometres to the north. The eastern drainage line passes through a dam used for stockwatering and care must be taken to ensure that there is no potential for contamination by runoff generated from the industrial site.

Although the region has a low annual rainfall, high intensity storms over a short duration can cause sheet flow along drainage lines. Adequate drainage will be required during these events to prevent flooding.

There are no potable groundwater supplies in the area. Groundwater in the area is hypersaline (up to 250,000 mg/L. total dissolved solids) and as such is unsuitable for domestic, horticultural or stock use. The water table is expected to be 15-20 metres below the surface.

The only potential use for hypersaline groundwater is in gold processing. Extraction is taken from paleo channels and the nearest extraction bores to the proposed industrial park are over 7 km from the park boundary.

Significant increases in either the magnesium or organic content of the groundwater would adversely affect its suitability for use in goldmining so contamination by either of these constituents must be avoided. However, the distance from Mungari to the paleo channels makes any such contamination improbable.

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

6.4 Biological Environment

The Mungari Industrial Park contains, for the main part, uncleared scrub land which is being used for the grazing of sheep.

A study of the flora and fauna on the site was commissioned by Landcorp in September 1992 (Appendix V1). The following account of the flora and fauna is a synopsis of the study's findings.

The Eastern Goldfields Region is of considerable environmental significance, occupying an area known biologically as the "South-western interzone" (Burbridge, 1960; Beard, 1979). This transitional region includes flora and fauna from both the more mesic south-west land division, a region of high species richness (Marchant, 1973; Hopper, 1979), and the arid interior, as well as numerous species which are either endemic to the goldfields or have restricted geographic distributions. (BSC, 1984).

Little biological research has been carried out in the eastern goldfields despite the importance of the region. Beard (1981) details previous exploration in the area, while broad scale vegetation mapping was first carried out by Gardener (1942) and later refined by Beard (1981). It was not until the Biological Survey of the Eastern Goldfields program conducted by the Biological Surveys Committee (BSC) of the late 1970's and early 1980's that any detailed flora and fauna surveys were conducted (Newbey Continued sporadic and Hnatiuk, 1984; McKenzie et al, in press). information on the region's biota arises from EIA's of proposed industrial and mining developments, CALM research projects and opportunistic collecting by amateur naturalists. Within the hinterland of Kalgoorlie biological surveys have recently been undertaken at the Kangaroo Hills -Calooli Timber Reserves Coolgardie (Bamford et al, 1991), Black Flag, a BSC survey site (McKenzie et al, in press) and Kurrawang Nature Reserve (Chapman et al 1991).

An intensive five day field survey was carried out in the project area from 16 to 21 September 1992. Assessment of the flora and vertebrate fauna was carried out using a variety of trapping, searching and observation techniques. Detailed survey sites within the project area were chosen as being (i) representative of major habitat land forms or vegetation associations, and (ii) areas of ecological significance.

Flora and Vegetation

The vegetation was classified into types on the basis of structure, species composition of the upper-stratum and land form. In general woodlands and shrublands, dominated by Eucalyptus, Eremophila and Acacia species, predominate in the region. The density and height of vegetation reflects the

moisture content of the soils, with low vegetation being recorded on skeletal, shallow or impermeable soils, especially those associated with granite exposures (Keighery and Milewski, in press). The mix of dominant eucalypt species in the woodlands can be relatively complex in some soils. Prior to the BSC survey the regions flora had not been systematically recorded and documented. However there is still scope for intensive botanical investigation of particular habitats which were under sampled, and groups of plants that have been inadequately explored.

The surveyed area contains a mosaic of vegetation associations. The major plant communities present were:

- Dense Acacia woodlands or shrub lands in which Acacia accuminata tended to dominate. Cassia nemophila was often common in the under storey with a herb storey containing species from the Asteraceae and Goodeniaceae families. Small herb fields, with similar species composition were scattered through this association.
- Open Eucalyptus griffithsii/Eucalyptus yilgarnensis woodland over mixed sparse to moderate density shrub land and Triodia scariosa.
- Open Eucalyptus clelandii/Eucalyptus celastroides woodland over mixed open shrubland. Olearia muelleri, Cratystylis microphylla, Dodonaea lobulata and Eremophila species dominated the under storey. This association resembled the Eucalyptus griffithsii/Eucalyptus yilgarnensis community but contained more chenopods and little or no Triodia scariosa in the ground layer of vegetation.
- Open Halosarcia/Maireana/Atriplex plains interspersed with stands of Eucalyptus salubris and/or Eremophila shrubs. These areas area associated with poor drainage and salinity.
- Small woodlands of *Eucalyptus salmonophloia/Eucalyptus* transcontinentalis with a very sparse under storey in which *Eremophila* caerulea and *Exocarpus aphyllus* were common. This association occurred in clay soils with scattered calcrete.
- Small woodlands of Eucalyptus clelandii with a very sparse, low under storey composed primarily of chenopods from the genera Atriplex, Sclerolaena and Maireana. This association occurred in clay soils with scattered calcrete.
- Mixed open woodland containing a complex mosaic of dominant eucalypts over a mixed under storey. Major species were Eucalyptus oleosa, Eucalyptus clelandii and Eucalyptus salubris, however Eucalyptus salmonophloia, Eucalyptus griffithsii and Eucalyptus yilgarnensis were also observed. Chenopods were common in the ground layer, with Eremophila and Acacia species common in the

shrub storey. The mixed under storey appears to have been particularly affected by grazing of Atriplex species, which was dominant in the under storey in one side of an area divided by a fence line and notably absent on the other side.

- Small granite outcrops which support sparse mixed shrubs and herbs.
- Cleared land supporting herbs and grasses only. Such areas are typically heavily weed infested.

Flora Species of Significance

There were no declared rare flora identified within the survey area. However one species gazetted as priority species was identified: *Eremophila parvifolia* and, a further species of interest, *Ptilotus holosericeus*.

Eremophila parvifolia Small Leaved Eremophila Priority 4: Eremophila parvifolia is a low (less than 0.5 metre) slender or rounded shrub with semi-orbicular leaves 1-2mm long and a small purple to lilac flower. It appears palatable to stock and many specimens showed evidence of previous grazing. It is currently classified as a priority 4 species, that is, a species "considered to have been adequately surveyed and which whilst being rare, is not currently threatened by any identifiable factors. Within the survey area it is relatively common and occurs in a variety of vegetation associations including eucalypt woodlands and poorly drained heavy clay areas. It was also recorded at relatively high density (1-5% of total vegetation) of Eucalyptus griffithsii/Eucalyptus oleosa woodland in the 1989/1990 Biological Survey of Kangaroo Hills and Calooli Timber Reserves.

Pilotus holosericeus is a prostrate herb with radial stems up to 20 cm and terminal flower heads which are conical, densely white to golden haired with green sepals which are apically pink. The cauline leaves are ovate, 1-1.5cm and shortly uncinate and the radial leaves are obovate, shortly uncinate and 4-6cm. Within the survey area it appeared largely localised to dense clay soils, where it was relatively common. A smaller number of plants were found in clay loams in woodland association. Subsequent to this survey, a further population is believed to have been discovered in Goongarrie National Park (pers communication Andy Chapman). Whilst the species is currently not subject to any prioritisation, it has a restricted distribution in the Goldfields area and appears to show considerable intraspecies variation based on the limited number of collections available. It is therefore likely that the conservation status of the species will be reviewed and assigned a priority coding in the near future (pers comm Ray Cranfield). anticipated that a priority of 2 (i.e.", known from one or a few populations, at lease some of which are not believed to be under immediate threat...") or 3 (i.e."...known from several populations, at lease some of which are not believed to be under immediate threat..."), is probable.

Fauna

The project area lies near the boundary of two major zoogeographic regions; the mesic South West and the arid central Australian Eyrean region (Serventy and Whitell, 1976). The Eyrean zoogeographic region occupies the greater part of inland Australia and is typified by arid adapted fauna. The South-West region contains both south-eastern Bassian and Eyrean faunal elements in addition to a high level of endemism. Consequently, the study area lies within a transition zone containing species representative from both zoogeographic regions and has a high species richness.

The field survey recorded 41 bird species, 6 native and 5 introduced mammals, 11 reptiles and 1 amphibian. On the basis of literature searches and known habitat preferences the project area may support approximately 115 bird species, 25 native and 7 introduced mammals, 65 reptiles and 5 amphibians (Appendix V1 biological survey report).

Within the project area one species gazetted as Schedule 1 on the 1990 CALM Rare and Endangered Fauna Schedule as "fauna that is likely to become extinct, or is rare" potentially occurs in the study area.

Scarlet-chested Parrot Neophema splendida - scarce to rare, occasionally locally abundant, highly nomadic. Last recorded in the study area during the period 1950-1976 (RAOU, 1984). Scarce irregular visitor to the region (Storr, 1984). Preferred habitats are open to moderately dense eucalypt myall and casuarina scrubs. Reported to be common in the southern part of the Great Victoria Desert (Pizzey 1983).

Additionally, two species gazetted Schedule 2 as "rare, or otherwise in need of special protection" may also occur in the area. They include:

Peregrine Falcon Falco peregrinus: - This species is widely distributed throughout Australia. Its status is considered to be "generally uncommon, probably declining in settled regions; still well established in remote areas (Pizzey 1983). While potentially occurring in the project area, it is a wide ranging species and is not dependent on any habitat which is to be disturbed. The Mungari Industrial Estate project is not considered to present any significant impact to this species.

Major Mitchell's Cockatoo Cacatua leadbeateri: - This species is widely distributed throughout Australia, its status is considered to be "widespread but usually much less abundant than other white cockatoos (Pizzey 1983). Often occurs near timbered water courses with River Red Gums Eucalyptus camaldulensis. This habitat is absent in the study area. While potentially occurring in the project area it is a wide ranging species and is not dependent on any habitat which is to be disturbed. The Mungari Industrial Estate project is not considered to present any significant impact to this species.

Mammals

Eleven species of mammal from 6 families were recorded during the field survey, of these 6 species were native and 5 introduced (Appendix VI). On the basis of known habitat preferences and species distributions the project area may support up to 25 native species. This compares favourably with several nature reserves which occur in the Kalgoorlie region, including Kurrawang Nature Reserve and Kangaroo Hills - Calooli Timber Reserves, with 9 native species being recorded in each. However as is typical of the Goldfields region, population densities of native species, excluding macropods, appear to be very low. In keeping with the known low densities of arid populations of the Echidna Tachyglossus aculeatus (Strahan 1983), only a few scattered signs of this specie's presence were noted. Conversely the Grey Kangaroo Macropus fuliginous was moderately common. Of the native species expected to occur in the project area, 8 species are bats which forage over all vegetation associations. However specific sites such as hollow limbs, tree trunks and deep rock crevices are utilised for roosting.

Thirty percent of the native mammals which occur or are expected to occur in the project area are Eyrean in biogeographic affinities with the major proportion of their distributions in arid central Australia. Another 20% are predominately mesic south western species such as the Fat-tailed Dunnart Sminthopsis crassicaudata. The project area lies on the northern limits of this species distribution. Two bat species, Chalinolobus morio and Eptesicus regulus have Bassian affinities with distributions spanning the southwest, southeast and the sub coastal areas of the south coast. Of the Eyrean species Notomys mitchelli, Pseudomys bolami and Ningui yvonneae are near the southern limits of their range. The remaining five species, such as the Echidna and Dingo, have Australia wide distributions.

Five species of introduced mammal are expected to be present in the project area. All are widespread in distribution. Rabbits *Oryctolagus cuniculus* were uncommon and generally occurring in lower loamy soil habitats. Very little evidence of the presence of Foxes *Vulpes vulpes* were noted aside from occasional scats or track. Only a single House Mice *Mus musculus* was captured in the dense mixed shrub land on shallow granite outcropping near the Muja - Kalgoorlie Power Line. Cats *Felis catus*, though unrecorded during the survey, are ubiquitous over all Australia and would certainly be present.

Birds

Bird surveys of the project area recorded 46 species, 10 non passerines and 36 passerines. The area may support up to 115 species based on known habitat preferences and species distributions, 53 non passerines and 62 passerines. The low number of field records reflects the short duration of the survey and seasonal influences with inclement weather experienced during the survey providing an unproductive period for biological surveys. Numerous species are rare, occasional vagrant visitors and 35 species such as dispersive waterbirds occurring only in good seasons after heavy rain

(Storr 1984). The area supports a large passerine woodland and mallee bird fauna comparable to other nature reserves in the region.

The project area lies in a zone in which the ranges of species with predominately southern or northern distributions overlap. Similar to the reptiles, the greater portion of bird species have mainly arid Eyrean affinities. Ninety six species (83%) have either all or the major part of their ranges in arid Australia. However 45 of these have Australia wide distributions, such as the Emu Dromaius novaehollandiae, Boobook Owl Ninox novaeseelandiae, and the Brown Falcon Falco berigora. Numerous mesic southern species such as Western Rosella Platycercus icterotis, Regent Parrot Polytelis anthopeplus, and Western Magpie Gymnorhina tibicen dorsalis are at the eastern limit of their range. While six species have arid sub-coastal distributions spanning the Great Australian Bight, such as the Yellow-rumped Pardalote Pardalotus xanthopygus, Mallee Heathwren Sericornis cautus and Gilberts Whistler Pachycephalus inornata. species, the Blue-breasted Fairy Wren Malurus pulcherrimus and the White eared Honeyeater Meliphaga leucotis, are at the southeastern extremity of a distribution that spans the area between the mulga-eucalypt line and the heavy wooded forest of the southwest.

Within the project area the passerines predominate in abundance (53%), particularly the honeyeaters, thornbills and corvids, with large numbers of Australian Ravens *Corvus coronoides* and Yellow-throated Miners *Manorina flavigula* being present. Among the non passerines the pigeons were dominant during the period of the survey, with the Crested Pigeon *Ocyphaps lophotes* being the most common.

Reptiles and Amphibians

Pit trapping and opportunistic collecting yielded 11 reptile and one frog species from the project area. With examination of known species distributions and habitat preferences it is expected that up to 65 reptile and 5 amphibians may occur in the area. However similar to the birds, the limited survey duration and inclement weather resulted in a low number of records. This is particularly conspicuous with the lack of collection of snakes. The large arid Eyrean component of the mammal fauna is repeated in the herpetofauna. Twenty six species (49%) have Eyrean biogeographic affinities only, while a further four species (7.5%) such as Lerista picturata and Morethia obscura have a predominately arid sub-coastal distribution with range extension into the South West. Eight species, such as Gehyra variegata, Heteronotia binoei and Lialis burtonis have Australia wide distributions occurring mainly in arid and semi-arid habitats. Only a few species, such as Rhinoplocephalus gouldii, are mesic southwestern in their distribution, with the project area being on the eastern limits of their range. Within the Eyrean frogs Neobatrachus centralis and N sutor are at the southeastern extremity of their ranges.

In terms of abundance, the skink *Lerista muellerii* was common among leaf litter and dead logs in mixed woodland areas along with the *gecko Gehyra variegata* and legless lizard *Delma australis*. Widespread and common over

the project area in woodlands of smooth barked eucalypts, such as Salmon Gums and Gimlets, was the gecko *Oedura recticulata*. Numerous individuals were captured during the survey night searches. Notably absent were the snakes, due to the survey timing, short duration and wet weather.

Faunal Habitats

Faunal habitats are closely aligned with land form - vegetation associations. The spinifex/eucalypt woodland occurring on sandy soils with a dense under storey layer of Triodia spinifex provides niches for many species of invertebrate, reptile and small mammals. Small carnivorous marsupials commonly occurring would be Ningaui and Sminthopsis species. A small number of species including the Desert Skink *Egernia inornata* may be largely confined to this habitat. This association represents a transitional habitat between the arid xeric Centralian spinifex sandplains and the more mesic eucalypt woodlands. Consequently the fauna has representatives of both these zoogeographic regions.

The widely occurring tall open mixed eucalypt woodlands and dense low "Gimlet" woodlands of the project area are dominated by a highly mobile avian community, arboreal and fossorial reptiles. The woodland form habitat is the next richest after the spinifex/eucalypt woodlands with a total of up to 180 species (22 native mammal, 90 bird, 68 reptile). This habitat provides the most structural diversity, from the tall crown layer of Salmon Gums Eucalyptus salmonophloia, the dense to medium dense shrub strata to a deep litter layer. The structural diversity in turn provides a rich array of ecological niches for exploitation by vertebrate fauna. The tall eucalypts contain numerous hollows for nesting and the upper storey is utilised for foraging by birds and bats. The eucalypt woodlands are the most widely represented habitat within the project area and are in very good condition. Fossorial species such as lizards of the genus Lerista and burrowing frogs like Neobatrachus sutor utilise the extensive litter beds surrounding trees in these areas.

The dense Heath/Shrubland vegetation associations are expected to produce the third richest faunal assemblages with up to 176 species (17 native mammal, 97 bird, 57 reptile, 5 amphibian). The rich floristic nature of the association with a preponderance of flowering shrubs and dense structure attracts a large number of nectivorous and insectivorous bird species such as the honeyeaters and robins. Additionally the association is rich in insects supporting a diverse reptile fauna within the litter layer, like *Diplodactylus pulcher*, *Diplodactylus mainii* and *Delma australis*. Per unit area the heath/shrub lands are poorly represented in the project area.

A variety of unique micro-habitats exist in granite outcrops not found elsewhere. The exfoliating rock slabs, small boulders, loose soils and porous leaf litter encourage numerous species such as the frog *Pseudophryne occidentalis*, geckos and mice *Mus musculus*. Granite outcrops are poorly represented in the study area and the surrounding area generally.

Summary

From this assessment it is evident that the biological environment of the site is similar to the general region, with nothing unique in the proposed location for the park.

6.5 Air Quality

The Kalgoorlie Boulder region has, for a number of years, experienced very high spot ground level concentrations of sulphur dioxide. These sulphur dioxide levels primarily resulted from the operations of three small roasters along the eastern edge of the city. With the development of the satellite Gidji Gold Roaster these smaller roasters have been closed.

In addition to the Gidgi Gold Roaster, the Kalgoorlie Nickel Smelter also emits sulphur dioxide. On occasions high spot ground levels of sulphur dioxide result from both of these operations.

In order to control sulphur dioxide for residential areas of the Kalgoorlie/Boulder region, the EPA has implemented an Environmental Protection Policy (EPP). The purpose of this policy is to achieve and maintain a level of air quality appropriate to the residential areas of a mining town.

The EPP specifies acceptable levels of sulphur dioxide over various averaging periods and the objectives are achieved by applying conditions on the operating licences of existing industries which emit sulphur dioxide. Ambient air quality objectives for sulphur dioxide referred to in the EPP for Kalgoorlie/Boulder are:

Objective Number	Averaging Period	Acceptable Level ug/m ³
1	1 hour	2 000
2	3 hours	1 300
3	1 day	365
4	1 year	60

Under the EPP only objective No. 2 is enforceable under licence conditions with all other objectives set as goals. These objectives apply only to existing operations. New sources will be required to achieve more stringent objectives.

Both Gidgi Gold Roaster and Kalgoorlie Nickel Smelter have developed and implement shutdown strategies in order to comply with the EPP for Kalgoorlie/Boulder residential areas.

A new draft EPP released by the EPA in February 1992 extends the area to be protected in this manner to include Kambalda, Coolgardie and Karrawang. A four year phasing in period will introduce an air quality limit of 1400 ug/m³ and an air quality standard of 700 ug/m³. Compliance with the standard is expected for 99.9% of the time.

POTENTIAL ENVIRONMENTAL IMPACTS

7.1 Introduction

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

Major issues discussed are noise, air quality impacts, 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 greatest 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 Mingari 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 noisesensitive 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.
- 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 Mungari:

- 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. 14).

On this basis the noise attenuation (reduction) under worst case conditions, over the various distances would be:

Distance	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

The Mungari Industrial Park is located at a considerable distance from major population centres with Karrawang some 4.5 km from the site being the nearest town. The nearest station homesteads are 1.5 km and 9 km from the site.

Therefore in terms of noise criteria, it is expected that the Mungari site will have sufficient buffer between the site and local residents to be acceptable for industrial development. As no specific industry has as yet been proposed for the park this assessment has not addressed elevated noise sources, level components, etc. Each individual industry will be responsible for ensuring that they meet EPA noise requirements at the nearest residence.

7.3 Air Quality Impacts

Air Quality Criteria:

The EPA has released a draft EPP (section 6.5) for air quality criteria in the Goldfields Residential Areas, ie. Kalgoorlie/Boulder, Kurrawang, Coolgardie and Kambalda.

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).

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.

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.

This second criterion is directed towards ensuring the long term protection of the environment and preventing individual emitters from unnecessarily consuming the region's capacity to absorb pollutants. It should be noted that the unnecessary utilisation of the environment's 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 in the region do not result in exceedences of ambient air quality criteria.

There are a wide range of technologies available for control of emissions from industrial processes (Appendix 4). For individual industrial proposals the EPA will carry out further assessment in order to ensure that the appropriate environmental air quality is maintained. A proponent will be expected to assess cumulative effects of its proposal together with existing emitters such as Kalgoorlie Nickel Smelter and Gidgi Gold Roaster and show how the cumulative impact meets the Environmental Protection Policy criteria prevalent at that time.

Air quality objectives of the draft EPP are:-

Ambient Air Quality Limits for Sulphur Dioxide

Commencing Date	Limit	Averaging Period
1 January 1992	1300 ug/m ³	3 hours
1 January 1993	2000 ug/m ³	1 hour
1 January 1994	1800 ug/m ³	1 hour
1 January 1995	1600 ug/m ³	1 hour
1 January 1996 and 1 January in each succeeding year.	1400 ug/m ³	1 hour

The above Schedule sets out the ambient air quality limit for sulphur dioxide which is to apply in each calendar year. It is intended that the Policy objective for the air quality limit will be achieved within five years.

SCHEDULE 2

Minimum Levels of Compliance with Standards

Commencing Year	Minimum Compliance Level	Maximum number of hours over standard per year
1993	98.5%	131
1994	99.0%	87
1995	99.5%	43
1996	99.9%	8

The above table sets out the minimum level of compliance with the ambient air quality standard which will be expected by the Environmental Protection Authority; and the corresponding maximum number of hours for which the standard may be exceeded in any 12 month period. If the standard is breached more frequently than this then the Environmental Protection Authority will take appropriate action.

These criteria are expected to be formalised by the EPA, however this does not preclude a tightening of standards in the future.

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.

Impact of the Site on Gidgi Gold Roaster and Kalgoorlie Nickel Smelter

It is not expected that the new EPP (Section 6.5) will apply to the protection of air quality of any new industrial estate developed in the region. Consequently the site will have little or no impact on Gidgi Gold Roaster or Kalgoorlie Nickel Smelter.

7.4 Public Safety Management Criteria

Since Mungari 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 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;
- 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 Figure 15 compares the above levels with individual risk levels for selected voluntary and involuntary risks published by the Australian Bureau of Statistics.

There is no industry specific information on the potential hazards which might be associated with industry locating within the proposed Mungari Industrial Park. However, a cumulative risk assessment has been carried out for the Kwinana Industrial Area by Technica Consulting Scientists and Engineers. This study contained risk and hazard information on all of the plants in the Kwinana area in 1991.

Assessment of the Kwinana study resulted in a risk footprint which is approximately 1.3 km in diameter, from the centre of the industrial area to the one in a million contour.

It is recognised that the meteorological conditions at Kalgoorlie are not the same as those for Kwinana, however, overlaying the risk footprint on the proposed site clearly indicates the capacity of the site to accommodate any of those industries located at Kwinana (Figure 16). The one in a million contour extends outside the site boundary by approximately 1.25kms while the ten in a million contour is almost entirely contained within the site.

Industry wishing to locate in the Mungari 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 rail and road. 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.

Should an explosives manufacturing plant or area be proposed for the Mungari Industrial Park a second industrial area would be required in order to allow a 1 km safety separation distance between the explosives area and industry within the park.

7.5 Methods of Waste Disposal

Liquid waste would be generated by several of the potential 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 other industries will be encouraged. Reuse in this manner is based on the cost of the water treatment required to make the waste water reusable 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 Mungari:

- irrigation
- evaporation

Evaporation is considered as the preferred option for disposal at Mungari. 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 Mungari Industrial Park:

Climate data for Mungari as outlined in Section 6.3, clearly indicates that except for short period of deluge rainfall evaporation exceeds precipitation, making disposal of liquid waste by evaporation an attractive option. Design of 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 or elevated bunding may also be required for unusual weather conditions. Monitoring bores may 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).

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

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 hypersaline.

An efficient monitoring programme will be established in conjunction with the EPA, WAWA, industry and Mungari Park Management to check for any leakage into the groundwater. Should any impact occur on the groundwater, the industry will be required to rectify pond performance.

Odour:

The normal source of smell is from anaerobic digestion ponds associated with agricultural processing where the liquid has a high Biological Oxygen Demand (BOD) level. Odour is largely related to overloading the pond's ability to support the 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 or other appropriate facilities. 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 Mungari site.

7.6 Solid Waste Disposal

There are various options for the disposal of solid waste from the Mungari 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 increases 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.

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 Mungari Park Advisory Board, Goldfields Esperance Development Authority 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.

7.7 Methods of Stormwater Drainage and Erosion Control

Runoff from the site will increase with industrial development due to the increased impervious surface areas (roofs, pavements etc.)

The drainage system proposed for the site has been described in Section 5.5 and will cater for sheet flow conditions, storm flooding and pollution control by use of detention basins, depressed road formations and perimeter interception drains.

Should erosion occur, areas will be rehabilitated.

7.8 Groundwater Impacts

As the groundwater in the Mungari region is hypersaline it is considered unlikely that industrial development could have any adverse effect on the groundwater.

Hypersaline groundwater is used by the gold industry in processing plants. However, it is considered unlikely that other industries within the park would have any use for hypersaline water and if this type of water was required, it would be recovered from disposal and not from bores located in the Mungari Industrial Park. Consequently, no drawdown from groundwater usage is expected.

7.9 Impacts on Conservation Values on the Site

The project area is diverse in both flora and fauna and encompasses land form and vegetation associations which are widespread through the Goldfields region. The land form/associations are generally represented within conservation reserves in the region. Despite a history of pastoral activities the majority of the vegetation is in relatively good condition following heavy rainfall during the recent winter season. The western portion of the survey area belonging to Mt Burges Station displayed more evidence of grazing pressure, with some habitats showing selective removal of species such as *Atriplex vesicaria*.

The principal impacts from the construction of the proposed development will be the local loss of vegetated area and reduction in area of some poorly represented habitats, such as dense heath shrub lands. The area loss from the developments is insignificant in comparison to the ecological land form/vegetation units represented in the region. Severe local environmental impacts in the project area will occur. However the impacts are deemed not significant for these widely distributed vegetation associations. Modification to the habitat while extreme is of significance only at the local level. No significant flora or fauna species should be adversely affected by this development.

Biota of significance which occur within the project area are the four Priority flora species, *Eremophila parvifolia* and the flora species of interest *Ptilotus holosericeus*. These species may require special protection at specific localities within the area. Further consultation and field survey to ascertain the exact distribution of this species will be carried out to determine areas which may be retained undisturbed thereby conserving the species in the area. Appropriate planning will be applied so that the proposed industrial park will not adversely impact significant species.

The impact on the fauna is generally secondary. There will be major local impacts initially with destruction of habitat and relocation of mobile species into adjacent habitats. Impacts will be minimised by staging clearing, limiting clearing to development sites, fencing off dangerous areas and limiting road and track development.

No significant faunal habitat or community exists within the project area. The species and habitats present are widely distributed in the Goldfields as a whole. Within the project area three species are gazetted as "rare, or otherwise in need of special protection" may potentially occur. They are the Scarlet-chested Parrot Neopheme splendida, Carnaby's Cockatoo Calyptorhynchus latirostris and the Peregrine Falcon Falco peregrinus. The three species are either nomadic or wide ranging and as such are not dependent upon any habitats within the project area. It is considered that the project presents no significant reduction in habitat or impact on resident populations of these species. In total, the Mungari Industrial park will have no significant impact on the fauna of the region.

7.10 Effects on the Transport System

The Great Eastern Highway provides the Mungari Industrial Park with ready access to Kalgoorlie, Coolgardie, Perth and the Eastern States. Traffic volumes recorded by the Main Roads Department (Figure 17) at a site located close to Coolgardie in June 1992 indicates a traffic volume of 609 vehicles per day up to 1 388 vehicles per day closer to Kalgoorlie. Capacity of the current road is estimated at 5 000 vehicles per day, hence there is significant capacity to accommodate traffic associated with the industrial park.

In order to reduce traffic passing through the residential areas of Kalgoorlie, Main Roads Department had proposed a Southern by-pass to connect with the existing Eastern by-pass. The Southern by-pass is expected to be in place within two years.

8.0 SOCIAL IMPACT

8.1 Regional Setting

The study area is located about 620 km east of Perth in the heart of the Goldfields on the Trans Australian Railway.

The City of Kalgoorlie/Boulder (population 26,079 - 1991 Census, First Count) is an important centre for the area in which the site is located, providing administrative and commercial services to the region. It is a natural centre for the region with a road and rail junction extending north to Leonora, south to Kambalda, east to the Eastern States and west to Perth.

The regional economy is dependent on the mining of gold and other minerals and the volatile markets for these resources are reflected in the economic cycles of the region.

The region has a relatively high proportion of Aboriginal people (5.7%) compared to the rest of the State (2.7%) as well as a high percentage of males and a significantly lower percentage of immigrants. (Regional Labor Market Report, Department of Employment, Education & Training, Perth, WA, 1992.)

8.2 Study Area

The study area has been defined on the basis of communities likely to be impacted by the establishment of the proposed industrial park. The nearest communities to the site are Coolgardie (13 km) and Kurrawang Aboriginal community (6.5 km). The City of Kalgoorlie/Boulder is the nearest regional centre. Together with the nearest neighbours to the site, these localities form the study area.

It is possible that some of the workforce for the proposed industrial estate may commute from areas outside the study boundaries, eg Leonora, Kambalda. However, incoming workforces and attendant populations are not expected to locate in these towns, and therefore no change is expected to their social organisation. Consequently such towns are not included in the study area.

8.3 Population

Population Estimates

The following table shows the Australian Bureau of Statistics' population estimates for Kalgoorlie/Boulder, Coolgardie and the region as a whole. This data is based on the 1986 Census and was drawn from the Goldfields Planning & Development Study 1989.

	1986	1991	1996	2001
Kalgoorlie/Boulder	24 198	28 200	29 100	29 400
Coolgardie	5 190	5 200	5 200	5 200
Goldfields Region	37 625	42 300	43 500	44 300

The first counts for statistical local areas 1991 Census data for Western Australia show the following counts for Kalgoorlie/Boulder and Coolgardie.

Kalgoorlie/Boulder	26 079	
Coolgardie	5 615	

The above population projections for 1991 were therefore just over 2 000 people higher than the actual count for Kalgoorlie, and about 450 people lower than the actual count for Coolgardie.

Although the estimates show an expected continued growth rate for Kalgoorlie, Coolgardie's population is expected to remain stable.

The regional population is expected to increase over the next twenty years as the population of Kalgoorlie/Boulder increases, but most of the outlying towns in the region are expected to remain stable as the effect of previous boom periods related to gold have levelled off.

8.4 Employment Characteristics

Labour Force

The following table shows employment by industrial area for the region and has been taken from The Goldfields publication 1988.

Mining	31.8%
Wholesale/retail	13.5%
Community Services	12.3%
Construction	6.6%
Business Services	5.8%
Hospitality/recreation	5.8%
Manufacturing	5.2%
Transport/storage	4.9%
Agricultural/pastoral	4.6%
Other	9.6%

Not surprisingly the major employer in the Goldfields is the mining industry and this is expected to be true for both Kalgoorlie/Boulder and Coolgardie where the economies are based largely on existing gold and other mines in the surrounding hinterland.

Although there is not a high proportion of managers and administrators there is a high level of skilled people indicated by the large proportion of tradespersons. The presence of a large mining sector indicates that the labourforce in the region is likely to have skills compatible with the potential industries identified for the proposed development (see Appendix 2).

Employment

Despite the large proportion of tradespersons in the region, trade skills are traditionally in short supply, particularly in the areas of fitters, heavy duty mechanics and diesel mechanics. (Regional Labour Market Report, Department of Employment, Education & Training, Perth, WA, 1992.)

Labourforce by Occupation in Region			
Major Occupation	% of Total	% WA	
Managers & Administrators	7.5	12.1	
Professionals	8.4	10.8	
Para-Professionals	7.4	7.0	
Tradespersons	16.5	15.9	
Clerks	11.4	16.9	
Sales & Personal Service	10.9	12.7	
Plant & Machinery Operators	16.8	7.8	
Labourers & Related Workers	18.5	14.8	

(Regional Labour Market Report, Department of Employment, Education & Training, Perth, WA, 1992.)

Perhaps because of its reputation as an area of strong economic growth and employment opportunity, a significant proportion of the labor market has moved to the region to gain employment. The labourforce is therefore considered more transient, moving on when conditions worsen. It is correspondingly likely that people will relocate to the area to work at the proposed industrial park.

Unemployment

As mentioned earlier, the labourforce in the region tends to be transient and related to demand so that people leave the region in times of downturn. This could explain the relatively stable unemployment rate for the region.

The following table shows the unemployment rate for Coolgardie, Kalgoorlie/Boulder, the region and Western Australia.

	Employed	Unemployed	Labourforce	UE Rate (%)
Coolgardie	2568	164	2732	6.0
Kalgoorlie/Boulder	12958	1028	13986	7.3
Region	15709	1213	16922	7.2
Western Australia	757183	88210	845392	10.4

(Regional Labour Market Report, Department of Employment, Education & Training, Perth, WA, 1992.)

Although some local employment could be expected from the proposed industrial estate, especially in the area of contract work such as earthmoving and landscaping the comparatively low level of unemployment in the region suggests that a high proportion of the workforce would relocate from outside the region.

8.5 Social Infrastructure

Education

The following table shows schools and students according to relevant State Education Department Statistical Divisions for 1991.

Government and Non Government Schools 1991 South Eastern Statistical Division

	Schools Government	Non- Government	Students Government	Non Government
Coolgardie	5	1	956	116
Kalgoorlie/Boulder	11	4	3,535	906

(The table includes both primary and high schools and was provided by the Goldfields Esperance Development Authority).

The construction of an additional junior primary school in Kalgoorlie this year to cater for a further 250 children together with the existing facilities shown above is expected to provide an adequate service for any incoming workforce.

Tertiary education is provided to the region via the WA School of Mines, an annex of Curtin University, and the Kalgoorlie College.

Health

Hospital administration put the current bed availability at the Kalgoorlie Regional Hospital at 100, but anticipated that this could be increased to a capacity of 190 without significant new infrastructure if required.

Industrial accidents/illnesses related to the mining sector are currently adequately catered for and, barring a major industrial accident on the proposed site, there are no difficulties foreseen in meeting its needs.

In the event of a major industrial accident, the Kalgoorlie Regional Hospital would act as a transfer point for casualties to Perth.

Accommodation

The Kalgoorlie/Boulder Tourist Centre reports the annual average occupancy rates for Hotels, Motels and Guest Houses with facilities in accordance with the following table.

	No of Rooms	Occupancy Rate
Kalgoorlie/Boulder	1076	52.33%
Coolgardie		29.28%

These occupancy rates indicate that short stay accommodation would be able to cope with any increase in activity in the area brought about by the proposed industrial park.

Due to continuing strong growth there is a high level of demand for residential land in Kalgoorlie/Boulder. This has led to a relative shortage, but has triggered moves by DOLA to develop additional blocks (already prefigured in the concept plan developed by DOLA some three or more years ago). Land will also be made available by the imminent relocation of the existing airport in the near future. Any increased demand for residential land generated by the development of "Mungari" can be accommodated within existing planning provisions.

8.6 Tourism

Tourism is estimated to account for only 6% of employment in the region and generates a small but significant income. The industry has been identified as having considerable growth potential. (Regional Labour Market Report, Department of Employment, Education & Training, Perth, WA, 1992.)

It is evident from the amount of mining activity in the area and the low conservation priority for the area that tourism does not depend on "scenic" surroundings. The proposed industrial park is therefore not likely to have a negative impact on tourist activity.

8.7 Transport

The major transport routes to and from the site are the Great Eastern Highway and the Trans Australian Railway.

Roads

The flow of traffic is expected to increase as the industrial estate develops and the majority of the workforce is expected to commute from

Kalgoorlie/Boulder. The Great Eastern Highway is capable of carrying a large number of extra traffic movements per day (Fig 17) so the increased flow of traffic is not expected to impact on other road users. The highway is built for heavy haulage traffic bound to and from the Eastern States and any extra truck movements associated with the site are not expected to impact on other road users.

A Southern bypass is planned for Kalgoorlie in the next two years and this should be in place well before any industries locate at the Mungari industrial park. Increased traffic flow should therefore have little impact on Kalgoorlie/Boulder.

Rail

Increased use of the Trans Australian Railway is not expected to impact on the community at Kalgoorlie. Issues to do with hazardous material will be dealt with in relation to the approvals process for particular industries that locate at the proposed Mungari site.

8.8 Nearest Neighbours

Residences

Only one near neighbour to the site was identified. The Mungari Homestead is approximately 1 km from the site. Discussions are underway with the property owner regarding purchase of the land for the industrial park. Part of the agreement will include the relocation of boundary fences for the properties along the perimeter of the industrial core.

The residence is on a pastoral lease and the occupiers manage the property as a sheep station. Future plans for the property include diversification into cattle, the regeneration of salt bush in the area and the implementation of a five year management plan.

Rural Amenity

The rural amenity of the area is likely to be disturbed by the development of industry. Nuisance effects from potential industries could possibly affect the nearest residence as it is situated on the border of the buffer zone. For example, even though noise will be kept to standard EPA levels at the edge of the buffer, it is possible that such background noise may be louder than noises associated with the present rural atmosphere, and therefore likely to disturb the nearest residents.

The residence of the other property containing part of the site is approximately 9 km away from the site, putting it well outside of potential impacts from nuisance effects.

Quarry

A small quarry was identified within the buffer zone. The owners are currently engaged in proving up work to establish the viability of the quarry as a source of granite and dimension stone. It is anticipated that the quarry activity will be compatible with the proposed industrial park and will be an appropriate activity for the buffer zone.

Property Value

The properties of consideration are that of the land owners and the quarry site. Both agriculture and quarrying are compatible activities with the buffer zone, and so property values should not be impacted by development of the site.

Nuisance Effects

Common nuisance effects are noise, dust, lights at night and emissions. The nearest neighbour to the east of the site, could potentially be impacted by nuisance effects. Nuisance effects from potential industries would be likely to affect the nearest residents situated on the boarder of the buffer zone.

As particular industries locate at the site, the nuisance effects associated with them will be assessed in relation to the nearest neighbour.

Gubrin Aboriginal Community

It is understood that the Gubrin Aboriginal Community Inc has expressed interest in purchasing one of the properties on which the site is located to run as a pastoral property and training school for the region's unemployed youth. As it is protected by an adequate buffer zone, this proposed activity is likely to remain appropriate land use.

8.9 Coolgardie

Coolgardie is the nearest major town to the site located 17 km to the east of the designated industrial park. The Coolgardie Shire has two population centres, Coolgardie and Kambalda.

The 1986 Census put Coolgardie Shire's population at 4,866 and the 1991 Census first counts for Western Australia put Coolgardie Shire's current population at 5,615. This indicates an overall increase of 15.4% and makes Coolgardie the fastest growing Shire in the region. This growth, however, can be accounted for by WMC's Kambalda Nickel Operations. Population projections indicate that the population is likely to remain stable through to 2001.

Coolgardie is a service town and dormitory for a number of Goldmines located in its hinterland. It is also situated in a comfortable location for travellers to overnight there on their way to Kambalda. Coolgardie has a low rate of unemployment (6%) and so is not expected to contribute disproportionately to the labourforce for the industrial estate. The proposed industrial park is not expected to impact significantly on the infrastructure at Coolgardie.

Discussions with the Shire President indicate that Coolgardie Shire would like to encourage the establishment of residential capacity to service the industrial site.

8.10 Kurrawang Aboriginal Community

The Kurrawang Aboriginal Community celebrated its fortieth birthday in October 1992. Kurrawang began as a Christian Mission in the early 1950s. The last 10 years has seen a trend towards community development programs and the establishment of a Federally funded Community Development Employment Program (CDEP) as well as a number of enterprises such as the Kurrawang Emu Farm.

The population, according to the community's administration officers, ranges from 80-100 permanent residents and there can be between 30-40 visitors in the community at any one time. The community school goes from grades one to seven and is associated with the Christian Aboriginal Parent Directed School located in Coolgardie. The community has a health clinic, sporting facilities, an administrative and store complex, chapel and conference centre as well as accommodation for conventions, usually used by Christian gatherings.

Community enterprises include the Community Store, an Emu Farm, a tourism and visitors complex associated with the Emu Farm and the Federal Community Development Employment Project (CDEP).

Currently the community is preparing a feasibility study on the commercial production of lucerne and examining the possibility of a commercial market garden.

In the longer term it is hoped to establish a tannery and small abattoir that could process the emus.

Community representatives spoken to identified the benefits of the proposed industrial estate as being an improvement to the tourist potential of Kurrawang, an opportunity for improved services and employment opportunities.

In particular, opportunities for sub-contracts such as small earth moving contracts and landscaping as well as direct employment, apprenticeships and training were identified.

Concerns were related to the potential for toxins to be borne on westerly winds from the proposed site towards the community.

It is not considered likely that emissions from the potential estate would affect the community, especially since the wind roses indicate few westerlies. See Section 6.5 and 7.3 for more detailed discussion of Air Quality.

8.11 Compatibility With Community Goals & Objectives

One community based environmental group was identified in the area. Goldfields Against Serious Pollution (GASP) has been in existence since the early eighties. GASP's objectives are to ensure that development in the area is environmentally acceptable and to prevent the region in becoming a "dumping ground" for noxious industry.

The importance of growth and development in the region is reflected in the statements of support by the local municipalities. Poor community attendance at the open day could also reflect a lack of community concern about the proposal, indicating a high comfort level in the community about industry. Given that the regional economy is based on mining and the population is used to industry, it is likely that the development of the industrial park is compatible with community goals and objectives.

8.12 Public Participation

A number of strategies were used to involve the local community in developing the concept for the proposed industrial park.

The level of knowledge of the proposal was high due to a number of media reports about a similar industrial park in the Northam area, prior to the Government's decision to proceed with approvals for the site.

Apart from the more generalised media reports, the level of knowledge of the proposal was increased, and the opportunity for the community to provide feedback to the project team was provided, at an open day on Saturday 3 October 1992.

The open day was held on the site and was not well attended by members of the public (5 people).

A full page advertisement was placed in the local newspaper advertising the open day and providing information about the proposed industrial site. The nearest neighbour to the site was interviewed and a presentation was made to the nearest community, the Karrawang Aboriginal Community.

Specific issues raised in relation to the proposed industrial estate were:

- property devaluation
- noise, dust, lights at night, sirens
- explosions
- · activity in the buffer zone
- · chemicals affecting groundwater
- employment and training
- long term health effects of noxious industries
- · concern for rural amenity of the area
- airborne emissions
- road access to quarry
- waste minimisation.

A Community Liaison Committee was established to progress the approvals for the industrial estate. The Committee is chaired by the Goldfields-Esperance Development Authority and has a membership of local authorities, business and industry, Aboriginal, pastoral and environmental representatives.

The initial meeting for the Committee was held on 10 August 1992.

Consulted groups and organisations:

Group/Organisation	Personal Contact	Telephone
Kurrawang Aboriginal Commun	ity X	
GASP	X	X
Nearest residence occupiers	X	
Quarry owners		X
Health Department		X
Coolgardie Shire Council	X	
City of Kalgoorlie/Boulder	X	

8.13 Construction Work Force

Temporary or short term accommodation is provided by a number of motels, hotels, hostels, guesthouses, caravan parks and single persons quarters. Excluding youth hostels, Kalgoorlie/Boulder has about 1076 rooms. The annual average occupancy rate for Kalgoorlie/Boulder is 52.33%.

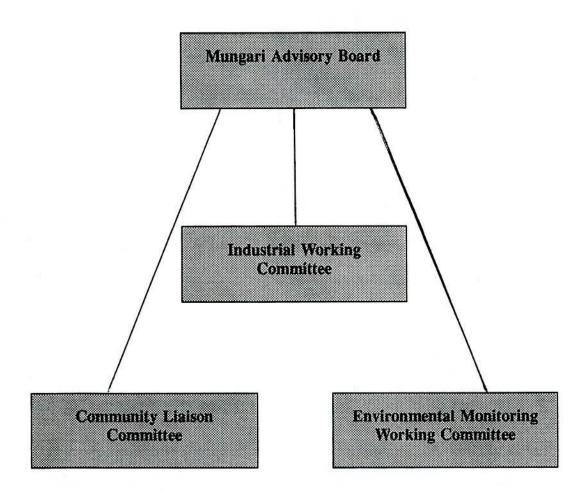
If a workforce of 120 people per plant is used as a basis for average construction workforce numbers then it is unlikely that temporary accommodation in the area would be adversely affected if existing accommodation is used.

It is, however, also possible that construction workforces will locate on site.

Management and location of construction workforces will be one of the terms of reference of the Mungari Advisory Board.

8.14 Advisory Board

It is proposed that a committee will be responsible for the management of the Industrial Park. Based on the structure of Kemerton Industrial Park, it is proposed that the advisory board 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 and other community representatives (eg Kurrawang residents and nearest neighbours).

By ensuring adequate community representation on the advisory 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. formulate the overall policy for the industrial park.
- 2. implement the Concept Plan.
- 3. provide direction to the working committees within the context of the developmental policies for the industrial park.
- 4. advise the State Government through 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, eg

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

8.15 Social Commitments

- 1. The proponent will establish a advisory board for the industrial park made up of representatives from Government agencies, community representatives and other appropriate agencies (ie workers, industry).
- Ongoing community consultation will be one of the tasks of the advisory board.
- 3. The development of local employment strategies will be one of the tasks of the advisory board.
- 4. The advisory board 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 Mungari 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 Mungari 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 and reflected in 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 Mungari Industrial Park, Landcorp 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 assessment process will be applied by the EPA in assessing the environmental acceptability of new proposals.

9.4 Monitoring

In order to assess changes 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 Mungari Advisory 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 Advisory 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 Advisory 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 specified 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 Tree Buffer on Site Perimeter

It is proposed to develop a zone around the industrial site within which a 'buffer' of local trees will be developed in order to reduce any disturbance to the rural amenity through visual impact. Priority will be given to development of this buffer in areas close to the nearest neighbours and the main rail line.

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 Mungari Industrial Park Advisory Board 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 Environmental Protection Authority, 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 Goldfields Esperance Development Authority and local shires to locate a suitable industrial waste site as soon as environmental approval for the Mungari 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:

 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.
- 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.
- 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 sulphur dioxide levels meet the requirements specified in the EPA's Environmental Protection Policy for Goldfields Residential areas.

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.

Transfer of Land

The proponent will ensure that leases or transfers of land to occupiers/purchasers within the industrial park are dependant on development proposed on the land meeting environmental criteria for industrial developments.

Referral of Proposals

The proponent will refer to the Environmental Protection Authority all proposals for development within the park.

APPENDIX II

Description of Industries with the Potential for Development at Mungari within 5 - 10 years

Flotation Reagents

Xanthates are used by the mining industry in the flotation process of nickel. Production requires ethanol, caustic soda and carbon disulphide.

Estimated project parameters are:

plant capacity 8-10,000 tpa capital investment \$5-10M employment 15-20.

Sodium Cyanide

Sodium cyanide is used as a reagent in the gold mining industry. Australia currently has plants at Kwinana and Gladstone, Queensland. The mining industry in the Goldfields region is a major consumer of this product.

Estimated project parameters are:

plant capacity 20-40,000 tpa capital investment \$15-20M employment 25-30.

Hydrated Lime

Hydrated lime is consumed by the gold and alumina mining industries. Currently the only plants in Western Australia are located in the metropolitan area.

Estimated project parameters are:

plant capacity 5-10,000 tpa capital investment \$40-50M employment 20.

Calcined Gypsum

Calcined gypsum is used in the production of plaster board for use in housing construction. Significant deposits of gypsum are available in the region.

Estimated project parameters are:

plant capacity 5-10,000 tpa capital investment \$2-5M employment 5-10.

Titanium Dioxide

Titanium dioxide pigment is used in the paint industry to give the paint its opacifier or hiding power. The process involves chlorination of synthetic rutile to produce titanium tetrachloride which is then oxidised to produce pigment.

Estimated project parameters are:

plant capacity

50-70,000 tpa

capital investment

\$2-5M

employment

5-10.

Phospate Fertilisers

Deposits of phosphate rock are located in the Goldfields region. These can be converted into fertiliser by reaction with sulphuric acid.

Estimated project parameters are:

plant capacity

500,000 tpa

capital investment

\$100M

employment

50-60.

Rare Earths

Several deposits of rare earths have been located in the region. These deposits have the potential to be processed into the individual rare earths by cracking with caustic soda and further processing with acids, ammonia and solvents.

Estimated project parameters are:

plant capacity

5-10,000 tpa

capital investment

\$50-100M

employment

40-50.

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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)
- . Health Department Discussion Paper on Industrial Waste Disposal
- . Dangerous Goods (Road Transport) Regulations 1983

The major policies applying to waste disposal on the Mungari 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

Soil Types at Mungari

APPENDIX IV

SOIL TYPES AT MUNGARI

Stewart Formation (Ts)

<u>Derivation of name</u>: Stewart Siding, grid reference E2911 N65779, Dunnsville 1:100 000 sheet 3036.

Type section: 1.8 m of sand exposed in a railway cutting at grid reference E2766 N65988 19 km north-east of Wallaroo Siding (Figure 10).

<u>Distribution</u>: Occurs as a patchwork of large-scale sand sheets on interfluve plateaux, valley sides and the continental divide.

<u>Lithology</u>: Bright yellowish brown (10YR6/6) framework supported, moderately to well-sorted, medium to coarse, subangular to subrounded quartz grains coated with clay and iron oxide, and fine grained kaolin spherites. Bimodal to polymodal, finely negatively skewed.

Thickness: Ranges from 0.2 to 4.5 m.

<u>Stratigraphic relationships</u>: Upper boundary is typically the modern land surface. In places is overlain by the Stacks Dam and Gidji Formations.

Synonyms: Sandplain material of Kriewaldt (1969a); Sandy loam of Kriewaldt (1969b). Can be correlated with the Gibson Formation of Glassford (1987) and Bullimore unit of Churchward (1977).

Mindjuring Member (Qbm) of the Burges Formation

<u>Derivation of name</u>: Mindjuring Rock, grid reference E2611 N65808, Dunnsville 1:100 000 sheet 3036.

Type Section: 1.5 m of quartzo-feldspathic sand in a sand pit at grid reference E2617 N65825 5 km west of Wallaroo Siding (Figure 10).

<u>Distribution</u>: Occurs as gently sloping sheets surrounding bare granite outcrops along major drainage divides.

<u>Lithology</u>: Brown (10YR4/6) to bright reddish brown (5YR5/6), poorly sorted, medium to coarse, angular to subrounded quartz sand with feldspar and mica, and some medium gravel-sized, subangular to subrounded granitic rock fragments, most of which show various stages of kaolinization, and some calcrete fragments. Bimodal to polymodal, negatively skewed.

Thickness: Thin veneer up to 2 m.

<u>Stratigraphic Relationships</u>: Upper boundary is the modern land surface. Overlies fresh granitic rock and granitic saprolite of the Caenyie Rock Landforms. Interfingers downslope with the Somerville Formation. Overlain by the Stacks Dam Formation in places.

Fossils: No fossils have been found.

Synonyms: Granite wash of Kriewaldt (1969a); Quartz and feldspar sand of Kriewaldt (1969b). Can be correlated with the Leinster unit of Churchward (1977).

<u>Discussion</u>: The unit is the weathering product (grus) of granite and forms without intermediate cobble and pebble-sized debris. The bimodality of the granite weathering products has been shown by Kesel (1977) to be one of the controlling factors in arid granitic landscapes.

Somerville Formation (Qcf, Qcs)

<u>Derivation of name</u>: Somerville, 4 km south-west of Kalgoorlie, grid reference E3505 N65945, Kalgoorlie 1:100 000 sheet 3136.

<u>Type Section</u>: 1.5 m of silty sand with epigenetic carbonate nodules in the subsurface in a gravel pit at Somerville, grid reference E3490 N65948 (Figure 10).

<u>Distribution</u>: Widely distributed as colluvial outwash plains filling basins and broad, major valleys (Qcf), and draping valley sides (Qcs).

<u>Lithology</u>: Dark brown (10YR3/3) to bright brown (7.5YR5/6), poorly to moderately sorted, fine to medium, subangular to subrounded quartz sand coated with clay minerals and iron oxide. Abundant medium gravel-sized epigenetic carbonate nodules in the subsurface with some fine to medium, subrounded mafio lithic fragments.

Thickness: Ranges from 0.3 to 15 m.

<u>Stratigraphic relationships</u>: Overlain by the Stacks Dam, Arrow Lake and Gidji Formations in many places on dissected surfaces. Overlies the Stewart Formation. Interfingers with the Mindjuring and Bullabulling Members of the Mount Burges Formation and the Fly Flat Member of the Peters Hill Formation.

Fossils: No fossils have been found.

Synonyms: Loam with kankar of Kriewaldt (1969a); Loam with kankar nodules of Kriewaldt (1969b). Can be correlated with the Menzies Formation of Glassford (1987) and Juliet unit of Churchward (1977).

<u>Discussion</u>: The unit is a colluvial unit, transported by sheetwash, which mantles the slopes and chokes major valleys of the area as valley-bottom and valley-side deposits. While the bedrock types on KALGOORLIE and DUNNSVILLE vary greatly, the colluvium developed from each rock type has broadly similar characteristics.

The sediments are indicative of semi-arid conditions in which the regolith was stripped from poorly vegetated hill slopes and laid down in major valleys and basins.

Carbonate nodules are a characteristic feature of the unit. These occur in the subsurface below a depth of 20 cm and are generally present throughout the profile.

The section on weathering and its effects gives details of the nodules. Samples of nodules were submitted for radiocarbon dating. The central core produced a date of >35 200 BP, while the outer skin was dated as $15\ 700 \pm 520$ BP (P. Thorpe, pers. comm.).

Systemic Description of the Landform Units

Granite and greenstone bedrock landforms cannot be conveniently defined and described using the formal lithostratigraphic approach adopted for the regolith units because regolith occurs as a very thin veneer or is absent over these units.

A more geomorphological approach has therefore been adopted.

Caenyie Rock Landforms (Tci, Tcd, Tcs)

<u>Derivation of name:</u> Caenyie Rock, grid reference E2810 N65740, Dunnsville 1:100 000 sheet 3036.

Geology: Massive Archaean granite with minor quartz reefs.

<u>Geomorphology</u>: Granite hills, inselbergs, bornhardts, and domes (Tcd) and tors (Tci). The unit also includes gentle flanking slopes on a bevelled, weathered rock substrate, and stripped zones above breakaways (Tcs).

The hills, inselbergs, bornhardts and domes have bare, exfoliating surfaces broken by joint clefts and benches with rock debris. Tafoni are common.

The flanking slopes are concave, with rock outcrops in the upper parts and lightly dissected detrital veneers in lower parts.

Gently sloping stripped zones, covered by a veneer of silcrete rubble, often occur above breakaways.

Silcrete and granite outcrop as pavement.

Much of the unit is underlain by deep pallid zone saprolite showing varying degrees of silicification.

Synonyms: Granite of Kriewaldt (1969a, 1969b). Can be correlated with the Falconer and Blackburn units of Churchward (1977).

APPENDIX V

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 dioxide 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 has been discussed earlier. 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 <u>thermal oxidation</u> 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 <u>direct combustion</u> 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 <u>catalytic oxidation</u> 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

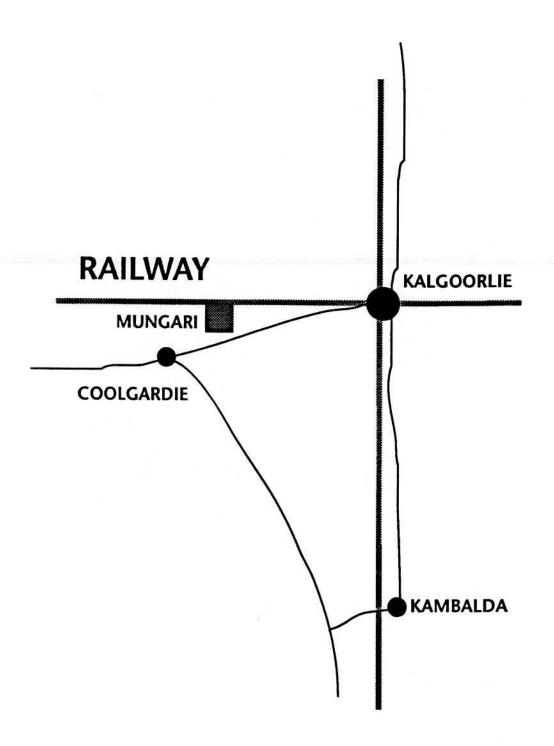
Washing, absorption and reactive scrubbing all involve gas-liquid diffusion for removal of odoriferous components from the vapour phase. This technique is used when the gas has a high moisture content and can handle large volumes of gas economically.

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 or odour counter-acts can also be used to address specific odour problems.



RAILWAY

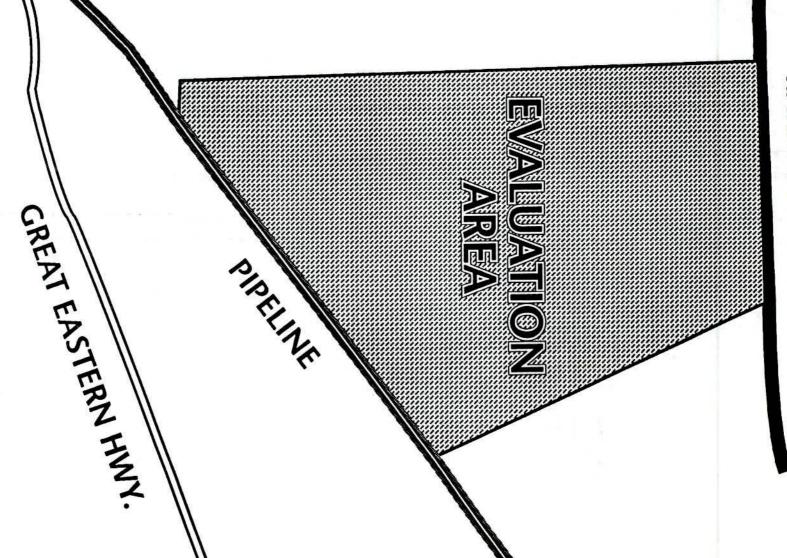
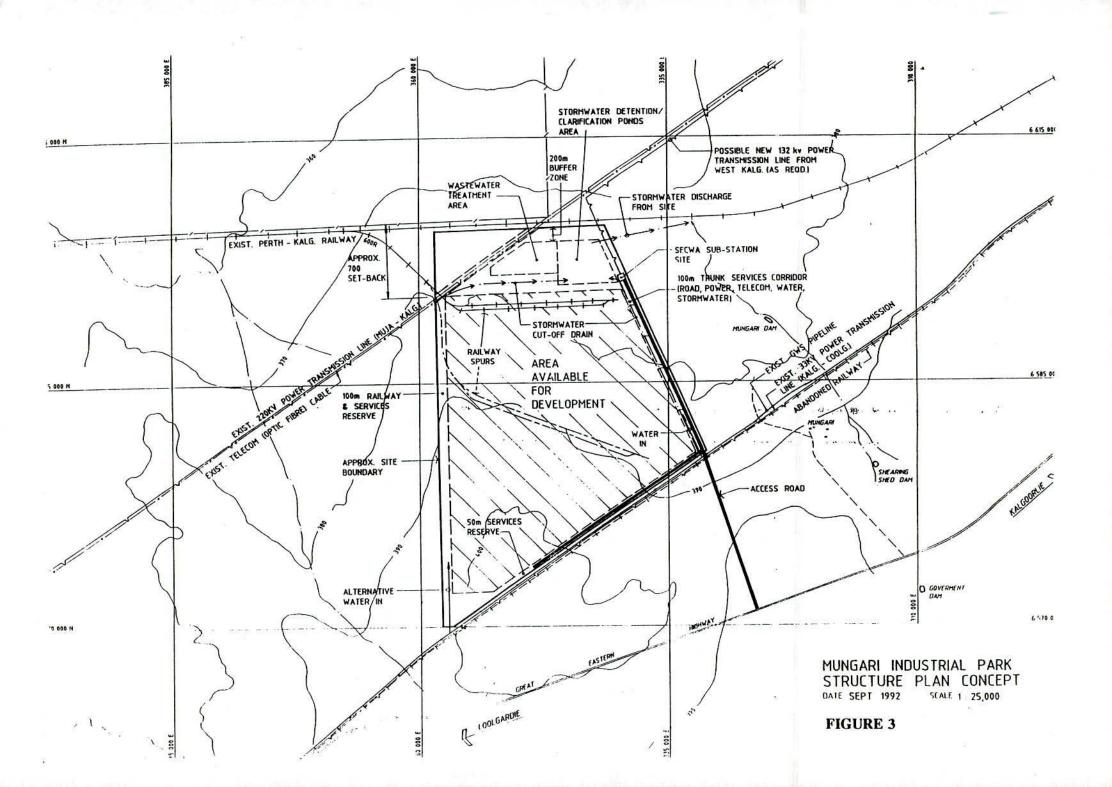


FIGURE 2

Mungari Heavy Industrial Park Location



Public Consultation Process

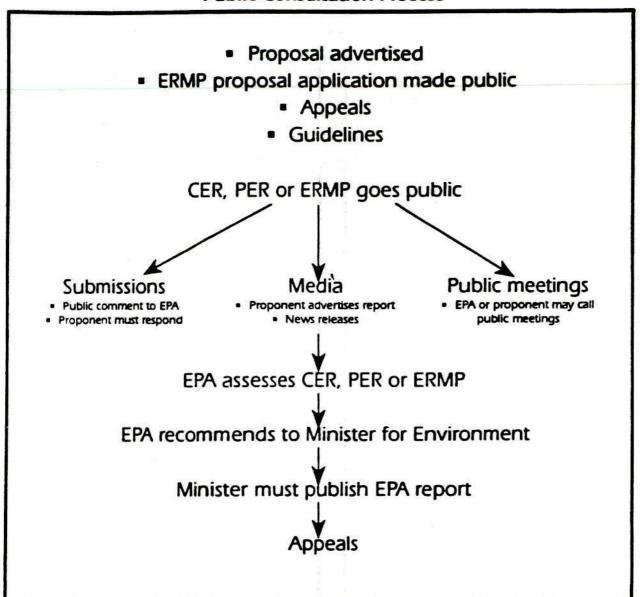
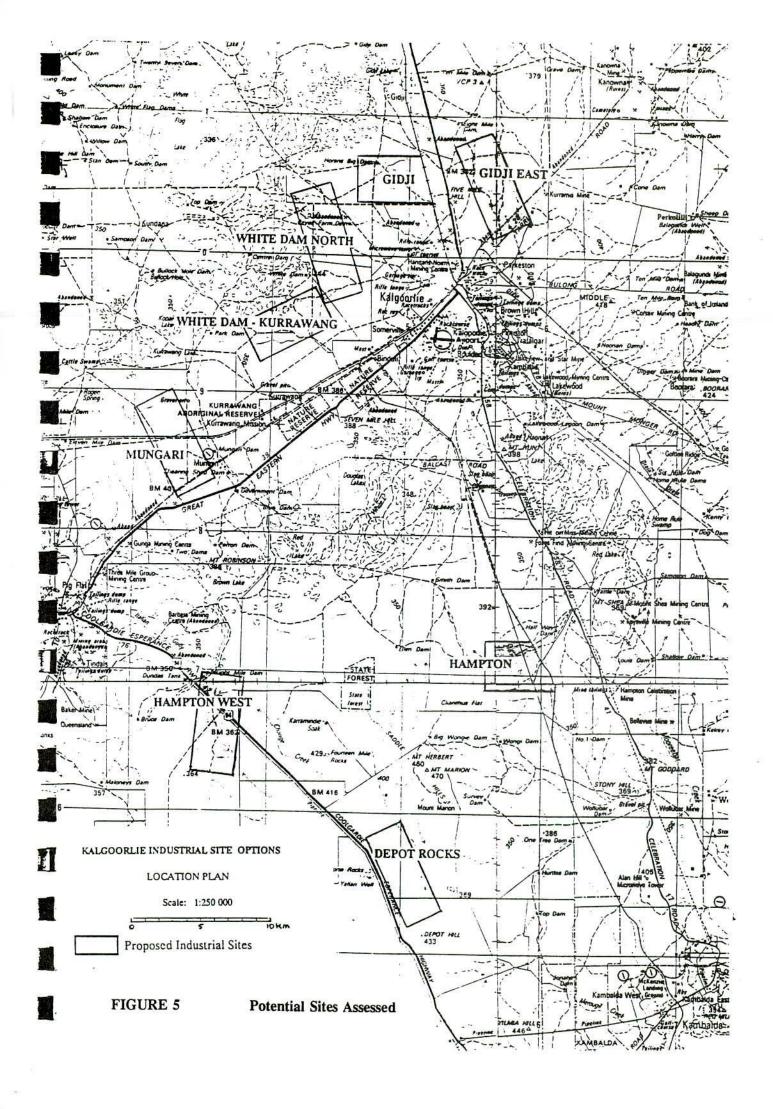
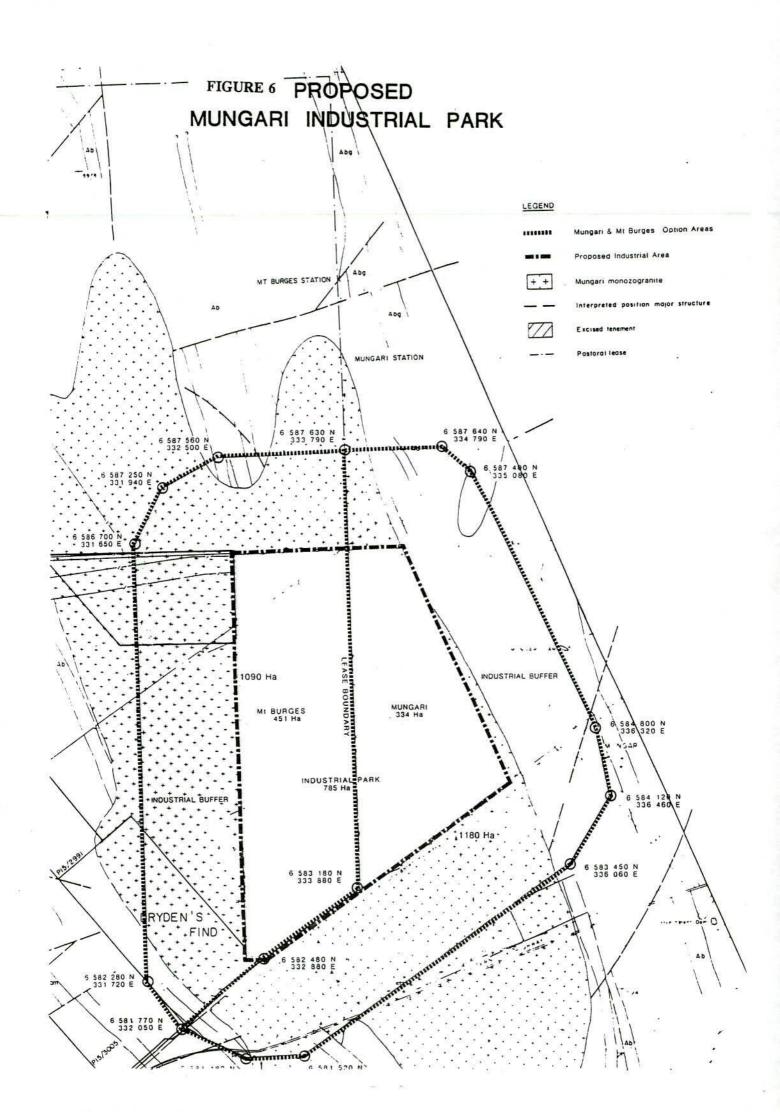


FIGURE 4 Environmental Assessment Process



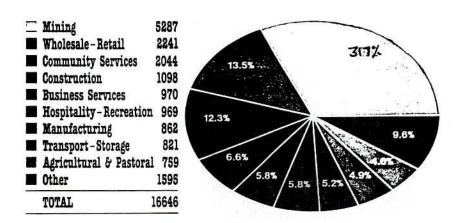


GROSS VALUE OF MINERAL PRODUCTION FROM THE GOLDFIELDS 1986/1987

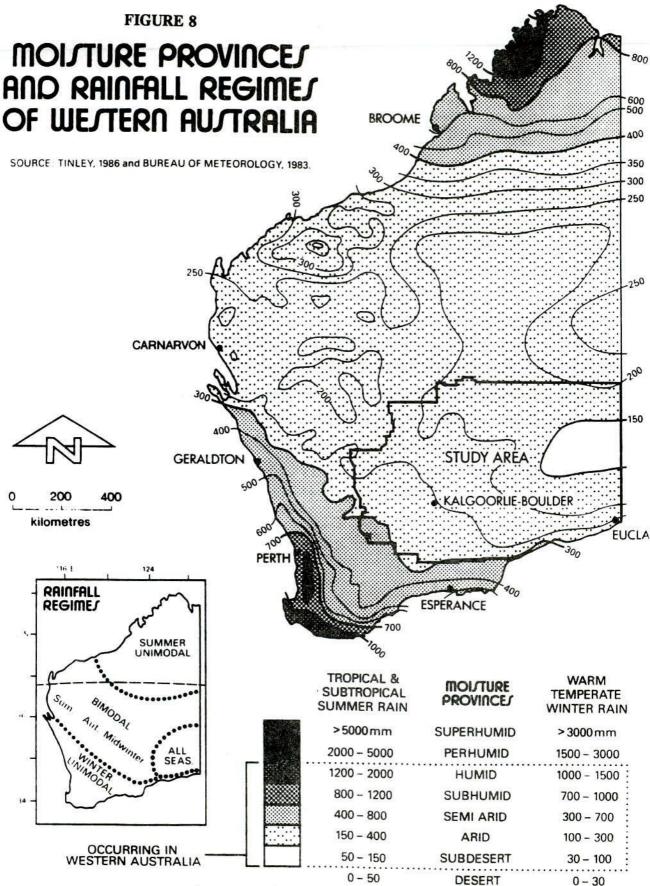
MINERAL	VALUE	PROPORTION
GOLD	\$736.0m	70%
NICKEL	274.8m	26%
COPPER	14.1m	
SILVER	19.7m	
COBALT	4.0m	4%
PALLADIUM	M 3.2m	## =:
PLATINUM	2.6m	
OTAL VALUE \$1		100%

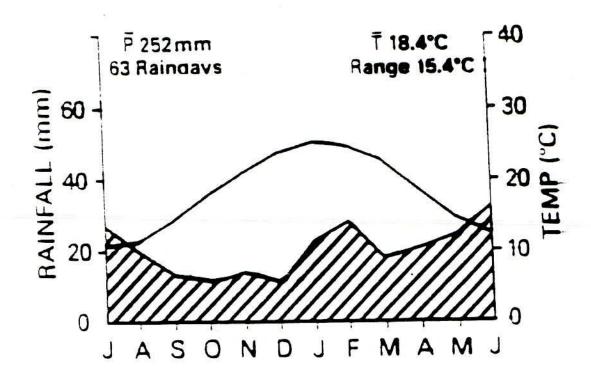
Source: Department of Mines Annual Report.

EMPLOYMENT BY INDUSTRIAL SECTOR







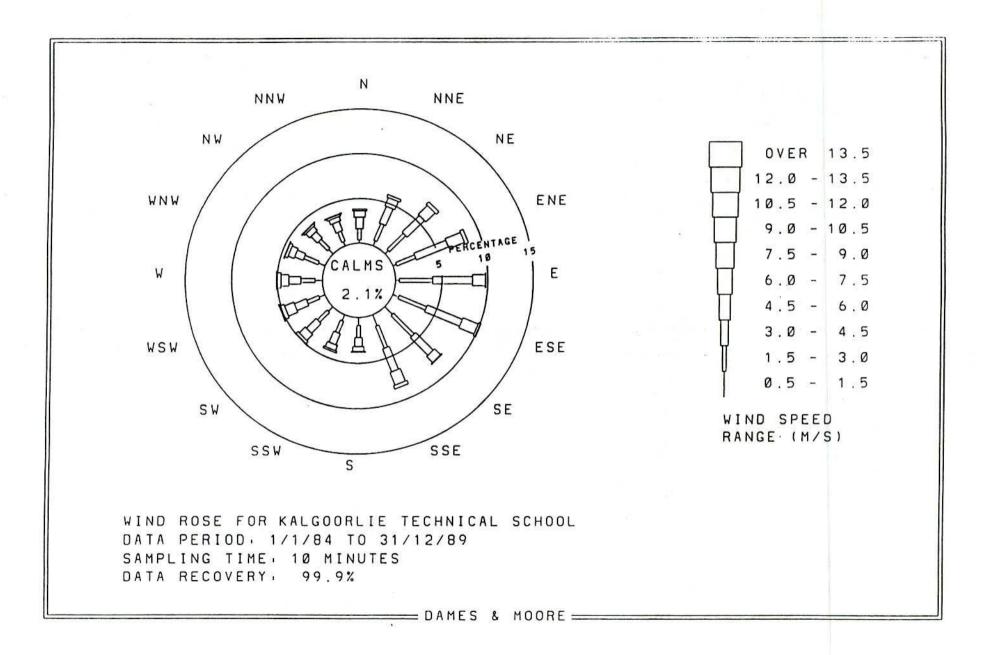


KALGOORLIE – BOULDER URBAN

Ē	686	Mean Annual Rainfall
Raindays	=	Total Number of Raindays on average per year
Ŧ	=	Mean Annual Temperature
Range	=	Difference between Mean Annual Max Temp and Mean Annual Min. Temp.

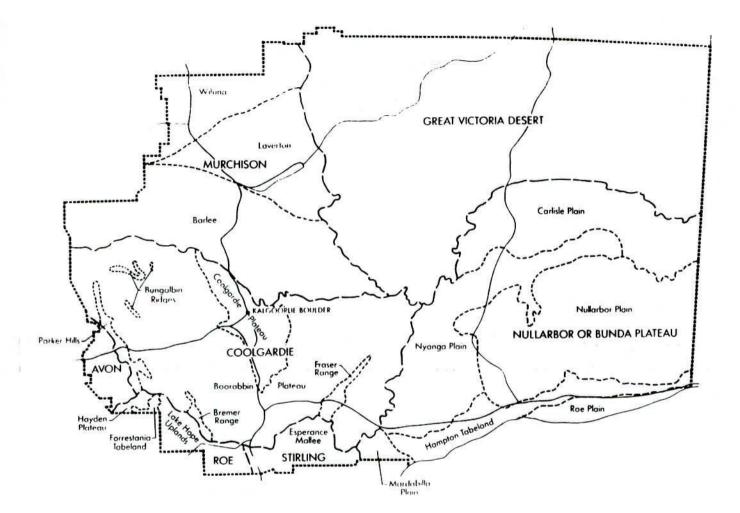
FIGURE 9

Kalgoorlie Boulder Climograph



J		MUNGARI INQUSTRIAL SITE	SCACE! 1150,000
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12	Figure 11 Mungari Industrial Estate Geology and Mineral Profile		/(7/1/ / m/ @
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PREDARIED FOR THE DEPT OF PLANNING AND URBAN DEVELOPMENT AND THE NORTH WHEST INFORMED AND THE NORTH WEST INFORMAL MAILED 1999.



FIGURE 12

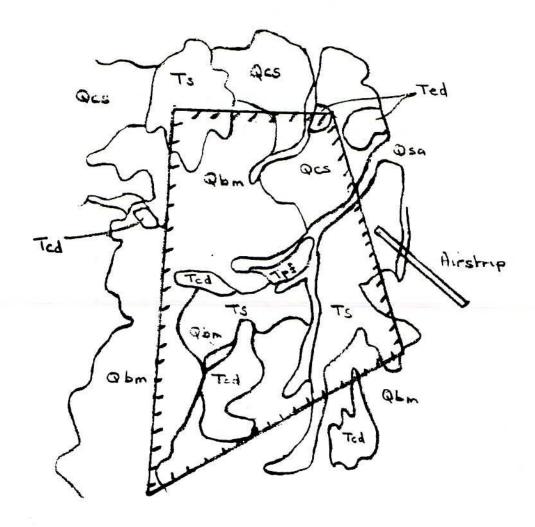
OF THE GOLDFIELD! REGION

LEGEND

REGION ROE

SUB-REGION Yolgoo





KEY

Qsa	Stacks Dam Formation
Qcs	Somerville Formation
Qbm	Mindjuring Member of Mt Burges Formation
Ts	Stewart Formation
Tpf	Fly Flat Member of the Peters Hill Formation
Tcd	Caenyie Rock Landform
Ted	Emu Hill Landforms
7777	Boundary Mungari Industrial Park

Figure 13 Mungari Heavy Industrial Park Regolith-landforms Source: Regolith of Kalgoorlie and Dunnoville Geological Survey of Western Australia

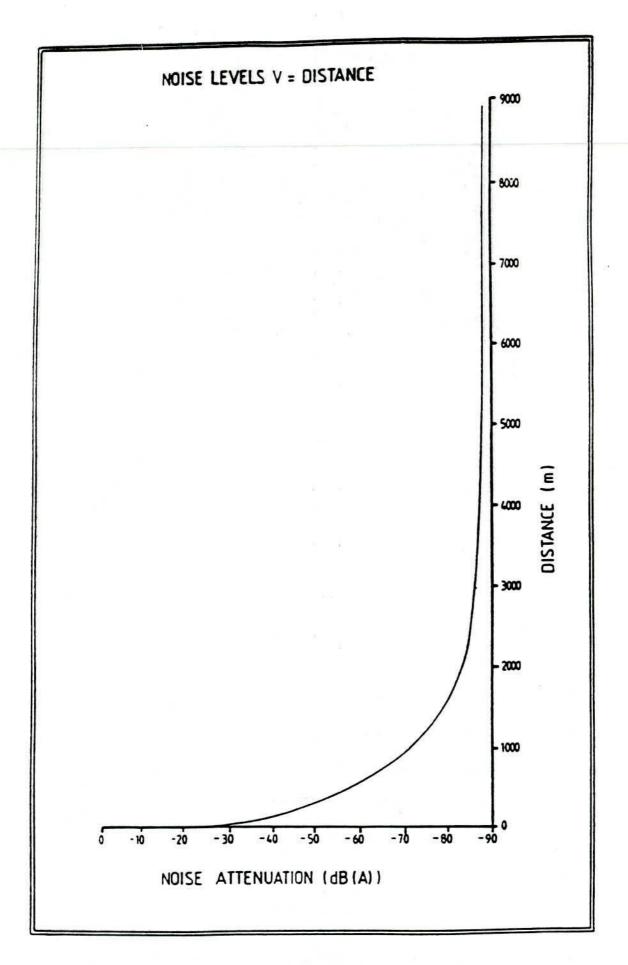
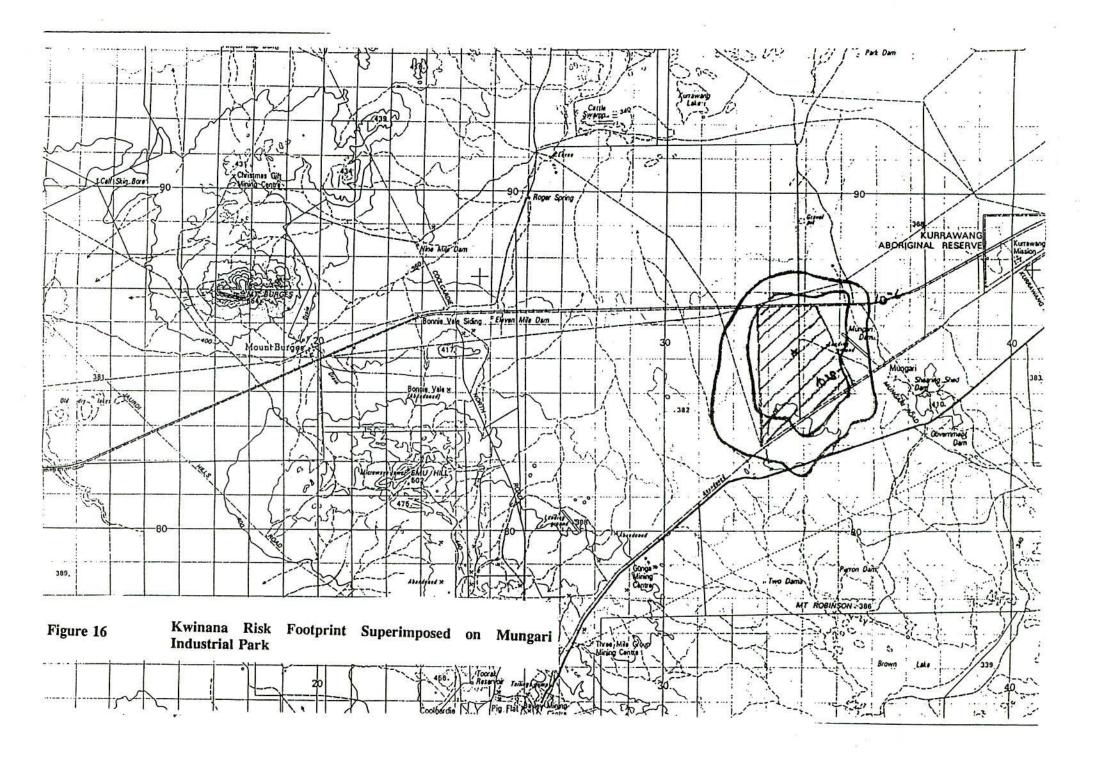


FIGURE 14

RISK LEVEL (NUMBER OF FATALITIES PEH MILLION EXPOSED YEARS) -0000: Figure 15 SMOKING TRAFFIC ACCIDENT SUICIDE / SELF INJURY Individual Risk Involuntary Risks DROWNING DRUGS AEROPLANE CRASH Levels LEUKAEMIA for DIABETES Selected RUN OVER BY CAR INVOLUNTARY HAZARD VOLUNTARY HOMICIDE & INJURY Voluntary FIRES ELECTRIC HAZARD and SHOCK INDUSTRIAL

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