Bulong Nickel Cobalt Laterite Project, 30km east of Kalgoorlie

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Resolute Resources Limited

Report and recommendations
of the Environmental Protection Authority

Environmental Protection Authority
Perth, Western Australia
Bulletin 826
July 1996

THE PURPOSE OF THIS REPORT

This report contains the Environmental Protection Authority's environmental assessment and recommendations to the Minister for the Environment on the environmental acceptability of the proposal.

Immediately following the release of the report there is a 14-day period when anyone may appeal to the Minister against the Environmental Protection Authority's report.

After the appeal period, and determination of any appeals, the Minister consults with the other relevant ministers and agencies and then issues his decision about whether the proposal may or may not proceed. The Minister also announces the legally binding environmental conditions which might apply to any approval.

APPEALS

If you disagree with any of the contents of the assessment report or recommendations you may appeal in writing to the Minister for the Environment outlining the environmental reasons for your concern and enclosing the appeal fee of $10.

It is important that you clearly indicate the part of the report you disagree with and the reasons for your concern so that the grounds of your appeal can be properly considered by the Minister for the Environment.

ADDRESS

Hon Minister for the Environment
12th Floor, Dumas House
2 Havelock Street
WEST PERTH WA 6005

CLOSING DATE

Your appeal (with the $10 fee) must reach the Minister's office no later than 5.00 pm on 2 August, 1996.

Environmental Impact Assessment Process Timelines

Date	Timeline commences from receipt of full details of proposal from proponent for public review	Time (weeks)
11/3/96	Proponent document released for public comment	
9/4/96	Public comment period closed	4
24/4/96	Issues raised during public comment period summarised by EPA and forwarded to the Proponent	2
17/5/96	Proponent response to the issues raised received	3
17/7/96	EPA reported to the Minister for the Environment	8 and a half

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Assessment No.996

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Recommendation No.	Summary of recommendations
1	That the proposal can be managed to meet the EPA's objectives, subject to the successful implementation of the proponent's commitments and the EPA's recommended conditions and procedures.
2	That, prior to construction of a leach residue and evaporation pond storage facility, the proponent prepare a strategy for disposal of process residue which identifies and demonstrates that the location, construction and operation of the facility achieves short and long term environmental objectives, including best practice environmental management and provides for effective rehabilitation and decommissioning of the structure.
3	That after five years the proponent should report on the development and performance of the leach residue and evaporation pond storage facility to the Environmental Protection Authority.
4	That the proponent include consideration of greenhouse gas emissions in the Environmental Management Plan to be prepared under Commitment 1.
5	That the proponent be required to prepare and implement a plan which describes the process for decommissioning and rehabilitation of the lease and which manages ground and surface water systems affected by the leach residue and evaporation pond storage facility, including development of a 'walk away' solution.
6	That, if the Minister provides environmental clearance that the proposal may be implemented, that clearance be subject to the Conditions set out in Section 6 of this report.

1. Introduction and background

1.1 Purpose of this report

This report and recommendations provides the Environmental Protection Authority's advice and recommendations to the Minister for the Environment on the environmental factors applicable to the proposal to develop a nickel/cobalt ore mining and processing operation 30km east of Kalgoorlie.

1.2 Background

Resolute Resources Ltd is the proponent for the project. Resolute Resources proposes to develop a nickel/cobalt project involving open cut mining of a lateritic nickel deposit at a mining rate of 500,000-650,000 tonnes/annum to a maximum depth of approximately 40 metres. The mined ore will be processed to produce 6,000-8,000 tonnes/annum of nickel (as metal) and 500-800 tonnes/annum of cobalt (as metal). In general, the process plant consists of facilities for ore preparation, pressure leaching, solid/liquid separation and neutralisation, solvent extraction and electrowinning. The Bulong Nickel Cobalt Laterite project has a minimum expected life span of fifteen years.

In December 1995, the proponent referred the project to the Environmental Protection Authority which set the level of assessment at Consultative Environmental Review (CER). Figure 1 is a location map for the project.

1.3 Structure of this report

This report is divided into 7 sections.

Section 1 introduces the report by stating its purpose, describing the historical background to the proposal and its assessment, and outlining the structure of the report.

Section 2 summarises the proposal. The proposal is described in more detail in the proponent's Consultative Environmental Review (Kinhill Engineers Pty Ltd, 1996a)

Section 3 explains the method of assessment and provides a summary of the topics raised through the setting of guidelines and in public submissions. From these topics and others raised throughout the assessment process, those considered to be issues that require further evaluation by the Environmental Protection Authority are identified. A table summarising this process is provided (Table 2).

Section 4 sets out the evaluation of the environmental issues associated with the proposal. Each issue is dealt with in its own subsection, which initially states the objectives of the assessment for that issue. The relevant Environmental Protection Authority policy is stated and any technical information is provided. Comments from key agencies/interest groups are summarised, and the proponent response is presented. The subsection on each issue is concluded with the Environmental Protection Authority's evaluation in terms of achieving the stated objectives.

Section 5 summarises the conclusions and recommendations and includes a table summarising the evaluation of the environmental issues (Table 6). Section 6 describes the recommended environmental conditions. References cited in this report are provided in Section 7.

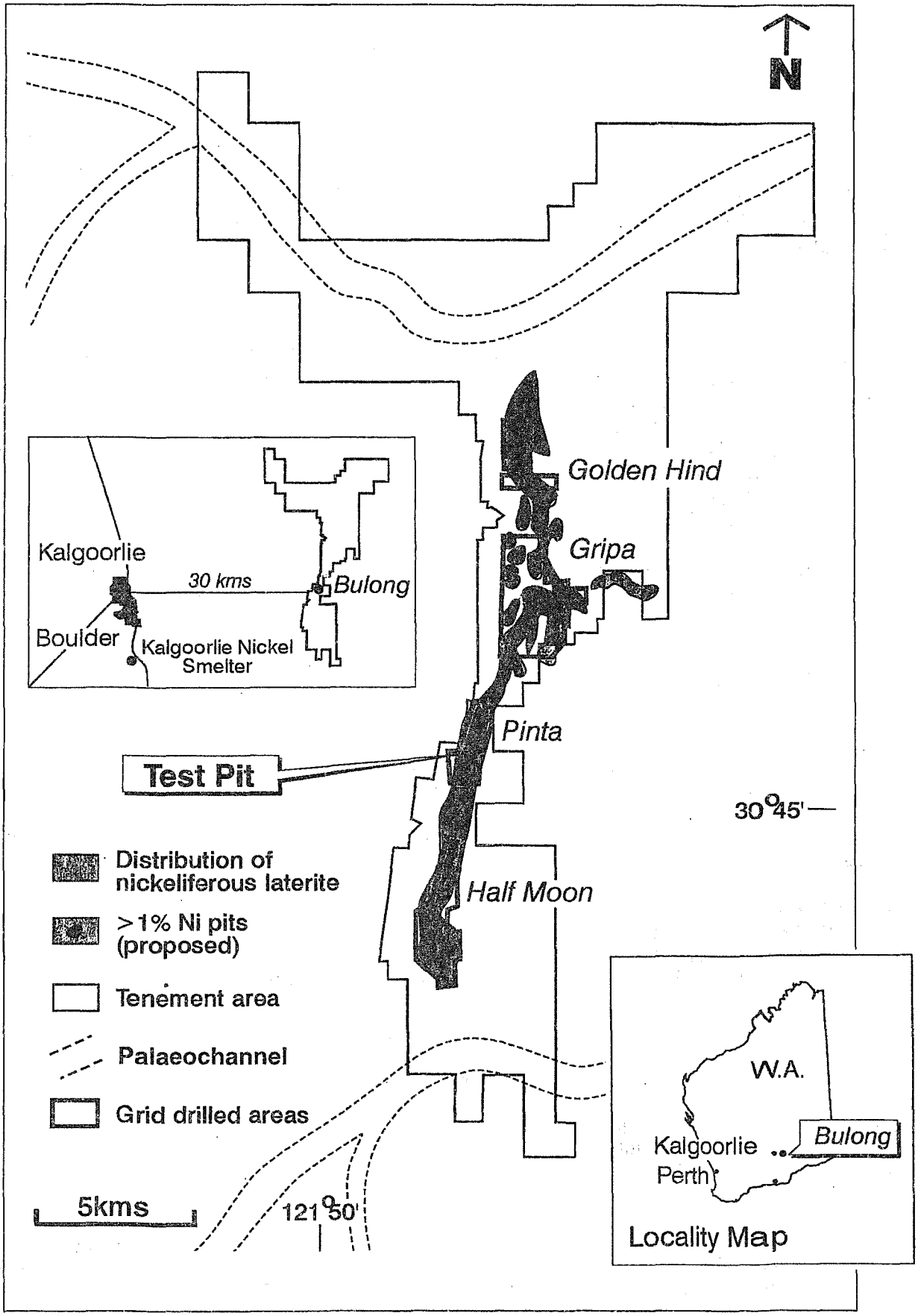


Figure 1. Location map (from Kinhill Engineers Pty Ltd, 1996a)

2. Summary description of the proposal

Resolute Resources indicate in the Consultative Environmental Review (Kinhill Engineers Pty Ltd, 1996a) that the major components of the Bulong Nickel Cobalt Laterite Project comprise:

- open-cut nickel-cobalt ore mining operations, including ore and waste rock stockpiles;
- a processing plant with facilities for ore preparation, pressure leaching, neutralisation, solvent extraction and electrowinning;
- leach residue and evaporation pond storage facility;
- the provision of sulphuric acid either from the burning of sulphur on site, or from the direct purchase of acid from Western Mining Corporation's Kalgoorlie Nickel Smelter;
- water supply borefield in the North Yindarlgooda Palaeochannel for process water;
- a pipeline to the Water Corporation of Western Australia reservoir in Kalgoorlie to supply potable water;
- on-site fuel and reagent and hazardous materials storage;
- dedicated mine haul roads and access tracks;
- an upgraded all-weather Kalgoorlie-Bulong road; and
- office, laboratory, workshop and other ancillary buildings

A detailed project description is provided in Section 2.0 of Resolute Resources' Consultative Environmental Review (Kinhill Engineers Pty Ltd, 1996a). Key project characteristics provided in the CER, are indicated in Table 1. The project layout is indicated in Figure 2.

Table 1. Summary of project characteristics (derived from: Kinhill Engineers Pty Ltd, 1996a)

Project Aspect	Description
Mining rate of ore	500,000-650,000 tpa
Life of project	15 years
Workforce - operations	160
Area of disturbance (approx.)	415ha
Depth of Pits	<40m
Leach residue storage facility	48ha
Evaporation pond storage facility	30ha
Process water demand	5,760kL/d
Limestone	120,000tpa
Sulphur requirements*	90,000tpa
Nickel Production	6000 - 8000tpa
Cobalt Production	500 - 800tpa

* should acid for purchase be unavailable.

3. Identification of environmental issues

3.1 Method of assessment

The purpose of the environmental impact assessment is to determine the environmental factors relevant to a proposal and to formulate conditions and procedures to which the proposal should be subject, should it proceed.

A set of administrative procedures has been identified (refer to flow chart in Appendix 1) in order to implement this method of assessment.

The first step in the method is to identify the environmental topics to be considered. A list of topics (or possible issues) was identified by the DEP, on behalf of the EPA, through the preparation of guidelines.

These topics are then considered by the proponent in the Consultative Environmental Review both in terms of identifying potential impacts as well as making project modifications or devising environmental management strategies.

The CER was then reviewed to ensure that each topic had been discussed in sufficient detail prior to its release for public and government agency comment. The proponent's CER was available for public review for four weeks between 11 March 1996 and 9 April 1996, during which thirteen submissions were received.

Following completion of the public review period, the responses received were summarised for the Department of Environmental Protection. This process can raise additional environmental topics to be considered by the proponent.

Resolute Resources was invited to respond to matters raised in the summary of submissions. Appendix 2 contains the summary of the submissions and the proponent's response to those submissions. The list of submitters is included in Appendix 3.

Nineteen environmental topics varying in significance have been identified. The EPA considers all the topics and identifies those that are considered to be issues of environmental significance that require further evaluation by the EPA. The remaining topics can often be addressed through the processes of other agencies or are no longer relevant to the proposal.

For each environmental issue, the environmental impacts of the proposal, and the proponent's environmental management commitments, were evaluated in the context of the EPA's assessment objective and relevant policy and technical information. The proponent's environmental management commitments and Outline Environmental Management Plan are included in Appendix 4 of this report. If the commitments achieve the assessment objectives, there is no need for the EPA to make recommendations to the Minister for the Environment on that issue, otherwise the EPA may recommend conditions and procedures necessary to achieve the EPA's objectives. Where the proposal has unacceptable environmental impacts, the EPA can advise the Minister for the Environment. The Minister for the Environment determines whether the proposal should proceed and under what conditions.

Limitation

This evaluation has been undertaken using information currently available. The information has been provided by the proponent in the CER and supplementary documentation, by DEP officers utilising their own expertise and reference material, by utilising expertise and information from other State government agencies, information provided by members of the public and contributions from EPA members.

The EPA recognises that further studies and research may affect the conclusions. Accordingly, the EPA considers that if the proposal has not substantially commenced within five years of the

date of this report, then such approval should lapse. After that time, further consideration of the proposal should occur only following a new referral to the EPA.

3.2 Public and agency submissions

Comments were sought on the proposal from the public, interest groups and local and State government agencies. During the public review period thirteen (13) submissions were received. A summary of these submissions was forwarded to the proponent for their response (Appendix 2). Of the thirteen submissions received, 5 were from State government agencies, 2 from local government agencies and 6 were public submissions.

The principal topics of concern raised in the submissions were:

Biophysical Impacts

- changes to groundwater levels affecting the supply of other users;
- impact on vegetation communities and flora;
- impact on fauna;

Pollution Potential

- management of wastes and emissions (especially sulphur dioxide);
- potential impacts on Lake Yindarlgooda;
- disposal of tailings;
- the importing and handling of sulphur through the Port of Esperance

Social Surroundings

- impacts on Aboriginal and European heritage (Bulong townsite/cemetery);
- road transportation;

Other

- Environmental Management Plan and appropriate monitoring; and
- decommissioning and rehabilitation.

The EPA has considered the submissions received and the proponent's response in its evaluation of Resolute Resources' proposal.

3.3 Review of topics

3.3.1 Identification of topics

Nineteen topics were raised during the environmental impact assessment process including those topics identified in the guidelines for the CER, subsequent consultations and the submissions described above. The topics are as follows:

Biophysical Impacts

- loss of land systems;
- changes to landform;
- impact on locally and regionally significant vegetation associations, Declared Rare and Priority flora;
- impact on Threatened and Priority fauna species and animal habitats;
- impact on surface water;

- impact on the water table due to the extraction of groundwater and its affect on other users;

Pollution Potential

- alternative options for location of leach residue and evaporation pond storage facility;
- solid and liquid process waste disposal (leach residue/evaporation pond);
- protection of groundwater;
- disposal of waste (other than leach residue and evaporation pond storage facility);
- gaseous emissions (including greenhouse gases and odours);
- dust;
- noise;
- possible importing and handling of sulphur at the Esperance Port;

Social Surroundings

- Aboriginal and European heritage;
- risks and hazards;
- transportation issues;

Other

- Environmental Management Plan;
- decommissioning and rehabilitation.

The EPA has evaluated the above topics and considers that a number of them can be managed by the proponent in accordance with their environmental management commitments and in compliance with Department of Environmental Protection regulations and guidelines or through approvals required from other agencies (see Table 2). Each topic is discussed below in order to identify those issues warranting further evaluation by the EPA.

3.3.2 Identification of issues requiring EPA evaluation

Biophysical Impacts

Loss of land systems

Resolute Resources estimate (Kinhill Engineers Pty Ltd, 1996a) that the project, which is located in area described as an Undulating Plain landform and is situated at the boundary between the Coolgardie and Austin Botanical Districts, will disturb less than 600ha during the first fifteen years of mining and production.

Impacts to land systems are reduced through a range of management measures such as protecting vegetation, reducing erosion potential, managing surface drainage, return of overburden to previously mined pits, and rehabilitation of disturbed areas. The general management principles and practices required to reduce impacts to land systems are common for most mining operations and are included in a number of other topics discussed. Factors which help to reduce the loss of land systems, such as project design, mine planning and management are inherent in the project's Environmental Management Plan. Conditions imposed by the State Mining Engineer through the Mining Act approvals process will also ensure appropriate rehabilitation of the minesite. These issues are incorporated in the Environmental Management Plan which is evaluated in more detail in Section 4.8 of this report.

Separate evaluation of this topic by the Environmental Protection Authority is not required.

Changes to landform

Changes to the landform will result from the mine pits, low grade ore and overburden storage areas, plant ore stockpiles, borrow pits, leach residue storage facility and other mining and processing infrastructure. The proposal involves the mining of multiple ore bodies using conventional open-pit techniques. Mining of the nickel-cobalt laterite resource will result in open pit mining to a depth expected to be less than 40m below ground level.

The potential impacts of changes to landforms are reduced through a range of management measures such as protecting vegetation, reducing erosion potential, managing surface drainage, return of overburden to previously mined pits, and rehabilitation of disturbed areas. The general management principles and practices required to reduce changes to landform are common for most mining operations and are included in a number of other topics discussed. For example, factors which help to minimise the loss of landform, such as project design, mine planning, rehabilitation and management are inherent in the project's Environmental Management Plan and in the decommissioning and rehabilitation of the project. Conditions imposed by the State Mining Engineer through the Mining Act approvals process will also ensure appropriate rehabilitation of the minesite. These issues are incorporated in the Environmental Management Plan and the rehabilitation and decommissioning programme in Sections 4.8 and 4.9 respectively of this report.

Separate evaluation of this topic by the Environmental Protection Authority is not required.

Impact on locally and regionally significant vegetation associations, Declared Rare and Priority flora

The primary impact of construction and operation of the mine, processing plant and waste disposal facilities will be the loss, or disturbance to, vegetation, including three Priority-listed species identified in the area. Approximately 400ha of vegetation will be cleared over the life of the project to facilitate construction of mine areas and infrastructure.

The general management principles and practices required to reduce impacts to vegetation are common for most mining operations and are included in a number of other topics discussed. For example, factors which help to reduce the loss of vegetation, such as project design, mine planning, management of surface drainage, rehabilitation and management are inherent in the project's Environmental Management Plan and in decommissioning and rehabilitation aspects of the project. These issues are evaluated in more detail in Section 4.8 and 4.9 of this report.

CALM indicated that, during rehabilitation programmes, it would be worth recording where and when topsoil from the recorded location of *Gnephosis intonsa* (a Priority 1 species) is re-used. This will assist with furthering the knowledge of the biology of this species.

This topic has been identified as an issue requiring evaluation by the Environmental Protection Authority.

Impact on Threatened and Priority fauna species and animal habitats

The development of the mine pits, overburden disposal areas, leach residue storage area, evaporation pond and establishment of the processing plant and mine infrastructure will require clearing and disturbance to fauna habitat.

The proponent indicates that no scheduled fauna were recorded during field surveys and as large areas of similar habitat and hence faunal composition occur in areas adjacent to the project site, the impact in regional terms will be minor. CALM has indicated its willingness to assist the proponent with compiling a package of information on likely rare fauna for the project area, for the purposes of workforce education. In return, CALM would expect any sightings to be reported. Public submissions expressed concern regarding efforts to reduce the desirability of exposed toxic waterbodies to avifauna.

This topic has been identified as an issue requiring evaluation by the Environmental Protection Authority.

Impact on surface water systems

The introduction of landform changes discussed above, particularly land disturbed by mining, the leach residue storage facility and evaporation pond, will modify surface drainage characteristics.

The proponent indicates that surface drainage is characterised by short isolated creek lines (usually less than 10km long) and diffuse ephemeral drainage lines flowing into the larger salt lakes such as Lake Yindarlgooda. Lake Yindarlgooda is an ephemeral salt lake with an estimated surface area of 323km^2. The proponent indicates that significant drainage lines which will intersect the mine pits will be permanently re-routed around the perimeter of the pits. Proposed alignments, after giving due consideration to maximum deposition rates, rain shadow, sheet flows and low flows, will be assessed to ensure that erosion problems do not result from the re-routing and that Declared Rare or Priority Listed flora are not impacted. The proponent has outlined in section 5.4 of the CER that it will develop and implement a final water quality/quantity monitoring programme, as part of an Environmental Management Plan (Commitment 1).

Consideration of the proposed leach residue and evaporation pond storage areas on Lake Yindarlgooda is presented in Section 4.4 of this report. The general management principles and practices required to reduce impacts on surface water systems are included in the project's Environmental Management Plan which is evaluated in more detail in Section 4.8 of this report.

Separate evaluation of this topic by the Environmental Protection Authority is not required.

Impact on the water table due to the extraction of groundwater

The extraction of saline water from borefields for project use, (up to 5,760kL/day) will lower groundwater levels and may adversely affect water supply for other users (eg: pastoralists) and the environment. Process water will be obtained from a borefield located north of the project area within the North Yindarlgooda Palaeochannel.

The Water and Rivers Commission indicated that although the proposed borefield appears to be capable of meeting the estimated process water requirements, pumping could interfere with neighbouring borefields. The impact of water extraction on other users is managed through Water and Rivers Commission approvals and licensing process.

The impact of lowered groundwater levels on the environment has been identified as an issue requiring evaluation by the Environmental Protection Authority.

Pollution potential

Alternative options for location of leach residue storage facility

The proponent investigated a number of options for locating the leach residue storage facility, including a paddock impoundment, valley impoundment and lake bed impoundment. The option preferred by the proponent is Lake Yindarlgooda.

Government submissions expressed concern regarding the short and long term performance of the tailings dam and evaporation pond in the salt lake. The Department of Minerals and Energy indicated that placing tailings walls in potential contact with standing or flowing natural waters is generally not good environmental practice. The Department of Environmental Protection requested further information from the proponent regarding the selection of Lake Yindarlgooda as the preferred location. Public submissions also questioned the acceptability of the Lake Yindarlgooda option and the potential impact on migratory birds and lake biota.

This topic has been identified as an issue requiring evaluation by the Environmental Protection Authority.

Solid and liquid waste disposal (leach residue/evaporation pond)

A leach residue and evaporation pond storage facility will be required for the 15 year life of the project. The proponent's preferred option is for a 48ha leach residue storage facility and a 30ha

evaporation pond to be located in Lake Yindarlgooda. The proponent indicates (Kinhill Engineers Pty Ltd, 1996a) that the potential environmental issues associated with leach residue storage on any site include leakage of liquor through seepage under or through an embankment, infiltration into underlying aquifers and dewatering and drying of the residue before rehabilitation.

Government and public submissions commented on the lack of information on the geotechnical aspects of the leach residue storage facility. The potential for and management of leakage from the tailings impoundment, the prospects for rehabilitation and decommissioning are also issues of concern.

This topic has been identified as an issue requiring evaluation by the Environmental Protection Authority.

Protection of groundwater

The storage of materials and mining and processing operations, particularly disposal of slurry to the leach residue storage facility, has the potential to pollute the groundwater.

The Water and Rivers Commission indicate that the project is located in an area where useable groundwaters are hyper-saline and confined to palaeochannels. The palaeochannel waters are suited only for use by the mining industry as process waters (unless given an expensive treatment to remove salts and minerals). In addition, palaeochannel waters are protected by low permeability soils and hence are not particularly vulnerable to contamination.

The primary concern in relation to the protection of groundwater is associated with the performance of the leach residue storage facility and evaporation pond and accordingly, this is discussed as a separate topic (see Section 4.5). Storage of hazardous materials and management of other wastes with the potential to pollute groundwater are managed through approvals required by the Department of Environmental Protection, Department of Minerals and Energy, Water and Rivers Commission, Health Department and Local Government Agency processes.

Separate evaluation of this topic by the Environmental Protection Authority is not required.

Disposal of waste (excluding leach residue and evaporation pond storage facility)

The construction and operation of the project will generate a number of different types of waste. In addition to wastes associated with leach residue and process water discussed above, the wastes of most concern include general wastes and overburden.

General wastes, such as waste oils, scrap metal, tyres, sewage etc, should be managed in accordance with the requirements of local government authorities and relevant government departments. The EPA considers that this issue is therefore manageable within the context of existing regulatory requirements and the proponent's Environmental Management Plan.

Overburden stockpiles will be utilised as much as practicable in the rehabilitation of open cuts, tailings dams and evaporation ponds. Overburden stockpiles will be contoured to reduce erosion and then spread with topsoil and revegetated.

The Department of Minerals and Energy indicates that more detail is required on the mining/rehabilitation sequence in the first couple of years and on the area of backfilled pits versus permanent waste dumps to be rehabilitated. Wherever possible, the return of overburden to the mined out pits is supported by the EPA. Where overburden is unable to be returned to the mined out pits it should be stabilised and rehabilitated to Department of Minerals and Energy specifications. The management of waste dumps for the proposal can be undertaken in an environmentally acceptable manner, through compliance with the requirements of the Department of Minerals and Energy and in accordance with an approved Environmental Management Plan (discussed in Section 4.8).

Further evaluation of this topic by the Environmental Protection Authority is not required.

Gaseous emissions (including greenhouse gases and odours)

Gaseous emissions of environmental concern relating to the operation of the project are primarily sulphur dioxide produced from the sulphuric acid plant. The proponent is still negotiating with Western Mining Corporation for the purchase of acid, which if successful, will obviate the need for an acid plant. If acid is purchased, sulphur dioxide emissions arising from the project would be negligible. The proponent indicates that no hydrogen sulphide is used in the process plant nor is it generated within the process and the only major source of NOx would be from the diesel-fired boiler plant. Carbon dioxide emissions are related to power generation and the neutralisation of the process streams by adding limestone.

State and local government submissions comment on the need for further clarification on emission rates. The City of Kalgoorlie-Boulder has requested that the Minister for the Environment re-assess the *Environmental Protection (Goldfields Residential Area) (Sulphur Dioxide) Policy 1992*. The Policy establishes standards for sulphur dioxide in ambient air in the region.

This topic has been identified as an issue requiring evaluation by the Environmental Protection Authority.

Dust

Construction and operational mining activities, materials transport and handling, stockpiles and storage of ore, low grade dumps and limestone will generate dust. The nearest residence is the Hampton Hill Station homestead which is located approximately 11km from the processing plant and approximately 5km from the nearest mining area.

Dust management measures will be included in the Environmental Management Plan to be prepared by the proponent to the satisfaction of the EPA. Dust associated with processing facilities would also be addressed within the Department of Environmental Protection's works approval and licensing provisions under the *Environmental Protection Act* (1986). The EPA believes that adequate controls exist under the pollution control provisions of the *Environmental Protection Act* (1986) to control dust should a problem arise.

Further evaluation of this topic by the Environmental Protection Authority is not required.

Noise

Adverse noise impacts are potentially associated with the development of any mining and processing proposal. Minor blasting will be necessary in some areas to shatter silica-rich layers prior to excavation. The nearest residence is the Hampton Hill Station homestead which is located approximately 11km from the processing plant and approximately 5km from the nearest mining area.

Compliance with the Noise Abatement (Neighbourhood Annoyance) Regulations is a requirement for both the processing plant and mine areas. The EPA believes that adequate controls exist under the pollution control provisions of the *Environmental Protection Act* (1986) to control noise associated with the processing plant and mining areas should a problem arise. However, there are currently no statutory regulations that govern road traffic noise.

This topic has been identified as an issue requiring evaluation by the Environmental Protection Authority.

Possible import and handling of sulphur at the Port of Esperance

The processing plant will require up to 900t/d of sulphuric acid to leach the ore. Should acid for purchase be unavailable, the 90,000 tonnes per annum of sulphur required for the process would be brought by ship to the Esperance Port, unloaded and stockpiled at Esperance and transported to Bulong by 75t road trains. The option to buy sulphuric acid is still open to the proponent.

The Shire of Esperance sought confirmation that a specific CER would be prepared for the importation of sulphur through the Esperance Port. Public submissions consider that sulphuric acid arising as byproducts of other regional projects should be purchased as opposed to the

importation of sulphur prill through Esperance. Importing sulphur could have significant impacts on the community of Esperance and the waters of Recherche Archipelago.

The importation of sulphur through the Esperance Port is currently subject to a specific environmental impact assessment at CER level. The environmental issues relevant to the importation of sulphur through the Esperance Port will therefore be evaluated by the EPA in its assessment of that proposal.

Further evaluation of this topic by the Environmental Protection Authority is not required.

Impact on Aboriginal and European Heritage

The proponent indicates that an Aboriginal heritage site survey has been conducted in accordance with the *Aboriginal Heritage Act, 1972*. Some sites were found but none of these need to be affected by the project. The Department of Aboriginal Affairs recommends that the proponent lodge a report with it once a survey is completed whether there is a Section 18 application involved or not. The project is subject to current claims for native title.

The proponent indicates that the old Bulong townsite may be considered as a European heritage site. It was at the centre of gold mining activities in the region in the late 1890s and early 1900s, and provided the necessary infrastructure for its population of some 620 people. The site is currently gazetted as a town and the town cemetery still exists at its original location south of the town. The proponent indicates that consultation would be undertaken with the Eastern Goldfields Historical Society before any disturbance was made to the site. Some public submissions expressed concern at the potential for damage to the old Bulong townsite cemetery and the need for protection measures such as fencing to be installed.

The proponent must comply with the provisions of the *Aboriginal Heritage Act* (1972) and native title claims are subject to an independent assessment by the Native Title Tribunal. Impact on European heritage values should be managed by the proponent in consultation with the City of Kalgoorlie-Boulder and relevant organisations such as the Eastern Goldfields Historical Society. The EPA considers that the predicted impacts of the project on Aboriginal and European heritage values can be adequately managed through processes outside the *Environmental Protection Act (1986).*

Further evaluation of this topic by the Environmental Protection Authority is not required.

Risks and hazards

Hazards associated with the project may be created by either the processing operations or by materials brought to the site such as fuels and chemicals. The project plant site is situated in an isolated area where the nearest residence is located 11km away.

On-site hazards to the workforce will be required to be managed in accordance with the occupational health and safety provisions of the *Mines Safety and Inspection Act, 1995.* All hazardous materials will be required to be transported, stored and handled in accordance with the *Dangerous Goods Regulations, 1992.*

Risks and hazards would be managed through compliance with the requirements of the Department of Minerals and Energy.

Further evaluation of this topic by the Environmental Protection Authority is not required.

Transportation issues

The project will require the transport of personnel, process materials, fuel and equipment, and product to and from the site. The transport of raw materials and products during the operations phase may cause impacts through spillage of loads and will also increase heavy vehicle traffic volumes along local and regional road systems.

Main Roads Western Australia (MRWA) has indicated that confirmation is required regarding which road route will be used for the transportation of 120,000tpa of limestone to the site. MRWA suggests that for the 15 year life of the project it would be logical to seal Bulong Road rather than to upgrade and maintain it to a gravel standard. The City of Kalgoorlie-Boulder has

indicated that the proponent will be required to upgrade the Bulong Road to a sealed standard to the satisfaction of the City Engineer.

These matters should be addressed by the local government authorities and relevant State government agencies such as Main Roads Western Australia in conjunction with the proponent.

Further evaluation of this topic by the Environmental Protection Authority is not required.

Other

Environmental Management Plan

The development of a mining and processing operation of this scale requires the implementation of a comprehensive programme of environmental management and monitoring to ensure that the impacts of the project are appropriately managed during all project phases.

Consideration of an adequate Environmental Management Plan requires Environmental Protection Authority evaluation.

Decommissioning and rehabilitation

The EPA has in past assessments recognised that rehabilitation management should not impose short or long term costs on the community of Western Australia. This is particularly important when the probable success of rehabilitation cannot be evaluated in the short to medium term.

The issue of decommissioning and rehabilitation requires Environmental Protection Authority evaluation.

3.3.3 Summary

Table 2 summarises the process used by the EPA to evaluate the topics raised during the environmental impact assessment process. The table identifies the topics, the relevant proposal characteristics, and comments received from specialist government agencies and the public. If a topic is considered environmentally significant it becomes an issue and is further evaluated by the EPA (as summarised in Table 6). Section 4 of this report provides this evaluation.

The issues identified in Table 2 as requiring further evaluation by the EPA are:

- impact on locally and regionally significant vegetation associations, Declared Rare and Priority flora;
- impacts on Threatened and Priority fauna species and animal habitats;
- impact on the water table due to the extraction of groundwater;
- alternative options for location of leach residue and evaporation pond storage facility;
- solid and liquid waste disposal (leach residue/evaporation pond);
- gaseous emissions (including greenhouse gases and odours);
- noise;
- Environmental Management Plan; and
- decommissioning and rehabilitation.

Topics	Proposal characteristics	Government Agency Comments	Public comments	Identification of issues
Biophysical impacts				
Loss of land systems	Construction and operation of the project will result in the loss of land systems within the region.	Identified as a topic in EPA guidelines.		Considered in the evaluation of the Environmental Management Programme - refer table 6 (Issue 8). Separate EPA evaluation not required.
Changes to landform	Multiple open cut mine pits, overburden disposal areas, borrow pits, processing plant, process residue storage facilities will change the existing landform.	**DEP** - Can all low grade ore be stockpiled to allow pits to be mined in one operation? This would allow rehabilitation to commence earlier and proceed progressively. Overall impact would be minimised if the number of pits backfilled was maximised. An indication of the percentage of pits backfilled would assist in the assessment of impacts.		Considered in the evaluation of the Environmental Management Programme - refer table 6 (Issue 8). Separate EPA evaluation not required.
Impact on locally and regionally significant vegetation associations, Declared Rare and Priority flora.	Direct disturbance (clearing 415ha) will impact upon vegetation. 3 Priority species are known to occur on the project site. No DRF species have been found. Indirect impacts such as changes to existing drainage patterns could lead to changes in vegetation. The impact of emissions such as SO_2 from the project could affect vegetation.	**CALM**-requests specific information during rehabilitation programmes on the re-use of topsoil from locations of *Gnephosis intonsa* (a priority 1 species). **DEP**-Regional and local significance of vegetation present on the site should be described. Impact of gaseous emissions and dust on vegetation.		EPA evaluation required.
Impact on Threatened and Priority fauna species and animal habitats.	Mine pit development, overburden disposal areas, tailings dam and mine and processing infrastructure will require clearing and disturbance of habitat. Fauna associated with Lake Yindarlgooda could be affected by the location and performance characteristics of the leach residue storage facility.	**CALM**-could compile information on likely rare fauna for workforce education and expect any sightings to be reported. **DEP**-effects of Lake Yindarlgooda residue impoundment on lake fauna and migratory birds. **WRC**-effects on biota such as shrimp and migratory birds from changes to lake water quality due to leach residue storage facility.	The effect on lake crustacea from nitrification of the waterbody. Measures to reduce desirability of tailings impoundments to water fowl and fauna.	EPA evaluation required.

Table 2. Identification of issues requiring Environmental Protection Authority evaluation

Biophysical impacts				
Topics	**Proposal characteristics**	**Government Agency Comments**	**Public comments**	**Identification of issues**
Impact on surface water.	Mining and processing activities, such as location of tailings dam, evaporation ponds, mine pits, haul roads and associated infrastructure will impact upon surface flow characteristics.	Identified as a topic in EPA guidelines.		Considered in the evaluation of the Environmental Management Programme - refer table 6 (Issue 8). Separate EPA evaluation not required.
Impact on the water table due to the extraction of groundwater.	The extraction of water for project use (6000m^3/d) , could lower groundwater levels and may adversely affect water supply for other users (eg: pastoralists) and the environment.	**WRC**-a licence to abstract groundwater must be obtained from the Water and Rivers Commission; pumping could interfere with neighbouring borefields; process water should be recycled. **DEP**-impacts on groundwater abstraction on vegetation are not clearly defined in the CER.		Impact of water extraction on other users is managed through Water and Rivers Commission approvals and licensing process. Impact of abstraction on environment requires EPA evaluation.
Pollution potential				
Alternative options for location of leach residue storage facility.	A number of options for the location of the leach residue storage facility were examined. The proponent's preferred option for location of the 48ha leach residue storage facility is Lake Yindarlgooda (an ephemeral saline lake with an estimated surface area of 323km^2).	**DEP**-Further information is required to support the statement that Lake Yindarlgooda is the most attractive option from an environmental perspective.	Lake Yindarlgooda is not an acceptable location for the evaporation pond or leach residue facilities.	EPA evaluation required.

Table 2. Identification of issues requiring Environmental Protection Authority evaluation (cont'd)

Pollution potential				
Topics	**Proposal characteristics**	**Government Agency Comments**	**Public comments**	**Identification of issues**
Solid and liquid process waste disposal (tailings dam/evaporation pond)	A 48ha leach residue impoundment facility and an evaporation pond is required. There is the potential for leakage and contamination of the environment. Rehabilitation potential depends upon long term physical and chemical characteristics of waste.	**WRC**- provision needs to be made within the containment structures to cater for extreme storm events; details of leach residue and evaporation pond seepage collection, monitoring and recovery needs better definition; **CALM**-hydrological modelling is necessary to assess the likely impacts of residue pond failure, and to finalise impoundment design; impoundment containing walls should be designed so that integrity is not compromised by lake waters; the concentrations of substances in the leach residue vary from those in the lake and additional substances not found in the lake are also found in the residue; the project could include assessing the impacts of impoundments on the lakes ecology; note the commitment to survey and collect data on ecology of the lake. **DME**-no adequate geotechnical description and assessment of the preferred "Lake Impoundment"; placing tailings walls in potential contact with standing or flowing natural waters is not good practice; the residue contains ammonium sulphate which may represent a eutrophication problem for the lake environment; **DEP**-further information is required to support the statement that Lake Yindarlgooda is the most attractive option from an environmental perspective.	Lake Yindarlgooda is not an acceptable location for the evaporation pond or leach residue facilities; impacts on birds and crustacea not investigated; no geotechnical or engineering data provided; ammonium sulphate with the leach residue could cause nitrification of the lake system.	EPA evaluation required.

Table 2. Identification of issues requiring Environmental Protection Authority evaluation (cont'd)

Topics	Proposal characteristics	Government Agency Comments	Public comments	Identification of issues
Pollution potential				
Protection of groundwater.	Storage of materials and operation of the plant, particularly disposal of slurry to the tailings dam and process water to the evaporation pond, has the potential to pollute groundwater.	**WRC**-groundwater is hyper-saline and confined to palaeochannels; protected by low permeability soils and not particularly vulnerable to contamination; storage of toxic or hazardous substances away from areas subject to flooding and use appropriate bunding.	Concerns regarding the possible contamination of groundwater from leaking tailings storage facilities.	Main issue of tailings dam and evaporation pond addressed in waste disposal (Issue 5, Table 6) and Environmental Management Programme (Issue 8, Table 6). Storage of hazardous materials is managed through approvals required by the DEP, DME and WRC. Further EPA evaluation not required.
Disposal of waste (other than tailings dam and evaporation pond)	Operation of the mine and plant will produce general wastes and overburden.	**DME**-more detail is required on the area of backfilled quarries verses permanent waste dumps to be rehabilitated; this issue will have to be addressed before Mining Act Conditions and approval can be progressed. **DEP**-disposal of mine waste oil needs clarification; indication of the percentage of pits backfilled would assist in the assessment of impacts.		General wastes addressed by local government authority and relevant government agencies (eg: Health Dept.). DEP's works approval and licensing requirements also apply. Overburden disposal is considered in the evaluation of other topics - refer table 6 (Issues 8 and 9). Further EPA evaluation not required.

Table 2. Identification of issues requiring Environmental Protection Authority evaluation (cont'd).

Topics	Proposal characteristics	Government Agency Comments	Public comments	Identification of issues
Pollution potential				
Gaseous emissions (including greenhouse gases and odours)	Operation of the plant will generate atmospheric emissions, including greenhouse gases.	**Shire of Kalgoorlie-Boulder**-request that the Minister for the Environment re-assess the Environmental Protection (Goldfields Residential Area) (Sulphur Dioxide) Policy 1992 relating to the amount of allowable sulphur dioxide emissions. **CALM**-SO_2 emissions would occur if sulphuric acid is produced on site. It is assumed that monitoring would be integrated into the existing WMC/KCGM/Kanowna monitoring programme. **DEP**-no mention is made of CO emissions; is nitrous oxide or H_2S likely to be produced and other greenhouse gases?; the quality of the vapour generated in the flash tank and vented to the atmosphere is not known.	The integrity of gravestones at the Old Bulong Townsite could be affected by SO_2 emissions.	EPA evaluation required.
Dust	Construction and mining activities, ore stockpiles, materials transport, handling and storage will give rise to dust.	**DEP**-the management of dust is a normal requirement associated with construction and mining activities.		Addressed by the proponent in Section 5.3 of the CER. Subject to DME and DEP requirements. Further EPA evaluation not required.
Noise	Mining and processing activities will increase ambient noise levels. The nearest residence is more than 11km away. Materials and product handling and transport will increase ambient noise levels.	**DEP**-Noise Abatement (Neighbourhood Annoyance) Regulations (1979) apply.		EPA evaluation required.

Table 2. Identification of issues requiring Environmental Protection Authority evaluation (cont'd)

Topics	Proposal characteristics	Government Agency Comments	Public comments	Identification of issues
Possible import and handling of sulphur at the Esperance Port.	Up to 90,000 tpa of sulphur is required for the production of sulphuric acid. Sulphur delivered as shipments to the Esperance Port and stored within the wharf area. Loadout to 75t road trains for transportation to Bulong (5 road trains per day, 5 days per week).	**Esperance Shire Council**-could not comment due to the lack of detail on this aspect. Sought confirmation from DEP that a specific CER be prepared for the importation of sulphur through Esperance. **DEP**-the import and handling of sulphur at the Esperance Port may cause concern for some Esperance residents, especially those already concerned by the handling of iron ore at the Port.	Sulphuric acid produced as a by-product of other regional projects should be purchased as opposed to the importation of Sulphur through Esperance.	The importation of sulphur through the Port of Esperance sufficient to meet the requirements of the Bulong and Murrin Murrin Nickel projects is subject to CER level of assessment. This issue will be addressed by the EPA through that assessment. Further EPA evaluation not required.
Social surroundings				
Impacts on Aboriginal and European Heritage.	Impacts on sites of significance to Aboriginal people. Impact on Old Bulong Townsite.	Identified as a topic in EPA guidelines.	The Old Bulong Townsite and cemetery contain important heritage and tourism features which should be protected.	Impacts on Aboriginal heritage values can be managed through the *Aboriginal Heritage Act 1972*. Impact on European heritage values is outside the scope of this assessment and should be managed by the proponent in consultation with the City of Kalgoorlie-Boulder and relevant organisations such as the Eastern Goldfields Historical Society. Further EPA evaluation not required.
Risks and hazards	Operation of the plant will introduce risks and hazards.	Identified as a topic in EPA guidelines.		Risk and hazard issues are subject to compliance with DME and DOSHWA requirements. Further EPA evaluation not required.

Table 2. Identification of issues requiring Environmental Protection Authority evaluation (cont'd)

Social surroundings				
Transportation issues	Potential for spill of raw materials, process chemicals and products whilst being transported. Increased vehicle movements on the Bulong Road.	**MRWA**-if transport of sulphur or sulphuric acid from Esperance Port is by rail instead of road trains this will need further study; which road route will be used for transportation of limestone; logical to seal Bulong Road. **City of Kalgoorlie-Boulder**-proponent will be required to upgrade Bulong Road to a sealed standard.	The number of vehicles per day travelling through the old Bulong townsite should be defined.	This issue should be addressed by the local government authorities and Main Roads Western Australia in conjunction with the proponent. No further evaluation required by EPA.
Other				
Environmental Management Programme (EMP).	An EMP is to be developed for environmental management of the project's construction, operations and decommissioning phase.			EPA evaluation required.
Decommissioning and rehabilitation.	Residual longer term impacts at the completion of mining operations will be mainly associated with the stabilisation of post-mining landforms, tailings dam and evaporation ponds.	**DME**-it is not clear whether there is an opportunity for sequential mining/rehabilitation. **DEP**-details regarding monitoring, revegetation, interim completion criteria should be addressed; rehabilitation of the evaporation pond is not addressed; potential for successful rehabilitation of the tailings impoundment is questioned.		EPA evaluation required.

Table 2. Identification of issues requiring Environmental Protection Authority evaluation (cont'd).

4. Evaluation of key environmental issues

4.1 Impact on locally and regionally significant vegetation associations, Declared Rare and Priority flora

Objective

To protect Declared Rare and Priority flora and avoid loss of locally and regionally significant vegetation associations and plant habitats, where possible.

Policy information

To meet the requirements of the *Wildlife Conservation Act*, (1950-1979) and maintain biodiversity in the State.

The *Wildlife Conservation Act* protects Declared Rare Flora (DRF) and requires specific approval to be given before any known DRF are removed.

Technical information

A description of flora and vegetation is provided in Section 3.3 and Appendix D of the proponent's CER (Kinhill Engineers Pty Ltd, 1996a). The main points from the CER are as follows:

1. A total of 285 species from fifty families (twenty two of which were represented by a single species) and 130 genera (eighty three of which were represented by a single species) were recorded from the project area.
2. The vegetation associations established for the project site are divided into the following types:
   - A: Sparse to open *Eucalyptus salmonophloia* woodlands over moderately dense, low shrublands dominated by Chenopods which occur on heavy alluvial clay soils;
   - B: *Eucalyptus* woodlands over mixed shrublands, which occur on sandier soils on higher stony ground; and
   - C: Vegetation associated with salt lakes.
3. No Declared Rare Flora were located within the project area.
4. One Priority 1 flora species (*Gnephosis intonsa*), one Priority 3 flora species (*Eremophila pustulata*) and one Priority 4 flora species (*Eremophila parvifolia*) were recorded from within the project area. These species will all be affected to some extent by the project.

The proponent indicates that approximately 400ha of vegetation will be cleared over the life of the project to facilitate construction of mine and infrastructure. "Once locations for mine pits, pipelines, roads and other infrastructure are finalised they will be inspected for the presence of Declared Rare and Priority listed species. If species of concern are located, the population size will be mapped to determine the potential impact of the development on both a local and regional scale. Where practical, haulage and access roads, pipelines and other infrastructure will be relocated to minimise these impacts." (Kinhill Engineers Pty Ltd, 1996a)

Comments from key agencies/interest groups

The Department of Conservation and Land Management (CALM) has advised the proponent that it would be worth recording where and when topsoil from the recorded location of *Gnephosis intonsa* (a Priority 1 species) is re-used (if at all) and any treatments used. This may

assist with furthering knowledge of the biology of this species. CALM also advised the proponent that *Eremophila parviflora* is no longer a Priority 4 species.

The Department of Environmental Protection sought clarification of the total development area proposed and an indication of the regional and local significance of the vegetation on the site

Response from the proponent

The proponent's response to the issues raised in submissions and discussed above (Kinhill Engineers Pty Ltd, 1996b) is included in Appendix 2 (Issue 1[page 1], and questions 1.1, 1.4 , and 1.7). In its response, the proponent has indicated that the whole project will disturb less than 600ha of vegetation during the first 15 years of operation. The mining activity together with the process plant is not expected to disturb more than 400ha. The proponent has indicated its willingness to cooperate with CALM regarding the Priority 1 species *Gnephosis intonsa.*

In its response to the regional and local significance of the vegetation the proponent, quoting from Keighery et al (1992), has indicated that at a regional scale the vegetation of the Bulong project area is both widespread and well represented although there is limited representation within conservation areas. With particular reference to dry land options for the location of the tailings storage facility, the proponent has indicated that at both the regional and local scale, the vegetation types, potentially affected by the footprint of the tailings dam, are widely distributed and well represented.

Environmental Protection Authority evaluation

Elements of the project which pose the greatest impact to vegetation are likely to be those which involve large scale clearing and potentially include the mining, leach residue and evaporation pond storage areas. Other elements such as borefields and infrastructure (eg: powerlines and water pipelines) also involve land clearing although the impacts are usually confined to narrow linear easements where there is greater potential to avoid sensitive areas or follow existing cleared alignments such as roads and fencelines.

Direct disturbance to vegetation through clearing or indirect disturbance as a result of changes to drainage patterns can be reduced through a range of measures including proper design and management of the project. The proponent has indicated in Section 5.6 of the CER (Kinhill Engineers Pty Ltd, 1996a) that it will develop and implement a range of measures, as part of the construction, operational and decommissioning stages of an Environmental Management Plan for the project. An Environmental Management Plan will be prepared and implemented to the requirements of the Department of Environmental Protection on advice of the Department of Minerals and Energy, the Department of Conservation and Land Management, the Water and Rivers Commission, the Water Corporation, and the Shire of Kalgoorlie (Commitment 1).

The EPA has concluded that the commitment made by the proponent, and the management measures outlined in the CER and in response to submissions, meet the EPA's objectives in relation to the management of potential impacts on flora and locally and regionally significant vegetation associations.

4.2 Impact on Threatened and Priority fauna species and animal habitats

Objective

Threatened and Priority fauna species and their habitat should be protected.

Policy information

To meet the requirements of the *Wildlife Conservation Act*, (1950-1979) and maintain biodiversity in the State.

The *Wildlife Conservation Act* protects Threatened and Priority fauna species and requires specific approval to take or kill protected fauna.

The Japan-Australia Migratory Bird Agreement (JAMBA) 1974 and the China-Australia Migratory Bird Agreement (CAMBA) 1986 are relevant as is the National Strategy for the Conservation of Australia's Biological Diversity to which Western Australia is a signatory.

Technical information

The proponent (Kinhill Engineers Pty Ltd, 1996a) states that:

- a survey of fauna was undertaken for the Bulong project area in June 1995;
- seven species of native mammal, six species of introduced mammal, fifty six species of birds and sixteen reptile species were recorded for the Bulong project area. The Bulong project area may support a further twenty-one native and six introduced species of mammal, including eight species of bat and nine species of marsupial. Using known habitat preferences and species distributions up to 124 bird species, sixty-eight reptile and two amphibian species may occur in the area;
- two species of bird that are protected under international agreements, three species of birds and two reptile species included as scheduled fauna under the Wildlife Conservation Act, may occur in the project area but were not recorded or found during the field survey;
- fauna habitats are closely aligned with landform-vegetation associations. Four terrestrial and two aquatic fauna habitats were identified within the Bulong project area;
- Appendix D of the proponent's CER (Kinhill Engineers Pty Ltd, vol 2, 1996a) indicates that Lake Yindarlgooda, an ephemeral salt lake, supports aquatic vegetation and a wide variety of fauna, including ephemeral crustaceans such as ostracods and the brine shrimp *Parartemia* species, as well as transitory water fowl and waders. Islands within the lake would also be potential breeding habitats for many migratory bird species;
- the potential effects of the project on fauna will generally be secondary and minor. There will be initially local marginal impacts, with destruction of habitat and relocation of mobile species into adjacent habitats;
- as large areas of similar habitat and hence faunal composition occur in areas adjacent to the project site, the impact in regional terms will be minor;
- the potential for impact to any scheduled fauna is considered minimal; and
- operational areas at the plant and key areas at the mine pits, leach residue and evaporation ponds will be fenced to protect both animals and the public.

Comments from key agencies/interest groups

The Department of Conservation and Land Management (CALM) notes the proponent's commitment to survey and collect data on the ecology of the lake and suggests that an appropriate scope for the project would be to assess the role of salt lakes in arid land ecology, based on the Lake Yindarlgooda model. CALM points out that it could assist the proponent with compiling a package of information on likely rare fauna for the site area, for the purposes of workforce education. In return CALM would expect any sightings to be reported and an increase in knowledge of rare species would ensure more reliable reporting.

The Department of Environmental Protection (DEP) sought further information on the regional and local significance of the lake, lakeside and pipeline route as fauna habitat. The CER does not provide an indication of the ecological significance of Lake Yindarlgooda for fauna,

particularly resident fauna (crustacea) and migratory bird species. The impact of spillage from the tailings dam on the fauna of the lake should also be discussed.

Public submissions indicated that little is known about the habitat requirements of birds that migrate to this region. Public submissions noted that, whilst acknowledging the phenomenon of crustacea in Lake Yindarlgooda, the proponent does not investigate the impacts on such species from nitrification of the waterbody. No comment is made by the proponent on what efforts are to be made to reduce the attractiveness of exposed toxic waterbodies to avifauna. The habitat image presented by residue or evaporation dams to moving water birds is likely to determine whether birds are attracted to these structures. These habitat images may involve the surface area of open water, the surface area of wet mud, islands and the presence of remnant or regrowth vegetation.

Response from the proponent

Measures to minimise disturbance to fauna are outlined in Section 5.6 of the CER (Kinhill Engineers Pty Ltd, 1996a). In responding to issues raised in submissions (questions 1.3, 1.6, 1.9 and 1.11, Appendix 2), the proponent has indicated that:

- the hydrochemical characteristics of the waters of the leach residue and evaporation pond are of low toxicity;
- migratory birds would be unlikely to drink from highly saline lakes and would be similarly discouraged from drinking the leach residue liquor due to the water's salty taste. Ingestion of small quantities would not pose a hazard to the birds and the pH of 7.4 indicates that there is no significant corrosive hazard to birds;
- CALM's offer to assist in compiling a package of information on likely rare fauna in exchange for information on sightings is accepted by the proponent;
- with respect to the proposed pipeline access and borefield alignment, the proponent expects the vegetation occurring in these areas to be relatively widespread within the region;
- salt lakes are numerous within the region, hence these habitats affected by the proposal are not considered significant at the regional level; and
- due to the lack of data available, a commitment has been made by the proponent in Section 5.5 and 5.6 of the CER (Kinhill Engineers Pty Ltd, 1996a) to conduct a study of the migratory birds and macro-invertebrates (eg: crustacea) inhabiting Lake Yindarlgooda.

Environmental Protection Authority evaluation

The proponent has indicated in Section 5.5 and 5.6 of the CER (Kinhill Engineers Pty Ltd, 1996a) that it will develop and implement a range of measures to manage the potentially adverse impacts of the project on fauna, as part of the construction, operational and decommissioning stages of an Environmental Management Plan for the project. The Environmental Management Plan will be prepared and implemented to the requirements of the Department of Environmental Protection on advice of the Department of Minerals and Energy, the Department of Conservation and Land Management, the Water and Rivers Commission, the Water Corporation, and the Shire of Kalgoorlie (Commitment 1).

The EPA has concluded that the commitment made by the proponent, and the management measures outlined in the CER and in response to submissions, generally meet the EPA's objectives in relation to impacts on fauna and fauna habitat. However, the suitability of Lake Yindarlgooda for the leach residue and evaporation pond storage facility is queried and is considered further in Section 4.4.

4.3 Impact on the water table due to the extraction of groundwater

Objective

To ensure that the proposed extraction of groundwater does not result in drawdown of the water table such that indigenous vegetation is threatened or other user rights jeopardised.

Policy information

The site falls within the Goldfields Groundwater Area and water resources use is administered via abstraction controls under Part III of the Rights in Water and Irrigation Act. The proponent should ensure that no detrimental impacts on water quality or availability occur as a consequence of the project.

Technical information

As described in the proponent's CER (Kinhill Engineers Pty Ltd, 1996a), the process plant will require 5,760 kL/d of saline water which will be obtained from a borefield located north of the project area within the North Yindarlgooda Palaeochannel. The process water supplies could accommodate the requirements of the operation for a minimum of fifteen years with an expected drawdown of 20m in the first year and 26m in fifteen years. A licence to extract groundwater from the borefield would have to be obtained from the Water and Rivers Commission.

Within the borefield area, the average depth to groundwater is 44m below ground level and the groundwater is hypersaline with a typical total dissolved solids concentration in excess of 160,000mg/L.

Analysis of the abstraction estimates for the process water borefield indicate that the drawdown on the areas surrounding the palaeochannel, based on their very low clay conductivity, will be almost negligible (low clay conductivity effectively controls the interaction between the aquifer and surrounding soils). This is particularly relevant in terms of effects on surrounding vegetation and in particular on the Bullock Holes Sandalwood Reserve (See Figure 2), which is not expected to sustain any adverse effect from drawdown of the palaeochannel.

Impacts on other bores in the area are possible due to the nature of the system, which is interconnected between the borefields. Drawdown at any one point will interact with other bores along the palaeochannel. The present drawdown estimates imply an interaction with existing borefields located upstream, the closest of which are about 15km from the western boundary of the proposed Bulong project borefield.

Permanent vegetation monitoring plots or transects will be established by the proponent in vegetation adjacent to each bore. The plots or transects will be assessed annually for indications of declining vegetation condition. Observation bores will be established to measure the effects of drawdown on the pore water of the soils overlying the palaeochannel aquifer.

Comments from key agencies/interest groups

The Water and Rivers Commission provided the following comments:

- the proposed borefield appears to be capable of meeting the estimated process water requirements of about 6000m^3/day, however; pumping at this rate could interfere with neighbouring borefields; and
- the proponent should be encouraged to recycle as much process water as possible to reduce the long-term depletion of the groundwater resources.

The Department of Environmental Protection has commended the proponent for committing to vegetation monitoring over the borefields to determine any vegetation impacts resulting from the loss of water from the clays overlying the aquifer. The impacts of such extraction on vegetation are unknown, and not clearly defined in the CER.

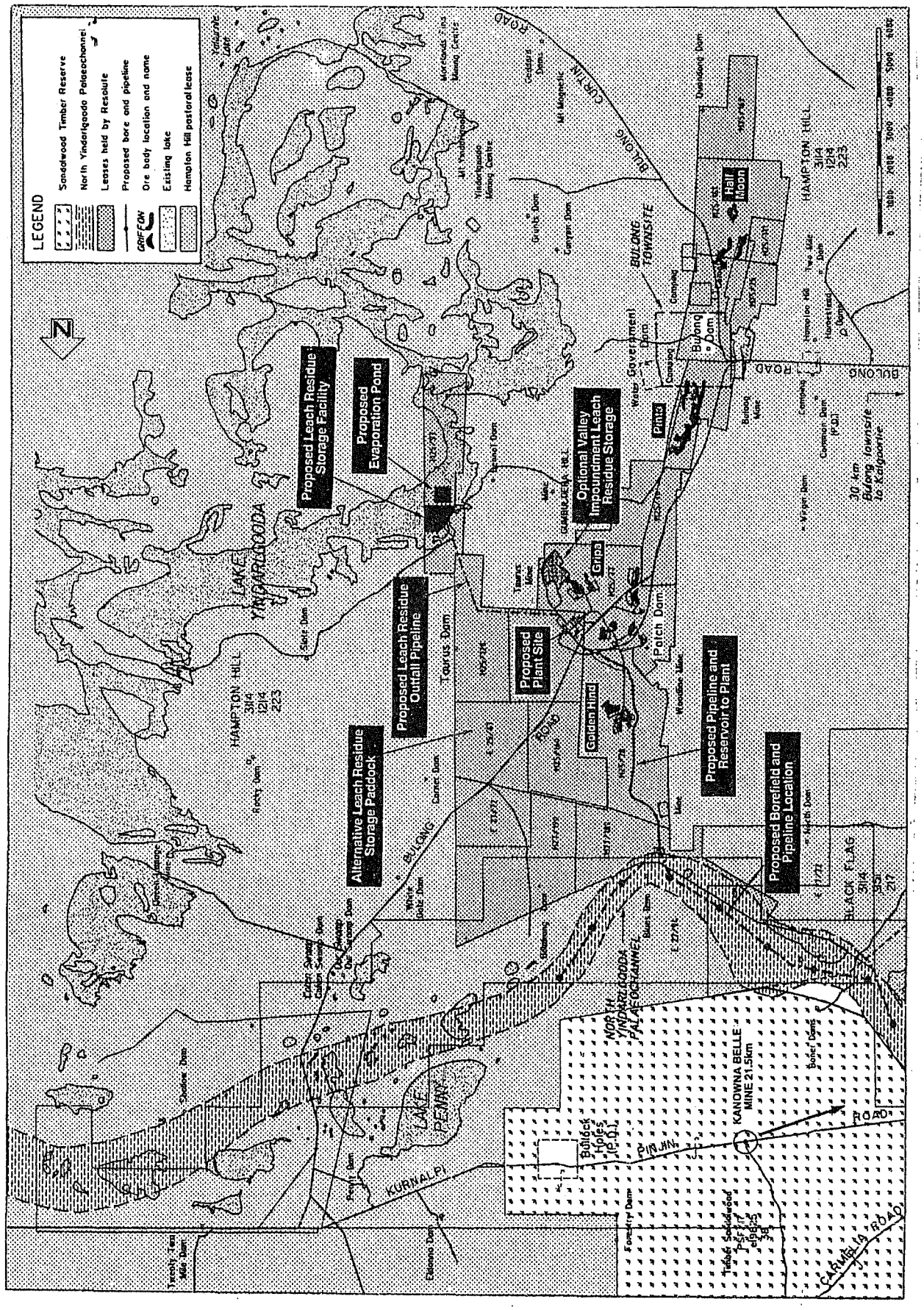


Figure 2. Project layout (Source: Kinhill Engineers Pty Ltd 1996a)

Response from the proponent

The proponent's response to the issues raised in submissions and discussed above is included in Appendix 2 (Questions 1.13, 1.14 and 1.15). In its response, the proponent has indicated the following:

- page 5.5, Section 5.4 of the CER provides a commitment to conduct a hydrological study to determine the effects of the Kanowna Belle and Bulong Nickel Cobalt Laterite Project abstraction from the North Yindarlgooda Palaeochannel. The proponent also reiterates that drawdown on areas surrounding the palaeochannel, based on the very low clay conductivity, will be almost negligible;
- the proponent plans to recycle all process water. Better metal recovery is obtained with recycled water so it is in the proponent's best interest to recycle; and
- there is no standing water table in the vicinity of the proposed mine, since the underlying stratas are impermeable and drilling has revealed no groundwater. The available evidence strongly suggests that the likelihood of withdrawal from the palaeochannel having any measurable impact on vegetation is very low. This is because the low conductivity clays overlying the palaeochannel effectively control the interaction between the aquifer and the surrounding soils.

Environmental Protection Authority Evaluation

The EPA notes that the project site falls within the Goldfields Groundwater Area and that a decision by the Water and Rivers Commission (WRC) on the acceptability of the proponent's borefields is required before a licence would be issued under Part III of the Rights in Water and Irrigation Act. Where uncertainties exist in relation to the adequate protection and management of groundwater resources, the WRC has a responsibility to require developers to provide them with appropriate detailed studies prior to decision making or the granting of any approvals to develop a borefield. The environmental impact assessment process can indicate where such uncertainties exist. However, where such studies indicate that water supply issues cannot be adequately protected or managed, it is the responsibility of the WRC to refuse the proposal or seek alternative measures to address the issues of concern.

The EPA notes from Section 4.3 of the proponent's CER (Kinhill Engineers Pty Ltd, 1996a) that permanent vegetation monitoring plots or transects will be established by the proponent in vegetation adjacent to each bore. The plots or transects will be assessed annually for indications of declining vegetation condition. Observation bores will be established to measure the effects of drawdown on the pore water of the soils overlying the palaeochannel aquifer.

The proponent has suggested that the likelihood of withdrawal from the palaeochannel having any measurable impact on vegetation is very low. The EPA recognises that this is likely to be the case. The proponent's Environmental Management Plan will outline the strategy for the development and operation of the process water borefield should individual bore monitoring indicate an adverse affect on vegetation as a result of drawdown attributable to a specific bore.

The EPA has concluded that the measures outlined in the CER and in response to submissions meet the EPA's objectives in relation to the management of potential impacts on the water table due to the extraction of groundwater. This does not remove the necessity to obtain approvals which may be required by other agencies.

4.4 Alternative options for location of leach residue and evaporation pond storage facility

Objective

To ensure that the location of the leach residue storage facility achieves the EPA's objectives for protection of the environment, including the application of best practice principles.

Policy information

There are no applicable environmental protection or other EPA policies.

Technical information (from: Kinhill Engineers Pty Ltd, 1996a)

In the investigation of options for location of a leach residue disposal facility, consideration was given to a paddock impoundment, a valley impoundment and a storage impoundment located on Lake Yindarlgooda (an ephemeral salt lake).

The advantages and disadvantages of each location are summarised in Table 3.

Table 3. Options for location of leach residue disposal facility (from: Kinhill Engineers Pty Ltd, 1996a)

Option	Advantages	Disadvantages
Paddock impoundment	Ease of construction Closest to plant Lowest operating cost Lowest capital cost	Good grazing land Lies in major watershed Potential hazard to vegetation In stock-droving route
Valley impoundment	Reasonably close to plant Low operation cost Reasonable capital cost Less embankment fill Poorer grazing land	Sterilises area of good vegetation Disrupts fauna habitat Water courses to be diverted On-going potential hazard to downstream vegetation Potential water course salination and downstream pastoral dams
Lake impoundment	No drainage problems Easier to achieve better final aesthetics No potential effects on vegetation No potential downstream salinity effects Possibility to reduce the area of salt-affected land in the area with the rehabilitation and vegetation of the impoundments	Highest capital cost Highest operating cost Effects on fauna (migratory birds and crustaceans) unknown Furthest from plant site Need for control of flood waters

"In consideration of all the above, the proponent's preferred option is to impound leach residue on Lake Yindarlgooda." (Kinhill Engineers Pty Ltd 1996a)

Comments from key agencies/interest groups

The Department of Minerals and Energy (DME) indicate that there is no adequate geotechnical description and assessment of the preferred "Lake Impoundment". DME considers that placing tailings walls in potential contact with standing or flowing natural waters is generally not good environmental practice, because it could affect erosion rates and wall stability and assist in conducting pollutants from the dam to the external environment. As well as containing metals, which may or may not be mobilised, DME indicate the residue contains 11,380mg/L ammonium sulphate which may represent a eutrophication problem for the ephemeral aquatic

environment. The DME sought clarification from the proponent regarding the operational significance of the "Optional" Valley Impoundment Residue Facility and whether it is an alternative to the Lake Impoundment.

The Department of Environmental Protection consider that the CER does not provide sufficient information to allow evaluation of the three options for location of the residue disposal facility. In its letter of 17 May 1996, the DEP requested a detailed comparative assessment of the environmental aspects directly affected by the location of the tailings 'footprints' between the dry land sites and lake site. The DEP indicated that an assessment of the significance of the vegetation affected by the dry land storage options is required and that this information should be weighed against an assessment of the significance of Lake Yindarlgooda.

In its advice the DEP indicated that salt lakes are not sterile but may have important cyclic functions. The DEP, quoting from the Australian Nature Conservation Agency 1993, indicated that Lake Barlee, an ephemeral salt lake located 148km west north-west of Menzies, is probably the most important breeding area for Banded Stilt in Australia, and that similar lakes, such as Lake Yindarlgooda, can represent a bountiful habitat to wildlife.

In addition, the DEP requested a comparative assessment of the performance characteristics for the tailings storage facility located on the dry land sites and the lake site, including, construction constraints; leakage potential, including design features required to reduce leakage, monitoring required to detect leakage and management required to recover leaked material; degree of management required in the short and long term.

One public submission considered that Lake Yindarlgooda is not an acceptable location for either the evaporation pond or leach residue facilities and submitted the following:

- the CER states that Lake Yindarlgooda is the most attractive option from an environmental perspective without stating why;
- the CER does not investigate the impacts on crustacea in Lake Yindarlgooda from nitrification of the waterbody;
- no detail of the paddock option is given and therefore no meaningful assessment can be made; and
- the paddock impoundment option seems to have been rejected on the grounds that it is the best grazing land in the region and that it is in the watershed of Lake Penny. Consideration of these matters was not applied to the other options including Lake Yindarlgooda.

Response from the proponent

The proponent's response to the issues raised in submissions and discussed above is included in Appendix 2 (Pages 1-11 and Questions, 1.12, 2.13, and 2.14). In its response, the proponent has indicated the following:

- whilst it is clear that neither the paddock or valley impoundment options contain vegetation of particular conservation significance, it is contended that such vegetation clearance in an arid area is not desirable if other options are available;
- the comparison of Lake Yindarlgooda with Lake Barlee as a (potential) important breeding area for avifauna is not necessarily valid and is not supported in any of the literature; and
- construction issues associated with ensuring proper operational performance of the Lake Yindarlgooda option are manageable.

The proponent's comparative assessment of the performance characteristics between options for the leach residue storage facility is shown in Table 4. According to the proponent (Kinhill Engineers Pty Ltd, 1996b), the Table represents the degree of acceptability (albeit subjective) on a scale of 1 to 5, ie: 1 is the least favourable, most expensive, most impact, longest time, hardest to manage etc.

Table 4. Location of leach residue disposal facility - comparative assessment of performance characteristics (from: Kinhill Engineers Pty Ltd, 1996b)

		LOCATION OF LEACH RESIDUE DISPOSAL FACILITY		
		LAKE	VALLEY	PADDOCK
Construction Restraints	Cost	2	3	4
	Weather	3	3	4
	Materials	3	3	4
	Time	3	3	4
	Equipment	3	3	4
Environment	Fauna	4	2	2
	Flora	4	3	2
	Aesthetic	4	3	2
Leakage	Potential	2	2	3
	Detection	4	2	3
	Recovery	4	3	4
Management	Operation	5	3	5
	Maintenance-short term	4	3	4
	Maintenance-long term	4	3	4
	Total score	49	39	49

This overall rating suggests that the valley impoundment is the least desirable option (Kinhill Engineers Pty Ltd, 1996b)

Environmental Protection Authority Evaluation

In relation to this issue the EPA notes that the proponent's preferred site for location of the leach residue disposal facility is Lake Yindarlgooda. The EPA understands from Table 3 above, that this site is preferred by the proponent over a more conventional land based paddock impoundment because it does not impact upon pastoral land in good condition and is not sited within a major watershed or catchment area or both. The EPA understands from the proponent's response to submissions (Appendix 2, p7) that objection to the paddock impoundment was not only because of the loss of grazing area but because no guarantee could be given that the retaining embankment would not leak highly saline water into the surrounding vegetation. The EPA notes that at both the regional and local scale, the vegetation types affected by the footprint of the leach residue and evaporation pond storage facility located on the paddock site option are widely distributed and well represented.

The EPA notes the proponent view that the valley-based impoundment option is the least desirable and acknowledges that this option appears to present difficulties in terms of tailings containment, potential leakage and on-going management.

In relation to Lake Yindarlgooda, the EPA is aware that it is an ephemeral salt lake which may have environmental significance (albeit episodic) but that the level of information on the environmental value of the Lake is limited. The proponent has indicated that the lake supports crustacea and that some birds do migrate to the area in wet seasons. The EPA also notes concerns raised by the Department of Minerals and Energy and the Department of

Environmental Protection regarding the short and long term performance and management of a lake-based residue facility.

While the EPA recognises that impoundment structures are essential for the project's operations it is not satisfied that options for the location of the leach residue facility have been adequately considered. *On the basis of existing information, the EPA believes that locating of the leach residue and evaporation pond storage facility on Lake Yindarlgooda is unlikely to meet environmental objectives set by the EPA and could be associated with a high level of risk for irreversible impacts to the environment of the lake. A paddock impoundment appears to have significantly reduced potential risks and impacts.*

The EPA has concluded that further work is required to ensure that the location, construction and operation of the leach residue and evaporation pond storage facility achieves short and long term environmental objectives, including best practice environmental management and provides for effective rehabilitation and decommissioning of the structure. Recommendation 2 reflects this requirement. The EPA recognises that, once decisions on the location of the facility have been made, construction and operational performance should ensure on-going protection of the environment. This is discussed in Section 4.5 below.

4.5 Solid and liquid waste disposal (leach residue and evaporation pond storage facility)

Objective

To ensure that environmental impacts arising from the disposal of tailings are kept as low as practicable and that best practice is implemented.

Policy information

The construction and operation of tailings disposal facilities is subject to works approval and licensing requirements under Part V of the Environmental Protection Act and requires the approval of the State Mining Engineer. Under the provisions of Section 84 of the Mining Act, specific conditions may be imposed for the purpose of preventing, reducing, or making good, injury to the surface of the land on mining leases and general purpose leases.

Technical information

The proponent indicates (Kinhill Engineers Pty Ltd, 1996a), that washed and neutralised leach residue from the process will have no economic value and will be stored in a secure facility. Supernatant leach residue is proposed to be pumped to an evaporation pond at Lake Yindarlgooda*. Development of the pond will involve constructing a bunded enclosure approximately 20ha in size within the confines of the lake. The evaporation pond will have a final height of 2.5m. It will be lined with low permeability material or high density polyethylene material to minimise seepage. Experimental work will be carried out to assess the impact of nutrient release into Lake Yindarlgooda in the event of leakage of wastewater from the evaporation pond. The pond will be of sufficient capacity to provide storage of precipitated salt for 10 to 15 years of operation.

The residue storage facility proposed to be located on Lake Yindarlgooda, will be bounded by embankments raised annually over the life of the facility and cover an area of 48ha. The maximum height of the tailings storage embankment is 21m above the existing ground surface (pers. comm. Mr R Cant, Resolute Resources). The potential environmental issues associated with leach residue storage on any site include leakage of liquor through seepage under or through an embankment, infiltration into underlying aquifers and dewatering and drying of the residue before rehabilitation. The leach residue storage will retain clay sediments and be fitted with underdrains to remove water seeping through the tailings. A decant system will be located

at the embankment to remove supernatant. The process plant is designed to recycle wastewater (decanted water). However, whenever this is not possible, it will be sent to the evaporation pond. Deposition into the residue storage will be based on the sub-aerial technique to maximise insitu material densities. Boreholes or seepage trenches will be installed outside the facility to monitor any future changes in groundwater quality and/or seepage. The typical analysis of leach residue liquor is provided in Appendix 5.

The proponent has indicated in section 5.5 of the CER (Kinhill Engineers Pty Ltd, 1996a) that it will develop and implement a range of measures in regard to leach residue, as part of the construction, operational and decommissioning stages of an Environmental Management Plan for the project. The measures proposed include rehabilitation trials, monitoring of various parameters and the development of management plans to ensure Lake Yindarlgooda is not adversely affected by the residue storage.

* Whilst Lake Yindarlgooda is the proponent's preferred option, the ultimate location of the leach residue and evaporation pond storage facility will be determined through the requirements of recommendation 2.

Comments from key agencies/interest groups

The Water and Rivers Commission (WRC) considered that details of leach residue and evaporation pond seepage collection, monitoring and recovery in the lake bed environment of Lake Yindarlgooda needs better definition, especially under circumstances where the lake contains water. Some profiling of the lake sediments is suggested by the WRC to determine if keyways need to be cut and filled with low permeability fill to limit lateral seepage through the embankments.

The Department of Environmental Protection requested information on the likely risk of residue pond failure. The DEP sought further details on leach residue and evaporation pond seepage collection, monitoring and recovery in the lake bed environment of Lake Yindarlgooda, especially when the lake contains water. Containment criteria and engineering specifications were also considered necessary by the DEP to enable the EPA to properly evaluate this issue. To assist the DEP, the proponent provided a geotechnical report on the proposed leach residue and evaporation pond storage facility, "Disposal of Leach Residue in Lake Yindarlgooda" (Knight Piesold, 1996). The Department of Environmental Protection referred this geotechnical report to the Department of Minerals and Energy for review.

Prior to review of the proponent's geotechnical report, the Department of Minerals and Energy (DME) indicated that an adequate geotechnical assessment of the stability and permeability of the Lake Impoundment would have to be completed by DME Geotechnical Services before the environmental acceptability of this part of the project could be determined. The DME indicated that this issue would have to be addressed before Mining Act conditions of approval could be progressed. Following its review of the proponent's geotechnical report (Knight Piesold, 1996), the DME indicates that it does not comply with DME's guidelines on the safe design and operating standards for tailings storages and that a number of issues remain to be addressed.

One public submission indicated that there are a large number of storage tailings facilities in Western Australia and that most if not all of these leak. The submitter, quoting from the 1994 "Conservation and Rehabilitation in the Gold Mining Industry" Report to the Hon Minister for Mines [not sighted] and the Keynote speech to the Third International Conference on Environmental Issues and Waste Management in Energy and Mineral Production held in Perth in August 1994, [not sighted] indicated the following;

- leakage from tailings has led to development of groundwater mounds beneath some tailings storage facilities; and
- concerns about discharge of contaminated seepage from tailings impoundments, which can impact surface and groundwater quality, have prompted the inclusion of geomembrane liners for tailings impoundments. This approach has been used extensively in the United States and Canada for tailings solids and liquid containment.

The submitter indicates that the Commonwealth Environment Protection Agency promotes the use of liners and that the proponent for the Bulong project should design an impermeable storage facility in the first instance rather than adopt a leakage management approach.

Response from the proponent

The proponent's response to the issues raised in submissions is included in Appendix 2 (Pages 5-11 and Questions, 2.16 - 2.31). In responding to many of the issues raised in submissions, the proponent has referred to and quoted from the report, "Disposal of Leach Residue in Lake Yindarlgooda" (Knight Piesold, 1996).

In summary, the proponent indicates that:

- experience in the industry does indicate that leakage through and/or under retaining embankments is a potential problem;
- for the Lake Yindarlgooda option, it is believed that the highly saline leach residue will have little or no effect upon the already highly saline water and sediments of the lake, and the impoundment design is such that any leakage will be returned to the evaporation pond and thence recycled to the process plant;
- having provided for flood conditions, the likely risk of pond failure is very low;
- the leach residue storage facility and evaporation ponds will be constructed in accordance with a technical specification which will be provided as part of the final design. The implementation of this technical specification during the construction phase is essential to ensure that the facility will function according to the design intent; and
- since the shoreline vegetation of Lake Yindarlgooda is relatively sparse and the salt lake has no vegetation, the leach residue storage facility will be rehabilitated to blend into this landscape.

Environmental Protection Authority Evaluation

In relation to the leach residue and evaporation pond disposal facility the EPA notes that since the release of the CER, a more detailed geotechnical and engineering investigation has been undertaken for the site. However, the EPA notes that the geotechnical study (Knight Piesold, 1996) does not, at this stage, satisfy the requirements of the Department of Minerals and Energy.

The EPA considers that there remains a lack of certainty regarding the ultimate performance characteristics of the impoundment, including leakage management and recovery and the potential for rehabilitation and decommissioning. Therefore, while the EPA recognises that impoundment structures are essential for the project's operations, it is considered that a more detailed understanding of the performance characteristics will be necessary. This will be provided through additional work necessary to satisfy requirements under the Mines Act and Works Approval under the Environmental Protection Act and through the requirements of the proponent's Environmental Management Plan (Commitment 1).

Notwithstanding the final location of the leach residue and evaporation pond storage facility to be determined through the strategy required by Recommendation 2, the EPA has concluded that the long term performance characteristics of the tailings material and the impoundment facility are not easy to predict. The EPA considers that wherever the facility is ultimately located, the proponent should provide an updated report on the progress of the facility's development after five years of operation. At such time, the EPA could determine appropriate follow-up reporting requirements. Recommendation 3 in Section 5 of this report reflects this requirement.

The EPA's evaluation does not remove the necessity for the proponent to obtain approvals which may be required by other agencies.

4.6 Gaseous emissions (including greenhouse gases and odours)

Objective

To ensure that gaseous emissions, including greenhouse gases and odours, both individually and cumulatively, do not cause an environmental or human health problem. The proponent should use all reasonable and practicable measures to reduce the discharge of wastes, including gases (EPA, 1996a).

Policy information

The EPA has promulgated two Environmental Protection Policies (EPPs) for atmospheric pollutants, for the Kwinana and Kalgoorlie areas. The EPA uses the Kwinana EPP standards and limits as guidelines for the assessment of new industrial projects (where there are no existing sources) and for existing industrial plants which are seeking approval for modifications (Environmental Protection Authority, 1992).

In the Kwinana EPP, a limit is defined as "a concentration not to be exceeded" and a standard is defined as "a concentration which it is desirable not to exceed". The standard is interpreted as the value which the ground level concentration must be below for 99.9% of the time.

The standards and limits for sulphur dioxide and particulates used in the EPP for the Kwinana policy area are summarised in Table 5 below.

Table 5. Standards and limits used in the EPP for the Kwinana Policy Area

Species	Area	Averaging Period	Standard ($\mu g/m^3$)	Limit ($\mu g/m^3$)
Sulphur Dioxide	Industrial Estate	1 hour	700	1400
		24 hour	200	365
		Annual	60	80
	Residential	1 hour	350	700
		24 hour	125	200
		Annual	50	60
Particulates PM_{10}	Residential	24 hour	-	120
		Annual	-	40

The National Health and Medical Research Council (NH&MRC) guidelines require that the ambient concentration of nitrogen dioxide (NO_2) does not exceed 0.16ppm or $320\mu g/m^3$ (as a one hour average, and not to be exceeded more than once a month).

Guidelines for maximum concentrations of oxides of nitrogen (NO_x) emissions from stacks and vents may also apply to industrial plants in addition to guidelines for ground level concentrations of NO_x emissions. The relevant (NH&MRC) guideline figure which is applicable to the proposed 30t/h diesel oil-fired package steam boiler used to produce less than 30MW of electricity is $0.5g/m^3$.

Carbon dioxide (CO_2) is a greenhouse gas and worldwide industrial emissions are considered to be a major contributor to global warming. The Federal Government, in accordance with international agreements, has announced an intention to stabilise carbon dioxide emissions in Australia by the year 2000. The Commonwealth has urged a program of co-operative agreements between industry and the government to reduce greenhouse emissions.

The EPA recently considered greenhouse gas emission policies in general, including the approach taken by the Commonwealth government and the review undertaken by the DEP into the status of WA's approach.

The EPA has adopted the following provisional policy in relation to the assessment of individual energy intensive projects which are likely to emit significant quantities of greenhouse gases. This will enable the State to address the issue of anticipated industrial expansion and substantial increase in greenhouse gas emissions in the next few years. Accordingly, the EPA considers that a proponent should, in their proposal documents:

1. calculate the greenhouse gas emissions associated with their proposals (using the methodology developed for Australia);
2. indicate the specific measures adopted to limit greenhouse gas emissions for that project;
3. as appropriate, whether on a project-specific basis, company-wide arrangement or within an industrial grouping, enter into the National C21 'Greenhouse Challenge' voluntary agreement programme for the estimation, reporting and auditing of greenhouse gas emissions; and
4. estimate as appropriate, the global emission credit (greenhouse gas offsets) achieved through implementation of the proposal.

Technical information

In its CER (Kinhill Engineers Pty Ltd, 1996a), the proponent has indicated the following:

- there will be no fugitive sulphuric acid mist emissions from the pressure leaching process;
- the production of sulphuric acid from the acid plant [if required] will result in the emission of approximately 535t/a of sulphur dioxide;
- the emissions of sulphur dioxide from the proposed sulphuric acid plant at Bulong will represent only about 0.011% of the total sulphur dioxide emitted in the Kalgoorlie area after the installation of the sulphuric acid plant at the Kalgoorlie Nickel Smelter;
- the maximum predicted ground-level concentration of sulphur dioxide attributable solely to the proposed Bulong sulphuric acid plant (about 20$\mu g/m^3$) should have little if any impact on vegetation;
- the option to buy sulphuric acid is still open and is the proponent's preferred option. In additional advice following its response to submissions, the proponent has indicated that the sulphur dioxide emissions from the project would be negligible if an acid plant is not required and acid is purchased;
- no hydrogen sulphide (H_2S) is used in the Bulong Nickel Project nor is it generated within the process; and
- the nearest residence to the plant area (Hampton Hill Station homestead) is located more than 11km away.

Dust emissions are examined in Section 3 of this report and no further evaluation of this topic is required by the EPA.

Nitrogen Dioxide

Nitrogen dioxide is a reddish brown gas which is soluble in water and is a strong oxidant. The major sources of man-made emissions to the atmosphere derive from the combustion of fossil fuels. In most situations, nitric oxide is emitted and is then transformed into nitrogen dioxide in the atmosphere. At low concentrations, nitrogen dioxide can cause irritation of the mucous membranes and may cause or exacerbate respiratory problems such as asthma and bronchitis (EPA, 1996a).

NOx emissions from the Bulong project are low and will be in the order of 0.149-0.246 g/m^3 and are primarily a product of combustion associated with the proposed diesel oil-fired package

steam boiler. National guidelines published by the National Health and Medical Research Council 1986, indicate that the above level is within recommended standards.

Sulphur Dioxide

Sulphur dioxide is a colourless gas which has a pungent odour and can irritate and be absorbed in the respiratory tract. The sensitivity of humans to sulphur dioxide varies considerably and asthmatics may suffer adverse reactions at quite low levels.

The gas also dissolves in moisture forming dilute sulphurous acid, which then forms sulphuric acid and sulphates, which can be readily absorbed onto small airborne particles. This increases the potential for adverse effects on humans and for environmental impacts such as leaf damage to plants and reduced water quality in wetlands (EPA, 1996a).

Sulphur dioxide emissions from the Bulong project will be associated with the proposed sulphuric acid plant [if required] with expected emissions of 1.9kg of sulphur dioxide per tonne of sulphuric acid produced or about 0.019kg/sec. The ground level concentration of sulphur dioxide in the Kalgoorlie region attributable to the proposed Bulong sulphuric acid plant will be about 20 $\mu g/m^3$. Sulphur dioxide emissions would be negligible if acid is purchased.

Carbon Dioxide

Carbon dioxide (CO_2) is a greenhouse gas and worldwide industrial emissions are considered to be a major contributor to global warming. Following discussion with the DEP, it is estimated by the proponent that approximately 40,000 tonnes per annum of CO_2 will be generated from neutralisation of the process stream by adding limestone following acid pressure leaching. At a nickel production rate of 6000 tpa this equates to approximately 7.3 tonnes of CO_2 per tonne of nickel metal produced. By way of comparison, the Murrin Murrin Nickel Cobalt Project will generate approximately 22.2 tonnes of CO_2 per tonne of nickel metal briquettes produced.

Odour

A potential source of odorous emissions would be a hydrogen sulphide plant. The proponent (Kinhill Engineers Pty Ltd, 1996a) has indicated that no hydrogen sulphide (H_2S) is used in the Bulong Nickel Project nor is it generated within the process.

Comments from key agencies / interest groups

The Department of Conservation and Land Management has indicated that the purchase of sulphuric acid has many environmental benefits for the region with respect to sulphur dioxide emissions, transport of chemicals and resource utilisation. CALM encourages the proponent to vigorously pursue this option.

The Department of Environmental Protection (DEP) requested additional information on the following:

- whether nitrous oxide (N_2O) or CO emissions are likely to be produced;
- whether the energy requirements of the process plant will be significantly altered if the option to purchase sulphuric acid is implemented (currently, excess heat recovered from the acid plant is proposed to be used for production of steam for the pressure leaching process);

The DEP notes the following:

- that the proposal appears to be located well away from residential and intensive public-use areas and there do not appear to be any significant environmental air pollution issues apart from the proposal's general proximity to Kalgoorlie;
- that the Bulong proposal is not a "significant source" with regard to the Environmental Protection (Goldfields Residential Areas) (Sulphur Dioxide) Policy 1992, and does not need to be brought within the operating framework of the Policy; and
- sulphur dioxide, dust and all other air pollution issues are likely to be easily regulated through Part V of the Environmental Protection Act.

Following the proponent's response to submissions, the DEP sought further clarification from the proponent on the changes to the project should acid be purchased rather than produced on-site from an acid plant.

One public submission proposed that the extant headstones, located within the Bulong Cemetery Reserve No 3978 where at least 19 headstones survive, should be treated to protect them from any possible fall-out of fumes, gaseous emissions, acid droplets and dust.

Council for the City of Kalgoorlie-Boulder resolved at its meeting on 10 April 1996 "...to request that the Minister for the Environment re-assess the Environmental Protection (Goldfields Residential Areas) (Sulphur Dioxide) Policy 1992 relating to [sulphur dioxide standards for the region to a level of not more than] 700µg/m^3 average over one hour, as recommended by the National Health and Medical Research Council."

Response from the proponent

The proponent's response to the issues raised in submissions and discussed above is included in Appendix 2 (Questions 2.3, 2.5, 2.8, and 2.9). In its response, the proponent has indicated the following:

- Figures 4.2, 4.3 and 4.4 in the CER clearly show that the impact of a sulphuric acid plant for the Bulong project (should one be necessary) would be negligible. At the levels predicted (0.019 kg/s or about 20 µg/m^3 ground level concentration) there will be no measurable impact on flora;
- the only emissions of carbon monoxide (CO) that may be present will be in the stack gases of the diesel-fired boiler plant when in use;
- nitrous oxide is not expected to be produced and while some hydrogen sulphide may be produced during neutralisation, it will further react with cobalt to form cobalt sulphide and remain within the process circuit;
- waste heat from the acid plant [if required] will be used for process steam production and electric power generation. Should sulphuric acid be purchased (obviating the need for an acid plant), process steam will need to be generated on site using diesel oil, gas or electrical energy while electrical energy would be purchased from Western Power or another supplier or generated on site from oil or gas. The total energy requirements would not be significantly altered but would need to be sourced elsewhere.
- little or no change will occur at [the Bulong townsite] with construction of the acid plant at the process plant site;
- following its response to submissions, the proponent has also advised that:
  - if the project has an acid plant, the diesel-fired boiler plant would be used to preheat the autoclave prior to initial start-ups, to provide make-up steam to the process and to act as a full standby power supply when the acid plant is not in operation.
  - NOx emissions from the diesel-fired boiler plant would be in the order of 0.149-0.246 g/m^3;
  - with purchased acid the process steam generator (diesel oil-fired steam boiler) would be used to provide all process steam requirements for the plant;
  - with purchased acid, the main electricity supply for the mine, the processing plant and the auxiliary facilities would be purchased from Western Power or another supplier, via a 33kV connection (*pers. comm. Mr R Cant, Resolute Resources*);
  - purchased acid would be contained in 3 x 3000t storage tanks and that acid storage would be designed to ensure emission levels are less than 50mg/m^3 of acid mist; and
  - it would specify emission criteria in tender documents for the plant and equipment supply for the project and that compliance testing will be carried out by the proponent during commissioning of the plant to confirm that emissions are within specified limits.

Environmental Protection Authority Evaluation

Following advice from the Department of Environmental Protection and the proponent's response to questions raised, the EPA considers that gaseous emissions from the proposed Bulong Nickel Cobalt Laterite project are manageable and acceptable, given its remote location. In arriving at this conclusion, the EPA notes that the predicted concentrations for nitrogen dioxide and sulphur dioxide are within limits specified in guidelines to the proponent. The EPA notes that should an acid plant not be required for the project then sulphur dioxide emissions are expected to be negligible. Although the proponent is unsure at this stage whether an acid plant will be required or whether acid will be purchased, it is evident that both options are environmentally acceptable. With regard to sulphur dioxide emissions the EPA notes that greater environmental benefit is associated with the purchase of acid rather than its production using an on-site acid plant.

It is the EPA's view that proponents should use all reasonable and practicable measures to reduce the discharge of wastes, including gases (EPA, 1996a). Detailed specifications for discharge of emissions, monitoring and reporting will be established by the Department of Environmental Protection in licence conditions set under Part V of the Environmental Protection Act. The proponent has indicated in Section 5.2 of the CER (Kinhill Engineers Pty Ltd, 1996a) that it will develop and implement a range of measures in relation to sulphur and fume emission management, as part of the construction, operational and decommissioning stages of an Environmental Management Plan for the project. The EPA notes that some elements in section 5.2 would not be required should acid be purchased (see Outline EMP, Appendix 4). The Environmental Management Plan will be prepared and implemented to the requirements of the Department of Environmental Protection on advice of the Department of Minerals and Energy, the Department of Conservation and Land Management, the Water and Rivers Commission, the Water Corporation, and the Shire of Kalgoorlie (Commitment 1). The proponent will specify emissions criteria in tender documents for the supply of equipment and undertake compliance testing during commissioning to confirm compliance (Commitment 2).

The EPA notes that the City of Kalgoorlie-Boulder Council resolved to request that the Minister for the Environment re-assess the *Environmental Protection (Goldfields Residential Areas) (Sulphur Dioxide) Policy 1992* (EPP) with a view to reducing the ambient air quality limit. The EPA notes that, in accordance with the EPP Regulations, the ambient air quality limit has been reduced on 1 January 1996, from 1800$\mu g/m^3$ to 1600$\mu g/m^3$ averaged over 1 hour, and that a further reduction to 1400$\mu g/m^3$ is scheduled for 1 January 1997. The EPA also notes that the ambient air quality standard for the concentration of sulphur dioxide for the area covered by the EPP is already set at 700$\mu g/m^3$ when averaged over one hour. This is the concentration of sulphur dioxide which it is desirable not to exceed. Section 36 of the Environmental Protection Act requires that the EPP must be reviewed in 1999.

The Bulong Nickel Cobalt Laterite project is not considered a significant source with regard to the EPP and does not have to be brought within the operating framework of the Policy. The EPA is also satisfied that the timetable for review of the EPP is appropriate.

In view of its provisional policy position for greenhouse gases described above, the EPA considers that Recommendation 4 is appropriate.

4.7 Noise

Objective

To ensure that the amenity of surrounding residents is not unduly affected by noise emissions emanating from the project and associated activities.

Policy information

The proposed plant would need to comply with the Noise Abatement (Neighbourhood Annoyance) Regulations (1979).

"There are currently no statutory regulations that govern road traffic noise. However, Main Roads Western Australia has a policy that traffic noise at residential locations should be restricted to an L_{10} 18 hour of 63dB(A) wherever practicable. The DEP considers that this level should be 58dB(A) wherever practicable. The DEP also considers that instantaneous (maximum) levels should not exceed 80dB(A) but preferably should be closer to 65dB(A)." (EPA 1996b)

Technical information

Construction of the ore processing plant and associated infrastructure will require mobilisation of plant and machinery and employment of a considerable workforce. As a result is expected by the proponent (Kinhill Engineers Pty Ltd, 1996a) that noise from heavy equipment may be experienced and intermittent noises associated with plant assembly at the site may occur form time to time. Noise associated from the operational phase of the proposal will originate from earth-moving machinery, the ore processing plant and in particular the steam-raising and generation plant.

Noise emissions will be reduced by the following measures:

- insulation or cladding of buildings and structures within the plant;
- specification of low noise equipment; and
- the use of silencers where necessary.

As a result of these measures, the maximum noise level at a distance of 1m from any item of equipment will not exceed the requirements of the *Occupational Health, Safety and Welfare Act 1984*. Noise levels in the immediate vicinity of the site arising from the project have not been estimated. However, the proponent indicates the impact of this noise will be minimal due to the distance of the plant from the nearest residence (Hampton Hill Station homestead), which is more than 11km away. The proponent considers the plant will satisfy the requirements of noise emission guidelines outlined in the current Noise Abatement (Neighbourhood Annoyance) Regulations 1979 and in the draft Environmental Noise Regulations with respect to adjoining and nearby land uses.

Section 5.9 of the CER (Kinhill Engineers Pty Ltd, 1996a) outlines a number of measures intended to manage noise levels. In particular, noise emissions will be controlled such that noise levels (resulting from the project) at the nearest noise sensitive location (Hampton Hill Station homestead) will not exceed 40dB(A) during Monday to Friday between 0700 hours and 1900 hours, 35dB(A) during Monday to Friday between 1900 hours and 2200 hours and on weekends and public holidays between 0700 hours and 2200 hours, and 30dB(A) always between 2200 hours and 0700 hours as per the Noise Abatement (Neighbourhood Annoyance) Regulations 1979.

Comments from key agencies/interest groups

Following the proponent's response to submissions, the Department of Environmental Protection requested information on the distance of the nearest residence from the mining operations.

Response from the proponent

In responding to the DEP's request, the proponent has indicated that the Hampton Hill Station homestead will be approximately 5km from the closest mining area.

Environmental Protection Authority Evaluation

There is no doubt that the proposed development of the Bulong Nickel Cobalt Laterite Project will increase ambient noise levels within and immediately adjacent to the project area. The EPA notes the management measures made by the proponent in the Section 5.9 of the CER (Kinhill Engineers Pty Ltd, 1996a), in particular, that it will adopt a policy to comply with the Noise Abatement (Neighbourhood Annoyance) Regulations 1979.

The EPA believes that adequate controls exist under the pollution control provisions of the *Environmental Protection Act* (1986) to control noise associated with the processing plant and mine site should a problem arise. In relation to truck movements to the project site, the EPA notes the remote location of the project and considers that the potential for surrounding residents to be adversely affected by noise impacts is low.

The management measures outlined in the CER and in response to submissions are adequate to achieve the EPA's objective in relation to management of noise impacts.

4.8 Environmental Management Plan

Objective

To ensure the project is managed during construction, operational and decommissioning phases, to reduce unnecessary impacts and to properly manage unavoidable impacts to an acceptable level.

Technical information

The proponent has presented an Outline Environmental Management Plan (see Appendix 4) for the proposed project. The main issues associated with the construction, operation and final decommissioning of the proposed development are perceived by the proponent to include:

- rehabilitation, erosion and sediment control;
- sulphur and fume emission management;
- dust management;
- surface and groundwater quality and quantity management;
- leach residue disposal;
- native flora and fauna management;
- solid and liquid waste management;
- community and public consultation; and
- noise management.

The Outline Environmental Management Plan included in Section 5 of the CER and included in Appendix 4 of this report, examines the above issues in regard to the proposed environmental management tasks, monitoring requirements, compliance criteria and corrective actions. The phase of the project, including before construction, during construction and operation, and decommissioning within which management measures should be implemented is also presented.

The intention to prepare and implement an Environmental Management Plan, as outlined in Section 5 of the CER, is reflected in proponent Commitment 1 as follows:

Commitment 1

An Environmental Management Plan as outlined in Chapter Five of the Consultative Environmental Review, which details the procedures, practices and timing for protection of the

environment including monitoring and reporting requirements, will be prepared and implemented to the requirements of the Department of Environmental Protection on advice of the Department of Minerals and Energy, the Department of Conservation and Land Management, the Water and Rivers Commission, the Water Corporation, and the Shire of Kalgoorlie.

Environmental Protection Authority Evaluation

The EPA considers it imperative that there be a management mechanism in place for the potential environmental impacts associated with the ongoing development of the project. This should also include appropriate monitoring frameworks, so that, over time, management measures can be further refined as required.

The EPA also recognises that approvals for this project are required under the Mining Act , that the Water and Rivers Commission will set conditions under the Rights in Water and Irrigation Act for the abstraction of groundwater, and that Works Approval and Licensing is required under Part V of the Environmental Protection Act.

The EPA notes from Section 5 of the CER (Kinhill Engineers Pty Ltd, 1996a) that the proponent is committed to implementing a range of on-going environmental management measures throughout the life of the project. In view of the pressures placed on the local environment, the EPA considers that Resolute Resources has an on-going responsibility in its pursuit of sustainable development, to enlist the technologies and financial resources they command to reduce environmental degradation.

The EPA considers that the CER has demonstrated that the environmental issues arising from this proposal are capable of being adequately addressed through appropriate management and monitoring. The proponent has commitments to ensure appropriate management and monitoring of the proposal. Of these, Commitment 1 requires the preparation of an Environmental Management Plan for the construction, operation and decommissioning phase of the project. The EMP is to be prepared to the requirements of the Department of Environmental Protection on advice of the Department of Minerals and Energy, the Department of Conservation and Land Management, the Water and Rivers Commission, the Water Corporation, and the Shire of Kalgoorlie.

The EPA concludes that the proponent's commitments and the detail contained in the CER and in response to submissions allow the achievement of the EPA's objective of managing the proposal during construction, operations and decommissioning, to avoid unnecessary impacts and to properly manage unavoidable impacts to an acceptable level.

4.9 Decommissioning and rehabilitation

Objective

To ensure an acceptable rehabilitation and decommissioning programme is put in place which incorporates a "closure strategy" agreed to by the Western Australian Government.

Policy information

Past assessments by the EPA of a range of mining proposals provide a policy framework for consideration of the rehabilitation and decommissioning phase of the project, and the expectations of the EPA.

The EPA has recognised that for rehabilitation to be most effective it must be integrated into the mining plans early on in the project's development, and not left to the conclusion of mining (EPA, 1991).

It is of paramount importance to the State that rehabilitation management does not impose short or long term costs on the community of Western Australia. This is particularly relevant when the success of rehabilitation cannot be evaluated in the short to medium term (EPA, 1994).

When approving other mining projects, the Minister for the Environment has required that there be a specific mechanism put in place for the development of the final decommissioning scenario for the site.

Technical information

The proponent indicates (Kinhill Engineers Pty Ltd, 1996a) that the primary objectives of rehabilitation are to stabilise the surface of all exposed surfaces and to re-establish self sustaining vegetation which is native to the area, has a high level of similarity to the surrounding vegetation, and fulfils the desired land uses of the area. The proponent indicates that:

- rehabilitation of the Bulong project area will be progressive and integrated with the proposed mining operations;
- all rehabilitation will be undertaken in accordance with the Department of Minerals and Energy guidelines;
- the process of rehabilitation will primarily involve the application of topsoil in order to provide an adequate substrate for the establishment of native vegetation;
- the objective of the residue storage rehabilitation is to create a non-polluting and structurally stable landform which is resistant to erosion and visually compatible with the surrounding landscape;
- rehabilitation trials will be conducted for the residue area as soon as practicable to determine optimum methods for establishment of native species;
- the rehabilitation of the evaporation ponds will require development trials to determine the best methods of establishing a stable ecosystem which fulfils DME requirements and final land use criteria;
- completion criteria will ensure that rehabilitation is directed towards alleviating soil compaction, erosion control and establishment of self-sustaining biological communities. Final completion criteria which are more site specific will be set during the mining and decommissioning phases, concurrently with evaluation of the on-going rehabilitation and monitoring. Consultation with relevant authorities and landowners will be included as part of the derivation of final completion criteria; and
- on completion of the mining and processing operations, all buildings and support facilities and debris will be removed and the areas rehabilitated.

The proponent has provided an outline of the rehabilitation measures proposed for the site as part of the Environmental Management Plan (Commitment 1).

Comments from key agencies / interest groups

The Department of Minerals and Energy (DME) notes that mine rehabilitation will sometimes involve partial backfilling and reshaping of the reasonably shallow pits (to 40m). Three deposits/pits are identified for mining in the first 5 year period but it is not clear whether there is an opportunity for sequential mining/rehabilitation. DME requires more detail on the mining/rehabilitation sequence in the first couple of years and on the area of backfilled quarries verses permanent waste dumps to be rehabilitated before Mining Act conditions and approval can be progressed.

The Department of Environmental Protection (DEP) raised a number of points, including the following:

- the success of rehabilitation in replacing the natural vegetation diversity is unknown;
- the objective of a 'self sustaining biological community' requires definition;
- saline areas may be difficult to rehabilitate;
- specific 'interim' completion criteria or goals need to be set prior to commencement of construction;
- rehabilitation of the evaporation pond is not addressed in the Outline Environmental Management Plan;
- the proposal to leave some pits dormant for unspecified periods so that the lower grade resource can be extracted in the future is questioned; and
- the proponent provide some commitment to backfill mined out pits with overburden from adjacent pits, where practicable. The overall impact of the mining operation would be significantly reduced if the number of pits backfilled was maximised. An indication of the percentage of pits backfilled would assist in the assessment of impacts.

Response from the proponent

The proponent's response to this issue is included in Appendix 2 (Questions 4.1-4.7). The proponent indicates that:

- rehabilitation or backfilling can only take place when it is considered that all ore has been removed. This determination is made in consultation with the Department of Minerals and Energy;
- DME will be provided with detailed mine plans when final designs are complete;
- it is agreed that specific interim completion goals will need to be set prior to the commencement of construction;
- rehabilitation of the leach residue disposal facility (including the evaporation pond) is covered in detail in Section 5.5 of the CER;
- there is little risk to native fauna posed by dormant mine pits;
- ore is usually mined to a cut-off grade being that which is considered economical to mine and process. Some low grade ore may be taken and stockpiled. Ore remaining in the pits which is lower than low grade ore could prevent pit backfilling as it may be considered as ore at some future date. The proponent indicates that DME requirements govern potential for backfilling; and
- the proponent will backfill adjacent mined out pits with waste from operational pits and/or leach residue as permitted.

Environmental Protection Authority Evaluation

The EPA concludes that for some elements of the environment, there remains a lack of certainty regarding the extent of environmental change attributable to the long term operation of the Bulong Nickel Cobalt Laterite project. In regard to the leach residue and evaporation pond storage facility, although the preliminary indications for management of this structure have been described, more detailed studies are still required. These studies will better define the ultimate location and long term performance characteristics and rehabilitation potential of the leach residue and evaporation pond facility and clarify the effect of these facilities on the environment. Some aspects of the project will also lead to irreversible impacts to the environment (eg: formation of mined out pits, overburden stockpiles, reduction of groundwater supply).

The management of rehabilitation and decommissioning is inherent in the proponent's commitment to prepare an Environmental Management Plan and in information contained in the CER (Kinhill Engineers Pty Ltd, 1996a) and the response to submissions (Appendix 2). Attention to rehabilitation and decommissioning requirements at the earliest stage of project development will provide decision makers with a high degree of confidence that an acceptable post mining condition can be achieved.

The EPA recognises that it may not be practical for Resolute Resources to detail specific plans for the rehabilitation of the project site early in the project life, bearing in mind its life expectancy of 15 years, and that the end use of the land may not be clear at this stage. However, the EPA considers that the process of planning for decommissioning, and the development of a 'walk away' solution, should be formally instigated early within the mine life. Accordingly, a plan describing the process of decommissioning should be developed within 5 years of commissioning the project (Recommendation 5, Section 5).

5. Conclusion and recommendations

5.1 Conclusion

Following review of the proponent's Consultative Environmental Review, the issues raised in submissions, advice received from government departments, relevant literature and the proponent's revised environmental management commitments, the EPA concludes on the information currently available, that the proposal by Resolute Resources Limited for the development of the Bulong Nickel Cobalt Laterite project can be managed to meet the EPA's objectives.

However, the proposed location of the leach residue and evaporation pond storage facility on Lake Yindarlgooda is of particular concern to the EPA. Further investigation in relation to that site and the paddock impoundment site is required before the EPA could support the Lake Yindarlgooda option.

5.2 Recommendations

Noting the conclusion reached, the EPA submits the following recommendations to the Minister for the Environment.

Recommendation 1

That the Minister for the Environment note that the EPA has concluded that the proposal can be managed to meet the EPA's objectives, subject to the proponent's revised environmental management commitments and the EPA's recommended conditions and procedures (see Recommendation 6).

Recommendation 2

On the basis of existing information, the EPA believes that locating the leach residue and evaporation pond storage facility on Lake Yindarlgooda is unlikely to meet environmental objectives set by the EPA and could be associated with high level of risk for irreversible impacts to the environment of the Lake.

The EPA recommends that, prior to construction of a leach residue and evaporation pond storage facility, the proponent prepare a strategy for disposal of process residue which identifies and demonstrates that the location, construction and operation of the facility achieves short and long term environmental objectives, including best practice environmental management

and meets the intent of recommendation 5 of Bulletin 826, to the satisfaction of the Environmental Protection Authority on advice from the Department of Environmental Protection, the Department of Minerals and Energy and the Water and Rivers Commission.

Recommendation 3

Within 5 years following commencement of the operation of the leach residue and evaporation pond storage facility, the proponent should submit a report which includes, but is not necessarily limited to the following:

1. a description of the development of the leach residue and evaporation pond storage facility;

2. details of the operation of the leach residue and evaporation pond storage facility and issues arising from and variations required to its operations; and

3. monitoring results.

to the requirements of the Environmental Protection Authority. The reporting required by this condition should be repeated thereafter at five-yearly intervals to the requirements of the Minister for the Environment.

Note: The Environmental Protection Authority will subsequently advise the Minister for the Environment on the need for further five-yearly reports.

Recommendation 4

That the Environmental Management Plan (EMP) prepared by the proponent under Commitment 1, include the following information to the satisfaction of the Environmental Protection Authority on advice of the Department of Environmental Protection:

Greenhouse gas emissions :

- calculate the greenhouse gas emissions associated with the proposal (using the methodology developed for Australia);

- indicate the specific measures adopted to limit greenhouse gas emissions for the project;

- as appropriate, whether on a project-specific basis, company-wide arrangement or within an industrial grouping, enter into the National C21 'Greenhouse Challenge' voluntary agreement programme for the estimation, reporting and auditing of greenhouse gas emissions; and

- estimate as appropriate, the global emission credit (greenhouse gas offsets) achieved through implementation of the proposal.

Reports of the results are to be submitted annually to the Department of Environmental Protection for audit, and are to be made publicly available.

Recommendation 5

Within five years of commissioning the Bulong Nickel Cobalt Laterite project, or at such later time considered appropriate by the Minister for the Environment on the advice of the Department of Environmental Protection, the proponent should prepare and subsequently implement a plan which:

- **describes the process for the decommissioning and rehabilitation of the project area;**
- **provides for the long term management of ground and surface water systems affected by the tailings storage facility; and**
- **provides for the development of a 'walk away' solution for the decommissioned mine pits, the process plant, tailings storage facility, process water ponds and associated infrastructure,**

to the requirements of the Environmental Protection Authority on the advice of the Department of Environmental Protection, the Department of Minerals and Energy and the Water and Rivers Commission.

Note: A 'walk away' solution means that the site shall either no longer require management at the time the proponent ceases operations, or if further management is deemed necessary, the proponent shall make adequate provision so that the required management is undertaken with no liability to the State.

Recommendation 6

That, if the Minister for the Environment provides environmental clearance that the proposal may be implemented, that clearance be subject to the Conditions set out in Section 6 of this report.

Issues	Objective	Evaluation Framework	Proponent's Commitments	EPA Recommendations
Biophysical				
1 Impact on locally and regionally significant vegetation associations, Declared Rare and Priority flora.	To protect Declared Rare and Priority flora and ensure no reduction of locally and regionally significant vegetation associations and plant habitats, where possible.	Compliance with provisions of Wildlife Conservation Act. Once locations for mine pits, pipelines, roads and other infrastructure finalised they will be inspected for the presence of DRF and Priority listed species. Low SO_2 emissions unlikely to impact on vegetation (see also Issue 6).	EMP to address flora and vegetation management (Commitment 1). Proponent willing to cooperate with CALM in relation to Priority 1 species, *Gnephosis intonsa*. Section 5.6 of the Outline EMP indicates that there will be no effect on any protected flora without prior assessment and authorisation from CALM	Proponent's commitments are considered adequate.
2 Impact on Threatened and Priority fauna species and animal habitats	Threatened and Priority fauna species and their habitat should be protected. The Japan-Australia Migratory Bird Agreement (JAMBA) 1974 and the China-Australia Migratory Bird Agreement (CAMBA) 1986 are relevant as is the National Strategy for the Conservation of Australia's Biological Diversity to which Western Australia is a signatory.	Compliance with provisions of Wildlife Conservation Act and the objectives of the National Strategy for the Conservation of Australia's Biological Diversity. Fauna habitats in the project area are well represented throughout the region.	EMP to address fauna management (Commitment 1). Section 5.6 of the Outline EMP indicates that there will be no effect on any protected fauna without prior assessment and authorisation from CALM.	Proponent's commitments are considered adequate.
3 Impact on the water table due to the extraction of groundwater.	To ensure that the proposed extraction of 6000m^3 per day of groundwater does not result in drawdown of the water table such that indigenous vegetation is threatened or other user rights jeopardised.	Water resources use in the area is administered via abstraction controls under Part III of the Rights in Water and Irrigation Act. Depth to groundwater, salinity and low conductivity of areas surrounding palaeochannel.	Monitoring and management addressed by proponent in commitments 1 (EMP).	Subject to WRC decision required on groundwater licence, proponent's commitments are considered adequate.

Table 6. Summary of Environmental Protection Authority recommendations

Issues	Objective	Evaluation Framework	Proponent's Commitments	EPA Recommendations
Pollution potential				
4 Alternative options for location of leach residue storage facility.	To ensure that the location of the leach residue storage facility achieves the EPA's objectives for protection of the environment, including application of best practice principles.	Adequacy of information on receiving environment and detrimental impacts.		In the absence of detailed information, the EPA believes that locating of the leach residue and evaporation pond storage facility on Lake Yindarlgooda is unlikely to meet environmental objectives set by the EPA and could be associated with a high level of risk for irreversible impacts to the environment of the lake. The EPA therefore recommends that the proponent should locate the dam and pond where objectives and recommendations could be met in the short and long term. RECOMMENDATION 2
5 Solid and liquid process waste disposal (tailings dam/evaporation pond).	To ensure that environmental impacts arising from the disposal of tailings are kept as low as practicable and that best practice is implemented (EPA Bulletin 816).	Works Approval and Licence under Environmental Protection Act, and Mining Act requirements. Appropriate location, design, rehabilitation, monitoring, and decommissioning and the implementation of best practice.		Report to EPA on leach residue disposal facility after five years of operations. RECOMMENDATION 3 Ensure the long term management of the leach residue disposal facility as part of an overall decommissioning and rehabilitation strategy. RECOMMENDATION 5

Table 6. Summary of Environmental Protection Authority recommendations (cont'd).

Issues	Objective	Evaluation Framework	Proponent's Commitments	EPA Recommendations
Pollution potential				
6 Gaseous emissions (including greenhouse gases and odours)	To ensure that gaseous emissions, including greenhouse gases and odours, both individually and cumulatively, do not cause an environmental or human health problem. The proponent must use all reasonable and practicable measures to reduce the discharge of wastes, including gases. (EPA, 1996 Bull 804)	Not a significant source with regard to the *Environmental Protection (Goldfields) (SO2) Policy*. Potential pollutants are subject to Works Approval and Licence requirements. Comply with EPA policy on Greenhouse gas emissions.	Monitoring and management of sulphur and fume emissions addressed by proponent in commitment 1 (EMP).	The proponent's EMP should include: • a monitoring and audit programme for all gaseous and odorous emissions, including greenhouse gases; • calculations of the greenhouse gas emissions (using methodology developed for Australia) and; • the proponent shall use its best endeavours to assist in the achievement of the government's desired position regarding the generation of greenhouse gas emissions. RECOMMENDATION 4
7 Noise	To ensure that the amenity of surrounding residents is not unduly affected by noise emissions emanating from the project and associated activities.	Noise Abatement (Neighbourhood Annoyance) Regulations (1979). As the project is located in a remote area, traffic noise levels have a low potential to affect surrounding residents.	Comply with the Noise Abatement (Neighbourhood Annoyance) Regulations (1979) (Commitment 10).	Proponent's commitments are considered adequate.

Table 6. Summary of Environmental Protection Authority recommendations (cont'd).

Issues	Objective	Evaluation Framework	Proponent's Commitments	EPA Recommendations
Other				
8 Environmental Management Programme.	To ensure the project is managed during construction, operational and decommissioning phases, to avoid unnecessary impacts and to properly manage unavoidable impacts to an acceptable level.		Section 5 of the CER provides an outline EMP which includes the following: • rehabilitation, erosion and sediment control; • sulphur and fume emission management; • dust management; • surface and groundwater quality/quantity management; • leach residue; • native flora and fauna management; • solid and liquid waste management; • community and public consultation; and • noise. An EMP as outlined in Section 5 of the CER will be prepared and implemented (Commitment 1).	Proponent's commitments are considered adequate.
9 Decommissioning and rehabilitation.	To ensure an acceptable rehabilitation and decommissioning programme is put in place which incorporates a "closure strategy" agreed to by the Western Australian Government.	Precedent of past mining projects, which require that long term rehabilitation and decommissioning options are considered early on in the projects development, to best integrate rehabilitation options with the mine plan. Uncertainty regarding long term performance characteristics of tailings impoundment and potential to successfully rehabilitate.	Addressed in proponent commitment 1 (EMP).	The process for planning for decommissioning and the development of a 'walk away' solution, should be instigated earlier in the life of the project. RECOMMENDATION 5.

Table 6. Summary of Environmental Protection Authority recommendations (cont'd).

6. Recommended environmental conditions

Based on its assessment of this proposal and the recommendations in this report, the Environmental Protection Authority considers that the following Recommended Environmental Conditions are appropriate.

PROPOSAL: BULONG NICKEL COBALT LATERITE PROJECT, 30KM EAST OF KALGOORLIE (996)

PROPONENT: RESOLUTE RESOURCES LIMITED

This proposal may be implemented subject to the following conditions:

1 **Proponent Commitments**
The proponent has made a number of environmental management commitments in order to protect the environment.

1-1 In implementing the proposal, the proponent shall fulfil the commitments made in the Consultative Environmental Review and in response to issues raised following public submissions; provided that the commitments are not inconsistent with the conditions or procedures contained in this statement.

The consolidated environmental management commitments were published in Environmental Protection Authority Bulletin 826 (Appendix 4) and a copy is attached.

2 **Implementation**
Changes to the proposal which are not substantial may be carried out with the approval of the Minister for the Environment.

2-1 Subject to these conditions, the manner of detailed implementation of the proposal shall conform in substance with that set out in any designs, specifications, plans or other technical material submitted by the proponent to the Environmental Protection Authority with the proposal.

2-2 Where, in the course of the detailed implementation referred to in condition 2-1, the proponent seeks to change the designs, specifications, plans or other technical material submitted to the Environmental Protection Authority in any way that the Minister for the Environment determines, on the advice of the Environmental Protection Authority, is not substantial, those changes may be effected.

3 **Proponent**
These conditions legally apply to the nominated proponent.

3-1 No transfer of ownership, control or management of the project which would give rise to a need for the replacement of the proponent shall take place until the Minister for the Environment has advised the proponent that approval has been given for the nomination of a replacement proponent. Any request for the exercise of that power of the Minister shall be accompanied by a copy of this statement endorsed with an undertaking by the proposed replacement proponent to carry out the project in accordance with the conditions and procedures set out in the statement.

4 **Location of Leach Residue and Evaporation Pond Storage Facility**
The leach residue and evaporation pond storage facility should be located, constructed and operated so that the environment is protected as far as practicable.

4-1 Prior to construction of a leach residue and evaporation pond storage facility, the proponent shall prepare a strategy for disposal of process residue which identifies and demonstrates that the location, construction and operation of the facility achieves short and long term environmental objectives, including best practice environmental management and meets the intent of Condition 5, to the requirements of the Department of Environmental Protection, the Department of Minerals and Energy and the Water and Rivers Commission.

4-2 The proponent shall implement the strategy required by Condition 4-1 to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection, the Department of Minerals and Energy and the Water and Rivers Commission.

5 Leach Residue and Evaporation Pond Storage Facility

The leach residue and evaporation pond storage facility should be managed to protect the environment and facilitate rehabilitation and decommissioning.

5-1 Within five years following commencement of the operation of the leach residue and evaporation pond storage facility, the proponent shall submit a report which includes, but is not necessarily limited to the following:

1. a description of the development of the leach residue and evaporation pond storage facility;

2. details of the operation of the leach residue and evaporation pond storage facility and issues arising from and variations required to its operations; and

3. monitoring results,

to the requirements of the Environmental Protection Authority. The reporting required by this condition shall be repeated thereafter at five-yearly intervals to the requirements of the Minister for the Environment.

Note: The Environmental Protection Authority will advise the Minister for the Environment on the need for further five-yearly reports.

6 Greenhouse Gas Emissions

Greenhouse gas emissions should be addressed in the Environmental Management Plan.

6-1 At appropriate times, the proponent shall address, in the Environmental Management Plan to be prepared under Commitment 1, the following additional matters relating to greenhouse gas emissions:

1. calculation of the greenhouse gas emissions associated with the proposal (using the methodology developed for Australia);

2. indication of the specific measures adopted to limit greenhouse gas emissions for the project;

3. entry into the National C21 'Greenhouse Challenge' voluntary agreement programme for the estimation, reporting and auditing of greenhouse gas emissions, whether on a project-specific basis, company-wide arrangement or within an industrial grouping, as appropriate; and

4. estimation of the global emission credit (greenhouse gas offsets) achieved through implementation of the proposal, as appropriate, with reporting on progress,

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

7 Decommissioning

7-1 The proponent shall achieve the satisfactory decommissioning of the project, removal of plant and installations and rehabilitation of the site and its environs.

7-2 To achieve the objective of condition 7-1, within five years following commissioning, or at such later time considered appropriate by the Minister for the Environment on advice of the Department of Environmental Protection, the proponent shall prepare a plan which:

1. describes the process for the decommissioning and rehabilitation of the project area;

2. provides for the long term management of ground and surface water systems affected by the leach residue and evaporation pond storage facility; and

3. provides for the development of a 'walk away' solution for the decommissioned mine pits, the process plant, leach residue and evaporation pond storage facility, and all associated infrastructure,

to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection, the Department of Minerals and Energy and the Water and Rivers Commission.

Note: A 'walk away' solution means that the site shall either no longer require management at the time the proponent ceases operations, or if further management is deemed necessary, the proponent shall make adequate provision so that the required management is undertaken with no liability to the State.

7-3 The proponent shall implement the plan required by condition 7-2.

8 Time Limit on Approval

The environmental approval for the proposal is limited.

8-1 If the proponent has not substantially commenced the project within five years of the date of this statement, then the approval to implement the proposal as granted in this statement shall lapse and be void. The Minister for the Environment shall determine any question as to whether the project has been substantially commenced.

Any application to extend the period of five years referred to in this condition shall be made before the expiration of that period to the Minister for the Environment.

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

9 Compliance Auditing

To help determine environmental performance and compliance with the conditions, periodic reports on the implementation of the proposal are required.

9-1 The proponent shall submit periodic Performance and Compliance Reports, in accordance with an audit programme prepared by the Department of Environmental Protection in consultation with the proponent.

Procedure

1 Unless otherwise specified, the Department of Environmental Protection is responsible for assessing compliance with the conditions contained in this statement and for issuing formal clearance of conditions.

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

Note

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

7. References

Australian Nature Conservation Agency 1993, *A Directory of Important Wetlands in Australia*

Australian Environment Council, National Health and Research Council 1986, *National guidelines for control of emission of air pollutants from new stationary sources: Recommended methods for monitoring air pollutants in the environment*, Commonwealth of Australia

Commonwealth of Australia 1996, *The National Strategy for the Conservation of Australia's Biological Diversity*, Commonwealth Department of the Environment, Sport and Territories, Canberra, Australia

Environmental Protection Authority 1991, *Proposed Mesa J iron ore development - Pannawonica,* Report and Recommendations of the Environmental Protection Authority, Bulletin 574, Environmental Protection Authority, Perth, Western Australia.

Environmental Protection Authority 1992, *Development of an Environmental Protection Policy for Air Quality at Kwinana,* Bulletin 644, Environmental Protection Authority, Perth, Western Australia.

Environmental Protection Authority 1993, Environmental Reviews, Guidelines for Proponents, Environmental Protection Authority, Perth, Western Australia.

Environmental Protection Authority 1994, *Boddington Gold Mine: Rehabilitation Strategy:,* Report and Recommendations of the Environmental Protection Authority, Bulletin 766, Environmental Protection Authority, Perth, Western Australia.

Environmental Protection Authority 1996a, *Mid West Iron and Steel, Geraldton Steel Plant, Narngulu Industrial Estate, Geraldton,* Report and Recommendations of the Environmental Protection Authority, Bulletin 804, Environmental Protection Authority, Perth, Western Australia.

Environmental Protection Authority 1996b, *Narrikup export abattoir,* Report and Recommendations of the Environmental Protection Authority, Bulletin 808, Environmental Protection Authority, Perth, Western Australia.

Environmental Protection Authority 1996c, *Nickel/Cobalt ore mining and processing operations, Murrin Murrin, 60 km east of Leonora,* Report and Recommendations of the Environmental Protection Authority, Bulletin 816, Environmental Protection Authority, Perth, Western Australia.

Environmental Protection (Goldfields Residential Areas) (Sulphur Dioxide) Policy 1992.

Kinhill Engineers Pty Ltd 1996a, *The Bulong Nickel Cobalt Laterite Project*, Consultative Environmental Review, vols 1 and 2, unpub.

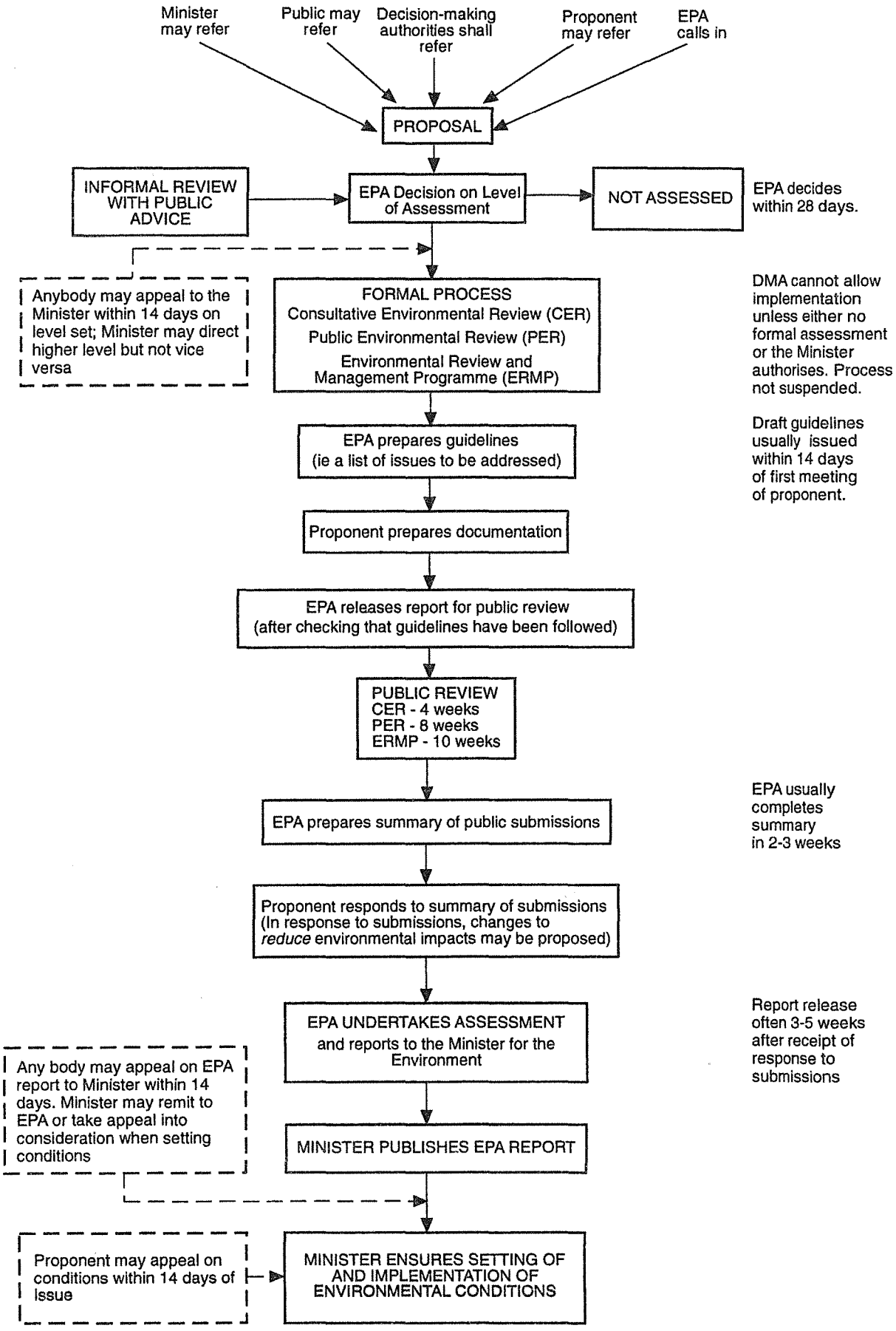
Kinhill Engineers Pty Ltd 1996b, *The Bulong Nickel Laterite Project, Summary of submissions on the Consultative Environmental Review, Replies to Questions*, unpub.

Knight Piesold Consulting Engineers 1996, *Disposal of Leach Residue on Lake Yindarlgooda*, unpub.

Appendix 1

Environmental Impact Assessment flow chart

EIA PROCESS FLOW CHART



Appendix 2

Summary of submissions and proponent's response

BULONG NICKEL LATERITE PROJECT

SUMMARY OF SUBMISSIONS
ON THE CONSULTATIVE
ENVIRONMENTAL REVIEW
REPLIES TO QUESTIONS

Prepared for:

RESOLUTE RESOURCES LIMITED

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BA5007-G-DO-003 Rev 1

BULONG NICKEL LATERITE PROJECT
RESPONSE TO DEP LETTER 1/96:097057 OF 17 MAY 1996

A. Issue 1

An assessment of the vegetation affected by both the potential land-based sites for leach residue disposal is set out below. Whilst it is clear that neither site contains vegetation of particular conservation significance, it is contended that such vegetation clearance in an arid area is not desirable if other options are available. Moreover, it can be anticipated that the pastoralist whose family has so carefully managed the lease for around ninety years, would be justifiably concerned at such a loss of vegetation.

Environmental Significance of Dry Land Tailings Storage Sites

The proposed Bulong Nickel Project is situated at the boundary between the Coolgardie and Austin Botanical Districts. A broad scale survey of the vegetation encompassing the general project area was carried out by Beard (1975), who classified the area as "Mixed low woodland" a_1c_2L1 which was dominated by '*Acacia aneura, Casuarina cristata* and *Eucalyptus* species'. However, the area is adjacent to and can more accurately be classified within Beard's broad category of 'sclerophyll woodland', in which two dominant species within the overstorey are *Eucalyptus salmonophloia* and *Eucalyptus griffithsii.* This broad vegetation classification encompasses both of the two potential dry land tailings storage sites. At a regional level the vegetation type occurs as a band 60-80 km wide from Queen Victoria Spring Nature Reserve in the east to Lake Barlee in the west, a length of 390 km.

The Biological Survey of the Eastern Goldfields undertaken by the Western Australian Museum and the Department of Conservation and Land Management (Mckenzie and Hall, 1992) for the Kurnalpi-Kalgoorlie area describe the Bulong Nickel project area as Undulating Plain. The vegetation typical of this landform unit comprised Eucalypt (dominated by *Eucalyptus salmonophloia, E. griffithsii, E. clelandii* and *E. lesouefii*) 'woodland with an understorey of tall shrubs on shallow soils and an understorey of low shrubs where soils were strongly clacerous' (Keighery *et al,* 1992). 'Much of the Kurnalpi-Kalgoorlie Study area supports woodland and low woodland typical of Undulating Plains and associated Broad Valleys' (Keighery *et al,* 1992). At a regional scale it can be inferred that the vegetation of the Bulong project area is both wide spread and well represented although there is limited representation with conservation areas (Keighery *et al,* 1992).

A) Optional Valley Impoundment Leach Residue Storage Site

This area is encompassed by two vegetation associations which form subsets of the 'Mixed low woodland' described by Beard (1975). The majority of the area comprises *Eucalyptus griffithsii* dominated woodland over *Eremophila oldfieldii* subsp. *angustifolia* dominated shrubland.

The relatively open woodland commonly features an open cover of *Eucalyptus griffithsii* with various species such as *Casuarina obesa*, *Eucalyptus celastroides*, *Eucalyptus kochii*, *Eucalyptus lesouefii* and *Eucalyptus stricklandii* co-dominant in different areas. Other tree species occurring sparsely within this association include *Acacia oswaldii*, *Acacia* sp. 1, *Casuarina pauper*, *Eucalyptus lucasii*, *Eucalyptus salmonophloia*, *Eucalyptus salubris and Santalum spicatum.* The open tall shrub stratum (> 2 m tall) is dominated by an open cover of *Eremophila oldfieldii* subsp. *angustifolia. Acacia acuminata* subsp. *burkittii* or *Alyxia buxifolia,* are co-dominant in some areas and various other shrubs including *Acacia horniteles*, *Acacia tetragonophylla* and *Exocarpos aphyilus* occur at lesser densities. The moderately dense to dense 0.5 m to 2 m tall shrub layer is dominated by open *Dodonaea lobulata, Eremophila oldfieldii* subsp. *angustifolia* and *Senna arternisioides* subsp. *filifolia* together with *Acacia acuminata* subsp. *burkittii, Acacia erinacea, Alyxia buxifolia, Eremophila glabra, Eremophila pustulata* and *Hybanthus floribundus* at some sites. Various other species including *Acacia hemiteles, Acacia tetragonophylla, Enchylaena tomentosa, Grevillea acuaria, Olearia muelleri, Scaevola spinescens* also occur at lesser densities. The open low shrub stratum is dominated by *Ptilotus obovatus* and also includes species such as *Enchylaena tomentosa, Olearia muelleri, Solanum lasiophyllum, Westringia dampieri* and various species of *Maireana.* At ground level there is an open cover of herbs which is often dominated *by Zygophyllum frutculosum.* The sparse cover of soft grasses includes *Aristida contorta, Eragrostis dielsii, Stipa elegantissima* and *Stipa* sp. 1. An average of 42 species ± 2.6 was collected from the five sites within this association.

The remainder of the site is covered by *Eucalyptus griffithsii* dominated woodland over *Acacia/Eremophila* shrubland over open spinifex *Triodia longiceps.* The relatively open (10-20% cover) tree overstorey is dominated by *Eucalyptus griffithsii* which is often co-dominant with another species such as *Eucalyptus celastroides, Eucalyptus lesouefii, Eucalyptus lucasii* or *Eucalyptus transcontinentalis. Santalum spicatum* occurs sparsely as a low tree. The relatively open cover of tall shrubs is dominated by *Acacia acuminata* subsp. *burkitii, Acacia quadrimarginea* and *Eremophila oldfieldii* subsp. *angustifolia,* together with lesser densities of *Acacia hemiteles, Acacia tetragonophylla, Alyxia buxifolia* and *Eremophila dempsteri.* The moderately dense moderate-height (0.5 m to 2 m) shrub layer is dominated by various combinations of *Acacia erinacea, Dodonaea lobulata, Eremophila dempsteri, Eremophila oldfieldii* subsp. *angustifolia and Senna artemisioides* subsp. *filifolia* with lesser densities of species such as *Eremophila oppositifolia, Hibbertia exasperata* and *Scaevola spinescens.* The relatively open low shrub stratum is dominated by *Hybanthus floribundus, Ptilotus obovatus* and *Westringia dampieri.* Various species including *Acacia erinacea, Cryptandra parvifolia, Eremophila parvifolia* and *Olearia muelleri* commonly occur at sparse densities within this stratum. At ground level there is typically an open cover of spinifex *Triodia longiceps* interspersed with a sparse to sometimes open cover of herbs. The herbs are often dominated by *Haloragis gossei* or *Zygophyllum fruticulosum* and also include lesser amounts of *Maireana georgei, Maireana integra, Ptilotus aervoides, Ptilotus exaltatus* and *Sclerolaena fusiformis.* Soft grasses are generally sparse and include *Aristida contorta* and *Stipa elegantissima.* The average species richness of sites within this association was 37 species ± 1.8 (n=10).

Conservation Significance

At both regional and local scales of resolution the vegetation types present at the optional valley impoundment leach residue storage site are widely distributed and well represented; however, representation within conservation areas is limited.

B) Alternative Leach Residue Storage Paddock

Unfortunately the survey conducted by *ecologia* (1995) did not encompass much of the area proposed for this facility. However the area which was examined contained the two associations which occur at the optional valley impoundment leach residue storage site with the possibility of some representation of a sparse *Eucalypt salmonophloia* over mixed chenopod shrubland in lower lying areas.

The additional association represented in the area is likely to be sparse to open *Eucalyptus salmonophloia* over chenopods dominated by *Atriplex vesicaria.* The open tall tree overstorey is dominated by an open cover of *Eucalyptus salmonophloia* with *Eucalyptus salubris* often occurring as a co-dominant. The usually sparse tall shrub layer commonly features *Eremophila dempsteri, Eremophila oldfieldii* subsp. *angustifolia* and *Atriplex nummularia.* Other tall shrubs occurring at lesser densities include *Acacia murrayana, Acacia tetragonophylla, Acacia* sp. 1, *Casuarina obesa* and *Lycium australe.* The moderately dense low shrub strata are dominated by an open to moderately dense cover of *Atriplex vesicaria* with lesser amounts of *Atriplex nummularia, Maireana integra, Maireana* sp. 2 and *Solanum nummularium.* Various other chenopods including *Enchylaena tomentosa, Maireana sedifolia, Maireana pyramidata and Salsola kalii* also occur. At ground level there is a dense cover of herbs dominated by various species including *Carrichtera annua, Erymophyllum* sp.1, *Zygophyllum fruticulosum* and chenopods such as *Eriochiton sclerolaenoides, Maireana villosa, Sclerolaena articulata, Sclerolaena diacantha* and *Sclerolaena patenticuspis.* Soft grasses are typically open to sparse and dominated by *Aristida contorta* with lesser amounts of *Eragrostis dielsii.* The average species richness per site was 41 species ± 6.7 (n=3).

Conservation Significance

At both regional and local scales of resolution the vegetation types present at the alternative leach residue storage paddock site are widely distributed and well represented; however, representation within conservation areas is limited.

References:

Beard, J.S. (1975). Vegetation Survey of Western Australia: Nullarbor. 1:1,000,000 Vegetation Series, University of Western Australia Press.

ecologia Environmental Consultants (1995). Bulong Nickel Laterite Project Notice of Intent: Biological Assessment Survey. Unpublished report for Kinhill Engineers Perth, 104 pp.

Keighery, G.J., Kilewiski, A.V. & Hnatiuk, R.J. (1992). Vegetation and Flora *In*: Mckenzie N.L. & Hall N.J. (eds) The Biological Survey of the Eastern Goldfields of Western Australia. Part I: Kurnalpi-Kalgoorlie Study area. Rec. W.A. Mus Suppl. No.41.

The comparison of Lake Yindarlgooda with Lake Barlee as a (potential) important breeding area for avifauna is not necessarily valid and is not supported in any of the literature. Lake Yindarlgooda is not listed as an important wetland.

Furthermore Lake Barlee with an area of 194,380 ha is about five times the area of Lake Yindarlgooda. Even more importantly, its catchment area of 1,790,000 ha should be compared to Yindarlgooda's 386,493 ha — a factor of more than 5 times.

Its water depth is noted as 0.5 m, usually less — with little variation over vast areas.

What matters most in the ecological significance of either lake is the period of time it can normally be expected to hold water on an opportunistic basis to provide breeding or other habitat for avifauna. The most definitive (and recent) work on this subject is that of Turner et al (1996)[1].who notes (Section 6.5.2 p.167)...

Persistence of Flooding

Flood persistence refers to the tendency of the flooded salt lake to retain a free water body within the lake boundaries. The persistence of a water body can be expressed as the change in lake inundation over a specified time interval. The extent of lake inundation was quantified as a percentage of surface water area divided by the total salt lake area. The change or decrease in persistence is attributed to evaporation, as minimal water infiltrates to the palaeochannels and regional water table due to the clayey nature of the lake floor.

The effect of catchment area on the persistence of salt lake flooding can be expressed in terms of a catchment area: salt lake area (A_C/A_L) *ratio. Higher A_C/A_L ratios tend to suggest increased persistence of inundated water bodies because larger catchments have a greater ability to capture significant rainfall.....*

The persistence of Lake Yindarlgooda is also about 9 — a very low figure. That of Lake Barlee is 9.2. The latter can clearly be expected to hold water for very long periods of time, given (a) its much greater surface area; (b) the fact that water may persist for 6-9 months which is why it is such an important breeding area. The former does not — as empirical and direct evidence also clearly shows.

B. Issue 2

Addressing first the factors of concern with comments quoted from Knight Piesold letter 6/469 of 23 May 1996:

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[1] Turner et al 1996: Groundwater Supply to the Mining Industry in the WA Goldfields. MERIWA Report No. 154, March 1996.

The lake sediments represent a fractured aquifer

Quote: *The lake sediments are relatively shallow (generally less than 1 m deep) and are underlain by siltstone/sandstone. As such the lake sediments are not themselves a fractured aquifer system but the rock underneath can be considered to fall into their category.*

Lake sediments require specific treatment to achieve lower permeability and if constructed insitu as proposed (Knight Piesold Report p18), the treatment may be inadequate to minimise seepage losses (Knight Piesold report pp 10/11).

Quote: *We found that the moisture content of the lake sediments is generally higher than optimum and therefore the material will need to be scarified and air dried to reduce the moisture content to within ± 3% of optimum prior to compaction. This is not an unusual expectation and should be achievable using normal construction equipment in a cost effective manner.*

Seepage recovery is unfavourable for the lake impoundment during periods of lake inundation.

Quote: *The proposed method of seepage recovery by Knight Piesold is to utilise an underdrainage system within the basin area under the supernatant pond. This will serve to intercept solution from the leach residue before it leaves the basin area. This system will not be adversely impacted by any inundation of Lake Yindarlgooda. Nothwithstanding this seepage interception system, we understand that you (actually DOME) are in favour of constructing an interception trench around the perimeter of the storage facility with a low bund for flood protection. Such an arrangement should not be prone to inundation providing the bund is constructed with low permeability material and has erosion protection on the face. If the lake is flooded for an extended period of time the interception trench may collect seepage water from the lake; however, this should not create any problem. Overall we believe that it should not be necessary to construct an interception trench initially, but should be present a possible remedial action if the monitoring boreholes detect environmentally adverse seepage occurring during operation of the storage facility.*

Optimum compaction of the floor of the lake impoundment would require favourable seasonal conditions (e.g. depth to ground water soil moisture content, minimal salt content).

Quote: *This is quite correct. It would be difficult to prepare the basin area during periods of rainfall. However, given the generally favourable climatic conditions prevailing in the area, this is not a significant concern.*

What contingencies are proposed if at the time of commencement of construction of the lake impoundment a significant rain event caused inundation of the lake, which could take several months to dry out.

Quote: *We have not examined the requirements of a contingency plan at this stage of design. However, if such a measure is considered necessary then this should not be a major problem. For instance, based on the hydrology work completed by Bateman Kinhill, it would be relatively straightforward to construct a low level bund around the site to maintain dry working conditions.*

C. Comparative Assessment

The Table I represents the degree of acceptability (albeit subjective) on a scale of 1 to 5, i.e. 1 is the least favourable, most expensive, most impact, longest time, hardest to manage etc.

BNLP
COMPARATIVE ASSESSMENT
PERFORMANCE CHARACTERISTICS

Construction Restraints	LAKE	VALLEY	PADDOCK
Cost	2	3	4
Weather	3	3	4
Materials	3	3	4
Time	3	3	4
Equipment	3	3	4
Environment			
Fauna	4	2	2
Flora	4	3	2
Aesthetic	4	3	2
Leakage			
Potential	2	2	3
Detection	4	2	3
Recovery	4	3	4
Management			
Operation	5	3	5
Maintenance-Short Term	4	3	4
Maintenance-Long Term	4	3	4
	49	39	49

This overall rating suggests that the valley impoundment is the least desirable option.

SUMMARY OF SUBMISSIONS ON THE CONSULTATIVE ENVIRONMENTAL REVIEW
REPLIES TO QUESTIONS

In response to the specific questions contained in your letter of 24 April 1996 that refer to your department's particular concerns in respect of leach residue storage, we reply as set out below. Note that a number of points are raised on occasion in the summary of issues and are also dealt with there or referred back to this response.

1 DEP — Leach Residue Storage — Site

Three methods for leach residue storage have been given consideration: *Paddock Impoundment, Valley Impoundment* and *Lake Impoundment.*

Paddock Impoundment: was the most conventional and economical in that it could be sited close to the process plant, presented a flat site for ease of embankment construction and providing nearby borrow for rehabilitation. A number of sites were considered and two were given more detailed consideration resulting in the site indicated in Fig. 1.1. Flat storage sites were obviously situated in low lying country and as such were the better sheep grazing areas. Sites given serious consideration all proved to be prime grazing areas and as such, after consultation with local pastoralists, alternative methods of leach residue storage were sought. Objection to the paddock impoundment was not only because of the loss of grazing area but because no guarantee could be given that the retaining embankment would not leak highly saline water into the surrounding vegetation. Experience in the industry does indicate that leakage through and/or under retaining embankments is a potential problem. Thus an alternative method for storage was sought.

Valley Impoundment: While this form of impoundment does offer some possible cost savings in embankment construction, it still retains the potential problem of leakage downstream and the resultant damage to vegetation and grazing areas. More detailed geotechnical and engineering design concepts were considered for the *valley impoundment* indicated in Fig. 1.1 resulting in a site visit by officers of DOME, CALM, DEP and the local pastoralist. The resultant consensus was to give serious consideration to the Lake Yindarlgooda for residue storage.

Lake Impoundment: Because of the above concerns, serious consideration was given to the storage of residue on Lake Yindarlgooda. At the time of submitting the CER, sufficient preliminary investigation and conceptual design had been done to establish the fact that such a facility could be engineered even if suitable material for embankment construction needed to be borrowed from sites remote from the lake. While it is believed that the highly saline leach residue will have little or no effect upon the already highly saline water and sediments of the lake, the impoundment design is such that any leakage will be returned to the

evaporation pond and thence recycled to the process plant. Since submission of the CER, a more detailed geotechnical and engineering investigation has been carried out by Knight Piesold dated April 1996 Ref. 656/4. A copy of this report is appended. The only matters raised in consultation with various departments were: (a) embankment stability, (b) leakage through or under the embankment and (c) migratory birds. Now that the depth of the lake sediments and the nature of the underlying material is known, embankment stability and integrity can be assured. (Ref Knight Piesold 656/4 Apr. 1996, which states ....

3.3 CONCLUSIONS OF SITE INVESTIGATION

The results of the site investigation and laboratory testing can be summarised as follows:

The permeability of the insitu soils is too high to use the materials insitu as a low permeability barrier.

The rate of groundwater flow through the insitu materials and especially through the open fissures indicates that a rapid response to water inflow into the lake can be expected (therefore the facility should be constructed above ground level).

The lake surface materials would be suitable for use in construction and would provide a relatively low permeability liner material. Excavation of these materials would be relatively easy but the material would need to be dried to the optimum moisture content before being used.

The pit overburden material would be suitable for use in construction.

The shallow surface material near the shoreline of the lake would probably be suitable for use as a drainage material.

3.4 STABILITY ASSESSMENT

The stability of the proposed embankment sections was assessed under both static and seismic loading conditions using limit state equilibrium methods. The computer program XSTABL developed at Purdue University was used for the analysis which was carried out using the modified Bishop method.

The shear strength parameters assumed for the analyses are summarised in Table 3.6.

Table 3.6: Assumed shear strength parameters

Material	C' (kPa)	Ø'	Y_b (t/m^3)
Insitu clayey sand	*2*	*30*	*2.03*
Saturated residue	*	*	*1.67*
Foundation silty sand	*0*	*34*	*1.95*
Rock toe	*0*	*38*	*1.6*
Bedrock	*10*	*40*	*2.3*

* *Values varied to determine minimum required values for adequate stability.*

The stability of the embankment under seismic loading conditions was assessed using pseudo-static methods of analysis. The acceleration coefficient used in the analysis was determined from the Earthquake Hazard Map of Western Australia 1991 as given in AS 1170.4 1993. For Bulong the coefficient is 0.06. The chance of this being exceeded in a 50 year period is 10% (equivalent to a return period of 475 years).

The results of the analyses are given in Table 3.7 and shown on Figures 3.1 to 3.3.

Table 3.7: Summary of stability analysis results

Construction Option	*Analysis*	*Residue Strength*		*Factor of Safety (FOS)*	
		C'	*Ø'*	*With Earthquake Loading*	*Without Earthquake Loading*
Downstream	*Downstream-Long Term*	**—*	**—*	*1.41*	*1.68*
Upstream	*Downstream-Long Term*	*0* *0* *0*	*21* *20* *19*	*1.12* *1.09* *1.06*	*1.34* *1.31* *1.27*
Upstream	*Construction Stability-Upstream Failure*	*12* *11* *10*	*0* *0* *0*	- - -	*1.09* *1.03* *0.97*

** Has no effect on FOS.*

The results indicate that for strength parameters in the usual range for earthfill the downstream construction option is stable. Variation in the strength of the residue for this option indicates that the residue has no effect on the downstream stability.

For the upstream construction option the downstream stability of the full height embankment is adequate at a residue strength of C'=0 Ø'=21.

The shear strength required for stability in the upstream direction during construction is about 12-14 kPa.

The analyses indicate for upstream construction the strength of the residue is critical for the stability of the embankments and it is considered essential that the strength of the residue be checked and confirmed as sufficient before upstream construction commences.

Evaporation Pond

All supernatant water from the leach residue storage and all recycled leakage water will be recycled to the process plant. The sole reason for the evaporation pond is to hold water under emergency situations e.g. a power failure — plant shutdown; heavy rainfall runoff to the leach residue storage facility. The size of the evaporation pond has been determined for the "worst foreseeable" situation. The same arguments in respect of suitable sites equally apply to the evaporation pond as they do to the leach residue storage.

2 DEP — Leach Residue Storage — Structural Stability and Hydrology

Structural Stability: It was previously thought that the embankment would rest on lake sediments but it is now known that it may be sealed to the underlying bedrock.

Hydrology: At the date of CER submission no hydrological study had been completed. Reference is now made to the BULONG NICKEL LATERITE PROJECT — HYDROLOGICAL REPORT by Kinhill Engineers, Brisbane; April 1996, which is attached as Appendix A.

3 DEP — Leach Residue Storage — Rehabilitation

Rehabilitation has been covered in the CER (2.10.2; 4.2.3 and 5.5) and in some more detail in the Knight Piesold report 656/4, April 1996, which states:

7. REHABILITATION

7.1 GENERAL

The rehabilitation of the leach residue facility and the evaporation pond will vary depending on whether Option 1 or Option 2 for the evaporation ponds is selected. For Option 1 both the leach residue storage facility and the evaporation pond will need to be rehabilitated. For Option 2 the remaining salt in the evaporation pond will be removed at the end of the operation and placed in the leach residue storage facility. The evaporation pond embankments will then be removed and used to provide the initial cover for the leach residue storage area.

For both options the rehabilitation method proposed is similar. Since the shoreline vegetation is relatively sparse and the salt lake has no vegetation the facility will be rehabilitated to blend into this landscape.

The following rehabilitation work is proposed:

Leach residue storage facility:

i In the final year of residue discharge the deposition sequence will be modified to reduce the deposition of residue from the western side of the facility. This will cause a shallow slot to form falling towards the west as the supernatant pond migrates westwards. As the pond migrates beyond the decant tower the water will be pumped to the evaporation pond from the decant access causeway using the submersible pump.

ii On completion of residue deposition the supernatant ponds will be drained to allow the residue surface to dry.

iii The access causeway will be removed and a drainage slot formed in a western direction to drain the surface of the storage facility.

iv The residue surface will be covered with a thin layer of imported material to reduce dusting problems.

v Pockets approximately 10 m x 10 m in size will be excavated to full root zone depth for small shrubs (of the order of 1-2 m deep).

vi The pockets will be lined with a root resistant geosynthetic liner.

vii The lined pockets will be backfilled with topsoil and small drought resistant shrubs planted.

Evaporation pond:

i All the water contained in the evaporation pond will be evaporated away.

ii For Option 2 the salt will be removed and stored in the leach residue storage facility. The embankments will be removed and used to line the residue surface. The surface will be restored to its original condition.

For Option 1 the surface of the evaporation pond will be reshaped so that it drains to the east. The holding pond will be cleaned of salt and removed. The surface of the evaporation pond will be rehabilitated in a similar manner to the leach residue storage facility.

As no precedent for this type of rehabilitation has been set in Western Australia it is recommended that a trial area should be designated adjacent to the evaporation pond for trials to develop the most satisfactory and economic solution.

1 BIOPHYSICAL IMPACTS

Direct Disturbance

1.1 Please clarify the total development area proposed
- "will not exceed" 425 ha (summary p. V)
- "up to" 400 ha (summary p. VII)
- "approx 400 ha..." of vegetation will be disturbed (summary p. IX)
- 600 ha (p. 2.2).

Response: *The whole project will disturb less than 600 ha of vegetation during the first 15 years of operation. The mining activity together with the process plant is not expected to disturb more than 400 ha. Page v should read 400 ha while pages vii, ix and 2.2 are correct.*

1.2 What routes will be selected for powerlines and pipelines? Will these avoid sensitive areas (refer DEP guidelines)? What areas are considered "sensitive"? How will losses be minimised?

Response: *Power and Pipeline Routes: It is proposed that the process water borefield pipeline route will follow fencelines to the process plant followed by some upgrading of the access fenceline tracks. It is proposed that the leach residue pipeline to the storage facility on Lake Yindarlgooda will follow as the route indicated on Figure 1.2 to Lake Yindarlgooda. The return water line from the evaporation pond will follow the same route. Detailed site investigation with more accurate ground contouring is required before final routes may be more accurately defined. It is anticipated that the powerline routes to the borefield and to Lake Yindarlgooda will generally follow the same routes but will obviously deviate in some instances where necessary to minimise line length. The proposed routes have been determined in consultation with the local pastoralist. Sensitive areas will be flagged and bypassed. Losses will be minimised by utilising existing access ways. The powerline route from Kalgoorlie will follow the existing public road and be within that easement.*

Flora and Fauna

1.3 What efforts will be made to reduce the desirability (habitat image) of the exposed toxic waterbody to avifauna?

Response: *Table 2.5, page 2.13, Appendix G and Table 2.3, page 2.11 list the hydrochemical characteristics of the waters of the Leach Residue and evaporation pond; Lake Yindarlgooda; and the North Yindarlgooda Palaeochannel respectively. Comparison of each of the substances listed show them to be of low toxicity (see definition below*). The concentrations of the substances are high, but the natural background levels in the environment (Lake Yindarlgooda and the palaeochannel) are also high. As water in the lake evaporates after the rare flood events, these substances will become increasingly*

concentrated and eventually salts will form. Migratory birds would be unlikely to drink from highly saline lakes and would be similarly discouraged from drinking the leach residue liquor due to the water's salty taste. Ingestion of small quantities would not pose a hazard to the birds. The pH value of 7.4 indicates that there is no significant corrosive hazard to birds.

*Toxicity The inherent potential or capacity of a material to cause adverse effects in a living organism (US EPA definition)

1.4 From the most recent CALM database, it is noted that *Eremophila parvifolia* is no longer a Priority 4 species (14/9/95.)

Response: *At the time of writing the biological survey report (July 1995) (Ecologia, 1995) the most current version of the CALM Declared Rare and Priority Flora List was used (i.e. that released on 14.9.94). Eremophila parvifolia was listed therein as a Priority 4 species occurring from Kalgoorlie to South Australia. In the next CALM listing (14.9.95) which was released after the report was written, this species was divided into two subspecies; E. parvifolia subsp. parvifolia ms. (Recorded from Balladonia, Calguna to South Australia) and E. parvifolia subsp. auricampa ms. (Recorded from Londonderry, Black Flag Station, Kalgoorlie and Bulla Bulling). E. parvifolia subsp. parvifolia ms. was retained as a Priority 4 species, while E. parvifolia subsp. auricampa ms., the subspecies occurring within the Bulong project area, was deleted from the Priority schedule.*

1.5 Specific information on the re-use of topsoil from locations of *Gnephosis intonsa* is requested during the rehabilitation programs, to assist with knowledge of the biology of the species.

***Response:** Agreed. The proponent is happy to cooperate with CALM.*

1.6 CALM would assist in compiling a package of information on likely rare fauna for the site area in return for information on sightings.

***Response:** This offer is gratefully accepted.*

1.7 The regional description of the vegetation is difficult to understand or to relate to the site description.

What is the regional and local significance of the vegetation present on the site (ie how much of the site is represented elsewhere)? What is its regional significance as fauna habitat? What are the regional and local impacts of removing specific vegetation types/fauna habitat (refer DEP guidelines)?

Response: *This question is difficult to understand as it is answered in very full detail in Appendices D1 (Regional Flora Description), D2 (BNLP Area Flora Description), D3 (BNLP Area Flora Species List), D4 (BNLP Area Priority Species List), E1 (Regional Fauna Description), E2(List of vertebrates, etc.), E3 (BNLP Area Fauna Habitats). It is suggested that the respondent reads Volume 2 - APPENDICES of the CER.*

1.8 The monitoring of sulphur and dust fallout does not address the impacts of these emissions on the vegetation.

What are the predicted impacts of gaseous emissions and/or dust on the native vegetation, and how will these be managed (see DEP Guidelines)? A figure showing emission contours would assist.

Response: *Figures 4.2, 4.3 and 4.4 depict the emission contours for SO_2 showing the effect of the BNLP alone, Kanowna plus the Gidji roaster plus the KNS at maximum rates as well as all the above combined. These figures clearly show that the impact of a BNLP sulphuric acid plant (should one be necessary at all) would be negligible. BNLP emission rates would be of the order of 0.019 kg/s compared to 17 kg/s from all other sources.*

At these levels, it is clear there would be no measurable impact on flora.

Note also that the ore is moist so that dust emissions are minimal (see Table 4.4) See also Table 1 in the Summary.

1.9 Not all of the site has been assessed, in particular areas of highest risk from residue leachate spillage (Lake Yindarlgooda and the pipeline route from the project to the residue storage and evaporation ponds).

What is the regional and local significance of the lake, lakeside and pipeline route flora and vegetation (ie how much of this vegetation and flora is represented elsewhere)? Are there any gazetted Rare or Priority Flora in these areas? What is the regional, local (and international) significance of this area as fauna habitat?

Response: *The Golden Hind mining area and the pipeline route from the borefield were not completed because of the weather. They are yet to be assessed. The pipeline route to the valley impoundment for leach residue was assessed but the route to the lake was not envisaged at the time. It is yet to be assessed. An archaeological assessment was made of the project by Quartermaine Consultants (reports available) and an anthropological assessment was made by Rory O'Connor (report available). The latter included European as well as indigenous peoples.*

With respect to the proposed pipeline access and borefield alignment, we would expect the vegetation occurring in these areas to be relatively widespread within the region. The pipeline access is dominated by two of the major associations present in the main project area (i.e. Eucalyptus salmonophloia over mixed tall shrubs and chenopods, and Eucalyptus griffithsii woodland over mixed shrubland). Drier areas along the borefield alignment are dominated by Eucalyptus celastroides woodland over mixed shrubland, a vegetation type which would be expected to be broadly distributed. The salt lakes scattered along the alignment are associated with a variety of vegetation types (e.g. samphire flats) which have only a limited distribution within the survey area, however since numerous other seasonal salt lakes occur in the region, these associated vegetation types are expected to be relatively widespread overall.

Salt lakes are numerous within the region, hence these habitats are not significant on a regional level. The Grey Falcon and Peregrine Falcon are the only Scheduled fauna species which would be expected to occur within the Salt Lake habitat. The Peregrine Falcon could potentially occur in any of the habitats within the project area, while the Grey Falcon would be expected only within the Chenopod Woodland and Salt Lake habitats.

The Rainbow Bee-eater is protected by CAMBA (China and Australia Migratory Bird Agreement 1992) and JAMBA (Japan and Australia Migratory Bird Agreement 1992), international agreements which are designed to the "protection of migratory birds and birds in danger of extinction and also for the management and protection of their environments". While this species may occur in the Salt Lake habitat, it was not recorded during the survey, and would not be expected to be dependent on any resource within the survey area which is to be impacted.

1.10 The impacts on priority flora cannot be assessed as the CER fails to identify the precise location of access roads and other infrastructure.

Response: *See Figure 3.3. Note that the most commonly occurring priority floral species (E. parvifolia) is now deleted from the Priority 4 Species List. The few (one priority 1, one priority 3) listed species found on site and discussed in Appendix D4 can be and will be avoided as described in Table 1, page vii of the Summary. This will be ensured during detailed planning. However, the approximate location of all roads have been indicated in the CER. The final location may be determined when all fauna and flora assessments have been made, ground surveys and detailed mine planning is complete. Only when detailed engineering is complete will the precise location of all access roads and infrastructure be known.*

Lake Yindarlgooda

1.11 The fauna report states that Lake Yindarlgooda supports aquatic vegetation and a wide variety of ephemeral crustacea. The CER does not provide any description of these. This area will be subject to the highest potential risk of spillage of hypersaline residue and nutrient release, particularly during flood events when high salinity/nutrient levels are not a part of the natural cycle. An understanding of the ecology of the lake is essential to enable some prediction of impacts to be made, particularly given the statement in the CER, that the changing salinity is a major influence on biological cycles of the saline lakes of the region. In addition, it is noted that the lake provides island habitats which would be potential breeding habitat for migratory bird species and that further investigations are required to determine the lake's ecological significance to the region. Any potential

disturbance to these habitats becomes particularly significant if the migratory bird species are protected under international (CAMBA/JAMBA) treaty, hence the lack of information makes it difficult to assess the impacts of the proposal, or to enable clearly defined management objectives to be made.

What would be the potential impacts of spillage of hypersaline residue on the vegetation/fauna of the lake? How will the information obtained in surveying the receiving environment (p2-14) be used? What information will be collected? How will the information affect management decisions? The 'development of management plans' (p5-4 'Corrective Action') is not sufficient to ensure that the lake is not adversely affected by the residue storage pond.

Response: *Due to the lack of data available, commitment has been made (see 5.6) — as suggested by CALM to commence a long term study of the migratory birds and macro-invertebrates. The salinity of the leach residue is so close to being the same as that already in the lake that there will be no effect on the minimal vegetation. A study plan will be drawn up with the assistance of and in close consultation with CALM utilising all pertinent data.*

Page vi of the Summary shows clearly the commitment to conduct baseline invertebrate monitoring as well as migratory fauna use on those rare occasions when the Lake contains water. Section 5.5, page 5.6 "Leach Residue", also provides further commitments and Section 5.6, page 5.7 discusses long-term surveys.

1.12 The CER discusses three options for the location of the leach residue storage facility, however does not provide sufficient information to allow DEP assessment of the three options. In particular, the CER indicates that the storage of leach residue on Lake Yindarlgooda is the most attractive option from an environmental point of view, however does not provide sufficient information on the receiving environment to justify this. (For example, Table 2.6 indicates that there will be no potential downstream salinity effects with the lake impoundment

option. This would not be the case if there was a leakage during the flooding of the lake when the receiving environment is less saline than the impoundment residue.) The potential impact of high levels of nutrient contamination have not been addressed.

Insufficient information is presented to adequately determine the environmental impacts of each location (refer DEP guidelines). Further detail is requested, including information on the predicted impacts on the conservation values of the vegetation, flora and fauna habitat of each site in a local and regional context and the expected impacts should leakage of hypersaline/high nutrient loaded residue occur.

Response: *This has been discussed above. Any leakage, including that which enters the bores and leakage drains will be pumped to the evaporation pond for recycling to the plant reducing the total water requirement from the borefield and the associated pumping cost. Any nutrients will be recycled with the leakage. The matter of pipeline leakage potential is discussed in 4.3.2, 3, 4 and 5.*

Allocation of Groundwater

1.13 The proposed borefield appears capable of meeting the estimated process water requirements of about 6000 m^3/day however pumping at this rate could interfere with neighbouring borefields. Prior to approval for a groundwater abstraction licence, the proponent will be required to provide further information.

Response: *See page 5.5, Section 5.4 where a commitment is made to ".....conduct a hydrological study to determine the effects of the Kanowna Belle and BNLP withdrawal from the North Yindarlgooda Palaeochannel ".*

It should also be noted as discussed on page 4.10, 2nd last paragraph, that ".....drawdown on areas surrounding the palaeochannel, based on the very low clay conductivity will be almost negligible....."

1.14 The proponent should be encouraged to recycle as much process water as possible to reduce the long-term depletion of the groundwater resources. It is not clear from the text whether the proponent intends to re-cycle supernatant and recovered leachate derived from the decant, or merely discharge it straight to the evaporation pond.

Response: *The proponent plans to recycle all process water. This must be for otherwise there will be insufficient bore pumps installed. Furthermore, better metal recovery is obtained with recycled water so it is in the proponent's best interest to recycle.*

1.15 An overall drawdown of 26 metres is predicted from the North Yindarlgooda Palaeochannel as a result of borefield extraction. The proponent is commended for committing to vegetation monitoring over the borefields to determine any vegetation impacts resulting from the loss of water from the clays overlying the aquifer. However, the impacts of such extraction on vegetation are unknown, and not clearly defined in the CER.

Response: *This is discussed in Section 3.2.3, page 3-3 of the CER. Here reference is made to the fact that there is no standing water table in the vicinity of the proposed mine, since the underlying stratas are impermeable and that drilling has revealed no groundwater. The available evidence contained in the latest literature (Turner et al 1996: Groundwater Supply to the Mining Industry in the WA Goldfields Report No.154, Project No. M127, Minerals and Energy Institute of Western Australia, March 1996) strongly suggests that the likelihood of withdrawal from the palaeochannel having any measurable impact on vegetation is very low. This is because the low conductivity clays overlying the palaeochannel effectively control the interaction between the aquifer and the surrounding soils.*

2 POLLUTION PREVENTION

Several submissions expressed concern regarding the environmental impacts of transporting sulphur over distance from the Port of Esperance. Another submission however, noted that this option is preferable to on-site generation due to the potential impact of SO_2 emissions on the region. The lack of detail in the CER regarding these issues was noted.

2.1 Due to the lack of detail regarding the implications of storage and handling of sulphur at the Port and its transportation through Esperance, a separate CER is requested to address those issues. The assessment of this aspect requires consideration of cumulative impacts as a result of the proposed development of the Murrin Murrin project.

Response: *This is the subject of a current CER by the Esperance Port Authority.*

2.2 The transport of elemental sulphur or sulphuric acid by rail rather than road needs further assessment. The relative hazard of transport of sulphuric acid instead of elemental sulphur has not been adequately addressed in the CER.

Response: *The economics are in favour of road transport at this time. Road transport reduces handling, (trans-shipment to road at South Kalgoorlie) potential dust hazard and losses. The CER addresses the case for acid production at the project site. It is not intended at this time to haul acid for its cost is prohibitive.*

2.3 The option to purchase acid has obvious environmental benefits for the region with respect to SO_2 emissions, transport of other chemicals and resource utilisation. The CER does not address the impacts of SO_2 emissions on the biota of the region. A comparison of the environmental impacts of both options would be useful.

Response: *This is addressed in the response to 1.8 above.*

2.4 Sulphuric Acid produced as a by-product of other regional projects should be purchased as opposed to the importation of Sulphur Prill through Esperance, due to the potential environmental impacts on the community of Esperance and the waters of the Recherche Archipelago.

Response: *This is addressed in 2.2 above.*

2.5 What is the quality of the vapour generated in the flash tank which is vented to atmosphere?

Response: *Current process design suggests approximately 10 t/h of water vapour being vented to atmosphere. This is expected to be considerably reduced in final process design.*

2.6 Apparently, oil recyclers will not take mine waste oil, so the disposal of oil also needs clarification. Also where are the current approved sites for off-site waste disposal, and what process will the proponent follow to gain an approved site if one is required in the vicinity of the mine?

Response: *A Western Australian oil recycler currently collects mine waste oil from the proponent's existing operations and has confirmed that they are interested in providing the same service for the BNLP. Approved rubbish disposal sites will be discussed with the City of Kalgoorlie-Boulder and DOME.*

2.7 The CER indicates that the groundwater is likely to become polluted. With what and to what extent? How will best practices have been implemented to avoid this contamination (refer DEP guidelines)?

Response: *The CER does not state that the groundwater will become polluted for it has been shown that there is no groundwater to depths of 100 metres. Hypersaline water that is present in the palaeochannels is the only known groundwater. The only place that contamination is mentioned is in 5.5 in reference to the monitoring of leach residue*

2.8 No mention is made of CO emissions. Is any produced (refer DEP guidelines)?

Response: *CO Emissions: The only emissions that may be present will be in the stack gases of the diesel fired boiler plant when in use.*

2.9 Is nitrous oxide (N_2O) or H_2S likely to be produced? Also, other greenhouse gases eg. Hydrocarbons (refer DEP guidelines)?

Response: *N_2O is not expected to be produced and while some H_2S may be produced during neutralisation, it will further react with cobalt to form CoS remaining within the circuit.*

2.10 Will the acid plant use vanadium pentoxide (V_2O_5) catalyst and if so, how will the spent catalyst be managed?

Response: *Vanadium pentoxide is proposed to be used in the acid plant as a Catalyst. Spent V_2O_5 may be returned to the USA for regeneration or disposal.*

2.11 Excess heat recovered from the acid plant is proposed to be used for production of steam for the pressure leaching process. If the acid plant is not required due to the availability of sulphuric acid from other sources, will the energy requirements of the plant be significantly altered?

Response: *Waste heat from the acid plant will be used for process steam production and electric power generation. Should it be that sulphuric acid can be procured at an acceptable price (obviating the need for an acid plant) then process steam will need to be generated on site using diesel oil, gas or electrical energy while electrical energy will be purchased from Western Power or another supplier or generated on site from oil or gas. The total energy requirements will not be significantly altered but will need to be sourced elsewhere.*

Storage of toxic or hazardous substances

2.12 Toxic and hazardous materials need to be stored away from areas subject to flooding and protected in weatherproof enclosures. The adoption of bunding around fuel and chemical storage tankfarms is endorsed, however AS1940 proposed for containment control is understood not to require semi-impervious compound construction. Low permeability (<10-9 m/sec) base lining and bunding is recommended. Where practical, these materials should not be used or stored within the catchments of surface water impoundments used for human or animal water supplies, or diversion channels installed to afford necessary protection.

Response: *It is intended that low permeability base lining and bunding will be utilised (clay from pit overburden) and the storage area is within a totally bunded process plant compound. The plant site chosen is on a ridge which can be diverted away from catchment areas for human and animal supplies.*

Lake Residue Storage

Numerous submissions addressed the proposal for Leach Residue Storage. All of these submissions commented on the lack of information provided in the CER, particularly with respect to the lack of hydrological modelling and understanding of the ecology of the receiving environment in relation to the risks and impacts of leakage/seepage into Lake Yindarlgooda.

2.13 Further information is required to support the statement that Lake Yindarlgooda is the most attractive option from an environmental perspective.

Response: *This is covered in the response to DEP comments.*

2.14 It is not clear what is the operational significance of the "Optional" Valley Impoundment Residue Facility. Is it an alternative to the lake Impoundment? Is it for possible expansion later in the Project? If it is we assume it is at least a deferred part of the project and will be the subject of geotechnical analysis and environmental assessment at the appropriate time.

Response: *The valley impoundment was one of four sites considered. It is not an alternative. It is not intended for later expansion.*

2.15 As well as containing metals, which may or may not be mobilised, the residue contains 11,380 mg/L ammonium sulphate which may represent a eutrophication problem for the ephemeral environment. What would be the impact of nitrification on:

the ecology of Lake Yindarlgooda;
any surface system in the area; and
the groundwater?

Response: *See also the response to 1.3 above. In addition, it must be said that any impact on Lake Yindarlgooda in terms of eutrophication would first require that it contained water - a very rare event (see Appendix A HYDROLOGY REPORT)*

Secondly the leach residue storage would then have to be breached or to be seriously leaking for the very small volumes involved to have any impact on the nutrient levels of the lake. This is addressed further in the response to question 2.18.

2.16 The substances contained in the leach residue, whilst mostly also present in the lake, occur in substantially different concentrations. What would be the significance of these variations should lake spillage/seepage occur?

Response: *It is not expected that the increased concentrations of magnesium, sodium or chlorine will have any effect on the lake environs though the addition of ammonium sulphate may have some effect. While all seepage will be contained and recycled, monitoring of test cells should provide useful control data for future management.*

2.17 No hydrological modelling of Lake Yindarlgooda has been undertaken. Modelling is required and should take into account average and above average (say 1 in 50 - 1 in 100 year) rainfall events and be able to predict the impacts from changes in runoff (due to mining operations), reduced lake surface area, and any change to groundwater tables adjacent to residue disposal and evaporation ponds.

Response: *See Appendix A HYDROLOGY REPORT. It should also be noted (Turner et al 1996) that the persistence of Lake Yindarlgooda is low. Flood persistence is defined as the tendency of the flooded salt lake to retain a free water body within the lake boundaries. Turner defines this as the change in a lake inundation over a specified time interval. The extent of lake inundation was further quantified as a percentage of surface area divided by the total salt lake area. (Area catchment Ac / Area lake Al). Higher Ac/Al ratios tend to suggest higher lake persistence. With an Ac/Al ratio of 9.0, Lake Yindarlgooda is amongst the least persistent of those examined in the goldfields. Black Flag for example has a ratio of 109, King of the West 156 and Lake Turner, 48.*

2.18 There is no adequate geotechnical description and assessment of the preferred "Lake Impoundment". An adequate geotechnical assessment of the stability and permeability of the Lake Impoundment would have to be completed by DME Geotechnical Service before the environmental acceptability of this part of the project could be determined.

Response: *This is covered previously and reference is made to the Knight Piesold report of April 1996.*

2.19 What is the likely risk of residue pond failure?

Response: *Considering the design proposed (see Knight Piesold Ref. 656/4 Sections 4.5 and 4.6), the risk is considered to be very low having provided for flood conditions. These sections state.....*

4.5 CONSTRUCTION OF THE FACILITY

4.5.1 Leach Residue Storage Facility

The facility will be constructed in stages over the life of the operation. Construction of the initial facility should be carried out by a suitably qualified earthworks contractor using either local borrow or pit overburden material. If local borrow is used care should be taken to ensure that the borrow area is positioned so that it doesn't affect the operation of the initial facility or any of the future stages of the facility.

The construction of the facility can be summarised as follows:

i Site clearing:
The embankment and area will be stripped of unsuitable material (nominal depth 100 mm) which will be placed in a suitable stockpile.

ii Embankment and basin foundation preparation:
The embankment cutoff trench will be excavated. The embankment footprint and basin area will then be scarified to 300 mm depth and recompacted.

iii Decant underdrainage system:
The underdrainage area will be excavated to a depth of 600 mm with a slope towards the decant tower. The base of the excavation will be scarified to a depth of 300 mm and recompacted. The excavated material will be moisture conditioned and a 300 mm compacted layer placed over the entire area. The underdrainage system will then be constructed so that its top surface is flush with the surrounding ground level.

iv Decant tower:
The central decant tower and underdrainage tower will be constructed with sumps to recover supernatant liquor and underdrainage. The decant tower will be surrounded with free draining rockfill with a minimum size of 100 mm.

v Embankment construction:
The initial embankment will be constructed in layers not exceeding the thickness required to achieve 98% of standard maximum dry density. The erosion protection downstream toe will be constructed simultaneously with the remainder of the embankment.

vi Access causeway:
The decant access causeway will be constructed by end dumping, shaped by a dozer and traffic compacted.

4.5.2 Evaporation Pond

The evaporation pond will be constructed for the life of the project. The construction of the evaporation ponds will be carried out at the same time as the initial leach residue storage facility using an earthworks contractor. The construction of the facility can be summarised as follows:

i Site clearing:
The embankment and basin area will be stripped of unsuitable material (nominal depth 100 mm) which will be placed in a suitable stockpile.

ii Embankment and basin foundation preparation:
The basin area will be shaped to provide the required falls. The basin area and embankment footprint area will be scarified to 300 mm depth and recompacted.

iii Embankment construction
The embankment will be constructed in layers not exceeding the thickness required to achieve 98% of standard maximum dry density. The erosion protection downstream toe will be constructed simultaneously with the remainder of the embankment.

iv Basin liner:
Borrow material will be imported, placed, moisture conditioned and compacted in two layers over the basin area and internal embankment walls and crest to form a low permeability liner 500 mm thick.

v Spillways:
The overflow spillway between the holding pond and evaporation pond and the emergency spillway from the evaporation pond to the lake will be excavated and lined with HDPE sheeting.

4.6 CONSTRUCTION QUALITY CONTROL

The leach residue storage facility and evaporation ponds will be constructed in accordance with a technical specification which will be provided as part of the final design. The implementation of this technical specification during the construction phase is essential to ensure that the facility will function according to the design intent. The following aspects will need to be carefully monitored during the construction phase by suitably qualified personnel:

Embankment area and basin foundation preparation.
Selection of suitable materials for liners and embankment fill.
Moisture conditioning and compaction of liners and embankment fill material.
Alignment and level of all pipework.
Selection and installation of pipes, bedding and drainage material.
Construction and installation of spillway liners and energy dissipation waste rock ponds.

Quality control tasks including gradations, moisture content and density tests will be carried out throughout the construction phase to ensure compliance with the technical specifications.

2.20 Containment structures need to be able to cater for extreme storm events (eg 100 year return frequency, 72 hour duration) including all runoff captured within the process area as described in the proposal. Placing tailings walls in potential contact with standing or flowing natural waters is generally not good environmental practice, both because it could affect erosion rates and wall stability and assist in conducting pollutants from the dam to the external environment. It may be necessary to design an impoundment with a second wall to ensure lake water does not bank against the residue — containing wall. Design specifications for the impoundments will need to be produced before the environmental acceptability of the proposal can be assessed.

Response: *Covered previously.*

2.21 The statement on page 2.17, para 6 commencing "water inlets...." is ambiguous and requires explanation and detail.

Response: *As suggested by DOME, any process water that needed to be temporarily sent to the evaporation pond should not be discharged into the pond at only one point. So, as stated, 'water inlets would be placed at a number of locations etc. — to reduce possible erosion of the lake surface', (or clay liner).*

2.22 Some profiling of the lake sediments is suggested to determine if keyways need to be cut and filled with low permeability fill to limit lateral seepage through the embankments.

Response: *This has been done and is covered previously (above).*

2.23 It is noted that most tailings storage facilities in WA leak and that there is a recognised Statewide and international concern regarding the discharge of contaminated seepage from tailings impoundments. This has resulted in the accepted practice of geomembrane liners for impoundments. Given that the Commonwealth EPA promote liners within "Best Practice Environmental Management Tails Structure", the proponent's practice of unlined impoundments, monitoring leakage followed by crisis management, is unacceptable.

Response: *This is covered previously (above).*

2.24 Details of leach residue and evaporation pond seepage collection, monitoring and recovery in the lake bed environment of Lake Yindarlgooda needs better definition especially under circumstances where the lake contains water.

Response: *As for 2.23.*

2.25 The CER states that there is always the possibility that some leakage from the residue storage would eventually occur.

What is the risk of leakage from the residue storage? The CER states that boreholes or seepage trenches will be installed outside the facility to monitor any future changes in groundwater quality and/or seepage and that these facilities will assist in minimising any environmental impacts? How often will these be monitored? What management will occur if groundwater contamination/seepage occurs?

Response: *This is covered previously.*

2.26 There is no information presented in the CER of the containment criteria or engineering specifications of the residue ponds. (Note: in the absence of information on the ecology of the lake or an assessment of impacts, the specifications should ensure **no** breaches or spillage will occur. These specifications may be relaxed in the light of greater certainty/understanding of the significance of impacts.)

What are the containment criteria and engineering specifications of the residue ponds and evaporation ponds? What are the sedimentation basins referred to in Section 5.4? What is the Corrective Action which would occur if spillage of high nutrient/hypersaline waters into the lake occurs (p5-8)?

Response: *The containment criteria for the leach residue ponds have been covered. The sedimentation basins referred to in 5.4 are those required for surface drainage channels to minimise and prevent erosion.*

2.27 The CER states that "consideration has been given to the control of flood water entering the lake in the vicinity of the impoundments and to the passage of lake water entering the lake water to the north or south during and after periods of high deposition", however does not present any of this information. The CER also indicates that natural drainage lines will be disturbed and would need to be 'rehabilitated' (Section 5.1). Insufficient detail is presented on the extent of disturbance or the level and nature of the expected impact on the receiving environment.

More information is required on the surface hydrology of the lake. What are the direction of surface water flows, maximum height and duration of flood events? Will the location of the ponds interfere with normal drainage patterns into the lake? What other natural drainage lines will be disturbed? What is the extent and nature of the impact of this disturbance?

Response: *Until such time as some more detailed engineering is completed, it is not practical to provide precise details for disturbed drainage channels when the cause for the disturbance is not yet known. See also Appendix A.*

2.28 Waterfowl and fauna will be attracted to the leaching ponds. Waterfowl in particular, are difficult to deter. In addition to the hypersalinity of the residue which in itself provides a biological hazard, it is not stated in the CER if the leachate is toxic. There is no assessment of the potential impact of the leachate on fauna.

What is the toxicity of the leachate residue and what biological hazard does this represent? What are the expected impacts of the leaching pond on waterbirds and other fauna? What are the management measures proposed to mitigate impacts?

Response: *The leach residue is not toxic. See also response to 1.3.*

2.29 The lack of geotechnical investigation on the lake storage option for leach storage residue is a concern. It is difficult to compare the environmental acceptability of each storage option without the knowledge of the lake substrata.

Response: *See response to question 1.3*

2.30 The CER makes presumptions about the drying and consolidation of the leach residue without the inclusion of investigations of the physical characteristics of the residue.

Response: *The CER makes judgements in respect of leach residue consolidation and drying based upon the investigation by D. Cooper & Assoc. (See Ref Vol 1 CER and Vol 1 NOI). Knight Piesold Report 656/4 notes .....*

Residue characteristics

Testing of the Bulong Nickel residue has been undertaken by others (D E Cooper & Associates, 1995) and the following residue characteristics have been adopted based on information received form this testwork.

Maximum air dry density	0.84 t/m^3 *(excluding salts)*
Particle density	2.74
Supernatant production	Undrained test 25.5%
	Drained test 16.5%
Slope	*1:100*

2.31 The CER states that storage of the evaporation pond will be for 10 to 15 years, yet the anticipated life of the mine is 15 years. Is a second pond required? Where will this be built? What size is required? The CER states the entire size of the storage paddock and evaporation pond will be 48 ha (p2-15), the use of small test ponds of an area of 30 ha, the construction of a second similar pond, with a maximum area of disturbance to the lake being 100 ha (p5-6). Please clarify.

Response: *The evaporation pond will be used as a holding pond for recycling supernatant leach residue storage water, leakage water and stormwater to the process plant so reducing that make-up required from the borefield. However, design must provide for the worst condition — assuming that all leach residue supernatant liquor needs to be evaporated. The pond has a life of 15 years. 10 years should be deleted. 2.10.1 describes the construction of the Lake Impoundment for Leach Residue and states that the area required for it (by design) will be 46 ha. 2.10.2 on page 2-17 does mention the use of small test ponds (for evaporation testwork) but goes on to state 'The maximum area required for the evaporation of leach residue supernatant water for the 15 year*

operation is (in fact) 30 ha to accommodate evaporated salts.' This is not inconsistent with a design area of 48 ha. Page 5-6, Table 5.5 states 'The maximum area of disturbance to Lake Yindarlgooda will not exceed 100 ha in the first 15 years of operation'. This makes a design total of 78 ha for 15 years. When access roads, pipelines and powerlines etc are considered, it seems prudent (5.5) to suggest that the maximum area of disturbance will not exceed 100 ha.

3 SOCIAL SURROUNDINGS

Four submissions stressed the heritage values of the Old Bulong townsite, particularly the cemetery, and expressed concerns that the haulage route would occur through the townsite, that the townsite could be disturbed directly or indirectly by mining activity, and that the integrity of the gravestones could be damaged by SO_2 emission.

3.1 The townsite and cemetery are important heritage and tourism features and have numerous visitors. The area must be protected whilst allowing for full public access. What protection measures (eg fencing, signage, gates) will be provided to protect the Cemetery and all the graves and headstones? What measures will be taken by the company to minimise interference with the cemetery by the proponent, employees, agents and contractors?

***Response:**. While the mining tenements do cover the Bulong Townsite, the proposed mining areas indicated on Figures 1.2 and 2.5 show pit outlines not ore body outlines. Bulong is accessed by a public road at this time and no change is intended to this situation. In fact, the pastoral road from Bulong towards Pinjin (as far as the process plant site) will be upgraded and diverted — when designed — to bypass the Bulong by easing the corner considerably. The proponent shall have no accommodation facilities on site and no private vehicles will be permitted. Employees will be bused to and from work and those driving the proponent's vehicles and contractors will not be permitted to leave designated access roads without specific authority. (Ref. Jones Agreement as amended—Appendix B of the CER). Thus project interference with the existing situation at the Bulong Townsite is avoided.*

3.2 Headstones will be damaged by SO_2. It is proposed that the proponent should treat the headstones with some form of non-staining protective spray as protection against any fallout of fumes, gaseous emissions, acid droplets and dust.

***Response:** Reference to Figures 4.1, 4.2 and 4.3 show that little or no change will occur at Bulong with the construction of the acid plant at the process plant site. Ref page 4-6 para. 2 and 3. See also response to 1.8.*

3.3 To what extent will any pit-site (the 'Pinta' lode) impact the townsite?

Response: *The Pinta orebody is not expected to have any effect on historic sites at Bulong though the Half Moon orebody may encroach on the southern end of the rifle range. The haul road form Half Moon shall be located to avoid any historic sites.*

3.4 What is expected traffic through the townsite?

Response: *Nil. See previous comment re road diversion.*

3.5 The camping Reserve outside the townsite should also be protected from disturbance. The townsite has tourism potential for development as an historic town.

Response: *The camping reserve is considered to be outside the proponent's mineral tenement and is within the pastoral lease. Refer Figure 1.2 in the CER.*

3.6 What is the estimated total number of vehicles per day expected to travel through the old Bulong townsite? How will these impact the heritage elements of the townsite, particularly the graveyard? How will the heritage elements of the townsite be managed and protected?

Response: *As mentioned previously, the public road from Kalgoorlie to Bulong will be diverted to the NE as it nears Bulong to meet up with the Bulong-Pinjin pastoral road — thus bypassing Bulong.*

Aboriginal Heritage

3.7 The CER p3-11 and 4-28 state that a survey was done by O'Connor & Associates and that 'some sites were found, but none of these need to be affected by the BLNP development'. No report has been lodged with the department of Aboriginal Affairs nor have sites been lodged with the Sites Register. It is recommended that the ethnographic and archaeological survey reports be submitted to the Aboriginal Affairs Department whether approvals are sought for site disturbance or not. It was noted that the area is subject to a claim for Native Title.

Response: *At the date of CER submission, an archaeological report had not been completed; hence no reports have been lodged. Quartermaine Consultants have now completed their Archaeological survey at the Bulong Nickel-Cobalt Project, Kalgoorlie; March 1996. Appropriate action will now be taken by the proponent in respect of the above report and that of Rory O'Connor — Report on an Ethnographic and Historical survey of the Bulong Nickel Project, November 1995.*

3.8 What is the archaeological and ethnographic significance of the area to Aboriginal people. How will the project impact and manage sensitive areas?

Response: *Quartermaine Consultants conclusions (p.32) states 'For these reasons, the sites are assessed to be of low to moderate significance.' The recommendations of Quartermaine Consultants will be followed and where necessary, infrastructure facilities shall be resited to obviate the need for disturbance.*

Risk and Hazards

3.9 How does the project comply with risk criteria in EPA Bulletin 611 and 627 (see DEP guidelines)?

Response: *Compliance with the risk criteria of EPA Bulletins 611 and 627 is as follows:*

Bulletin 611 refers to the requirement for a risk assessment where the project "....involves a significant element of risk to the public...". This is clearly not the case in the BNLP project. Bulletin 627 refers to Environmental risk and discusses this in terms of "....damage to a rare or unique part of the natural environment or widespread damage to the broader environment. It is submitted that neither scenario is applicable to the BNLP. In terms of Section 3.4 "Environmental risk" of Bulletin 627, it can be said that the BNLP does not constitute a risk requiring quantitative evaluation.

4 REHABILITATION

4.1 It seems that mine rehabilitation will sometimes involve partial backfilling and reshaping of the reasonably shallow pits (to 40 m). Three deposits/pits are identified for mining in the first 5 year period but it is not clear whether there is an opportunity for sequential mining/rehabilitation.

Response: *Rehabilitation or backfilling can only take place when it is considered that all ORE has been removed. This determination is made in consultation with DOME. It is yet to be determined whether this may occur within the first 5 years of operation.*

4.2 More detail is required on the mining/rehabilitation sequence in the first couple of years and on the area of backfilled quarries versus permanent waste dumps to be rehabilitated.

BULONG NICKEL LATERITE PROJECT

HYDROLOGY REPORT

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1 INTRODUCTION

Some hydrologic modelling has been carried out for the catchment of Lake Yindarlgooda as part of the Bulong Nickel Cobolt Laterite Project. This modelling has considered the runoff into the lake from the catchment and the depth of water which could be expected in the lake during major flood events.

The lake is in the arid zone of the eastern goldfields of Western Australia with very low rainfall and high evaporation. This region has almost no recorded hydrologic data so the analysis is based on an appreciation of general hydrologic conditions in this region.

2 DESCRIPTION OF ISSUES

The climate of the region is dry with a mean annual rainfall of only 257 mm recorded at Kalgoorlie. Mean monthly rainfall and pan evaporation data are listed in Table 1.

Table 1: **Mean Monthly Data**
Kalgoorlie (Source: Bureau of Meteorology)

Month	Rainfall (mm)	Rain Days	Pan Evaporation (mm)
January	22	4	392
February	28	4	312
March	19	4	271
April	20	5	178
May	28	7	111
June	31	8	77
July	25	9	85
August	21	7	114
September	14	5	169
October	16	4	255
November	18	4	305
December	15	3	372
Total	257	64	2641

Storm event rainfall was also calculated for a range of storm durations and probabilities using "Australian Rainfall and Runoff". These showed that a significant portion of the annual rainfall can occur in a short period of time. Rainfall totals are listed in Table 2.

Table 2: **Design Rainfall**
Calculated from "Australian Rainfall and Runoff"
Rainfall Depth - mm

Duration (h)	Average Recurrence Interval (ARI yrs)		
	2	50	100
12	31.2	91.9	110.8
24	39.8	111.4	133.0
48	49.9	131.0	155.5
72	54.7	139.7	164.9

Lake Yindarlgooda is a large lake with a surface area of 323 km^2 (at an elevation of 320 m AHD). It is a salt lake normally reported to be dry but there are no quantitative data on the observed lake level.

The catchment draining to the lake has a large catchment area of 3,442 km^2 and the soil of the catchment is generally highly porous sandy soil. The catchment area however, is difficult to define because of flat terrain and poorly defined drainage. Streams in the catchment generally flow only after very heavy rainfall with most local runoff being lost by infiltration or evaporation before reaching the discharge point in the lake. There are no recorded hydrologic data on any of the streams which flow into the lake.

3 HYDROLOGY ANALYSIS

The issue with the hydrologic analysis was to assess the quantity of water which will flow into the lake during average and high rainfall events. Since it is clear that significant amounts of water will flow into the lake only in major storm events, such events were considered.

"Australian Rainfall and Runoff" has estimated losses from major storm rainfall events for all regions of Australia. It is recognised that there is very limited data available for this particular region, but the losses from storm rainfall events have been provided as between 20 and 40 mm initial loss and 3 mm/h as the median continuing loss. With these losses averaged over the catchment, no runoff would occur from the catchment at all, following events of less than, say, 40 - 45 mm (see Table 2 above).

In practice runoff from such catchments occurs during high rainfall events from the main stream channel areas with an insignificant amount of runoff occurring from the major part of the catchment. Rainfall on the surface of the lake itself contributes directly to the depth of water without losses, that is 100% of rainfall on the surface of the lake.

With evaporation losses over the year varying between 12.6 mm/day and 2.6 mm/day (an average of 7.2 mm/day) water stored in the lake after a major flood event is likely to evaporate before the occurrence of another event.

There is no factual information available to estimate the volume of water which will run off the catchment but it is considered likely to be about 5% of the rainfall. To test the sensitivity of this, the impact of having 10% of rainfall becoming runoff was also tested but this amount was considered to be higher than was likely. This assumed that the complete lake is connected and that runoff in one part of the lake can flow to all other parts. The maximum depths of water expected in the lake from these storm events are listed in Tables 3 and 4.

Table 3 :**Lake Level Reached in Storm Events**
Runoff - 5% of Rainfall
Level (m)

ARI (yrs)	Storm Duration - h			
	12	24	48	72
2	0.05	0.06	0.08	0.08
50	0.14	0.17	0.20	0.21
100	0.17	0.20	0.24	0.25

Table 4 :**Lake Level Reached in Storm Events**
Runoff -10% of Rainfall
Level (m)

ARI (yrs)	Storm Duration - h			
	12	24	48	72
2	0.06	0.08	0.10	0.11
50	0.19	0.23	0.27	0.29
100	0.23	0.27	0.32	0.34

With the ARI 100 year storm event and assuming 10% runoff from the catchment, the lake level reaches 0.34 m deep. This amount of water will evaporate from the lake within 1 to 4 months depending on the time of the year when the inflow occurs.

Because of the small proportion of the catchment affected by mining, the area actually developed will have an insignificant incremental effect on the amount of runoff. Because of the small proportion of the proposed facility at the lake surface in the form of the leach residue dam and evaporation pond, there will be an insignificant impact on lake water levels by the project. Water in the lake will be ponded against the residue storage facility for only a short period of time and this is provided for in the embankment design.

4 CONCLUSION

This report has provided some simple hydrologic modelling of Lake Yindarlgooda. Runoff into the lake is expected to be infrequent with the lake level expected to rise to between 0.2 and 0.3 m in the ARI 50 year event. This water will evaporate rapidly. The facilities proposed as part of the mine cover a very small proportion of the catchment (about 0.1%) and surface area of the lake (about 0.2%) and are expected to have an insignificant impact on lake water levels (<1 mm for the ARI 100 year event).

Appendix 3

List of submitters

1. Department of Conservation and Land Management
2. Department of Minerals and Energy
3. Main Roads Western Australia
4. Water Corporation
5. Water and Rivers Commission
6. City of Kalgoorlie-Boulder
7. Esperance Shire Council
8. Conservation Council ofWA Inc.
9. Eastern Goldfields Historical Society
10. Western Australian Genealogical Society Inc.
11. Western Australian Genealogical Society Inc., Goldfields Branch
12. Mr M Logan
13. Ms M Lynan

Appendix 4

Proponent commitments (including Outline Environmental Management Plan)

1. An Environmental Management Plan as outlined in Chapter Five of the Consultative Environmental Review, which details the procedures, practices and timing for protection of the environment including monitoring and reporting requirements, will be prepared and implemented to the requirements of the Department of Environmental Protection on advice of the Department of Minerals and Energy, the Department of Conservation and Land Management, the Water and Rivers Commission, the Water Corporation, and the Shire of Kalgoorlie.

2. The proponent will specify emissions criteria in tender documents for the supply of equipment for the Plant. Compliance testing will be carried out by the proponent during the commissioning of the Plant to confirm that the emissions from the plant equipment are within the specified limits. The commitment will be implemented to meet the requirements of the Department of Environmental Protection.

5.1 REHABILITATION, EROSION AND SEDIMENT CONTROL

Policy: To comply with the requirements of the *Environmental Protection Act 1986*, and the *Soil and Land Conservation Act 1945*.
To provide rehabilitation measures in accordance with Department of Minerals and Energy (DOME) guidelines such that erosion and sediment loss are minimised.

Before construction	During construction and operation	Decommission
Tasks		
• Develop erosion control plans (ECPs)showing erosion control measures relevant to each section of the work with particular detail on erosion-susceptible areas (e.g. drainage lines). • Install temporary erosion control facilities prior to earth disturbance.	• Comply with ECP • Conduct research within the first two years of operation to determine optimum techniques for rehabilitation of various stockpiles. • Progressively rehabilitate disturbed sites. • Utilise existing access roads where possible to minimise area of disturbance. • Strip and stockpile topsoil from disturbed areas and reuse as soon as possible. • Store topsoil in accordance with DOME guidelines. Topsoil stockpiles or stockpiles to be rehabilitated will not be sprayed with saline (>1000 µS/cm) waters. • Control erosion in drainage lines, particularly where lines are re-routed around leaching pits. • Utilise as far as possible, overburden materials for rehabilitation of open cuts, construction of leach residue dam and evaporation ponds.	• Remove infrastructure not required from site and rehabilitate disturbed areas. • Reinstate natural drainage lines. • Contour, cover with topsoil and rehabilitate overburden stockpiles. • Contour residue storages and evaporation ponds to produce stable structures and rehabilitate. • Cap all drill holes within the tenements with the KNO plug. • Remove all above-ground installations and lines, with minimum disturbance to soil and vegetation. • Leave below-ground installations in place. • Batter all remaining stockpiles to maximum slopes of 20% and rehabilitate according to DOME guidelines.
Tasks—Rehabilitation	• Profile land surfaces so they are free of large depressions and pits, windrows or ridges and are free-draining at low gradients. • Cover final rehabilitated surfaces with topsoil. • Deep rip on the contour land surfaces to be rehabilitated. • Undertake progressive seeding using locally-collected species. • Install erosion control and sediment trapping structures at appropriate locations to minimise downstream siltation. • Establish photo-point monitoring locations to provide qualitative feedback on the effectiveness of rehabilitation procedures.	
Monitoring	• Monitor progressive rehabilitation (e.g. for vegetation density) on an annual basis to determine rehabilitation success against agreed completion criteria. • Record the area of disturbed land annually and note the nature of the disturbance (e.g. pit, road, pipeline). • Determine erosion rates seasonally as per water quality samples (refer also 5.4) sediment levels collected in sediment control structures and rate of erosion (e.g. gully) development. • Conduct regular (e.g. annual) photographic surveys from photo-points at rehabilitation sites.	
Deliverables/Compliance Criteria		
• ECP for each section of work	• The total area of disturbance to the environment will not exceed 425 ha within the first fifteen years of operation. • All areas disturbed shall be rehabilitated to agreed DOME standards. • All disturbed areas will be rehabilitated to stable and structurally sound landforms which are protected against water and wind erosion. • Landforms which are compatible with pre-mining land uses (e.g. grazing) and ecological values which are stable and compatible with the surrounding landscape will be created. • All mine pits inactive for periods greater than twenty-four months will have their pit walls battered to slopes less than 20° and be rehabilitated in accordance with DOME Guidelines. • Final land uses will be non-polluting and will not compromise surrounding land uses and ecological values. • The site will be rehabilitated to form a self-sustaining biological community. • More specific completion criteria will be set during the mining and decommissioning phases. Completion criteria will be set for vegetation species composition, vegetation density and cover, fauna species composition and abundance, water quality, erosion rates, visual quality and land capability. • Erosion in drainage lines will not lead to formation of gullies deeper than 1.0 m. • Erosion in capped, rehabilitated landforms will not be deeper than 0.5 m within 10 years of rehabilitation.	
Corrective action		
• Amend ECP as necessary	• Implement ECP to comply with performance indicators.	

5.2 SULPHUR AND FUME EMISSION MANAGEMENT

Policy: To comply with the national guidelines for control of sulphur dioxide emissions from sulphuric acid plants (Australian Environment Council/National Health and Medical Research Council, 1985).
To comply with the national guidelines for maximum airborne nickel concentrations (Australian Environment Council/National Health and Medical Research Council, 1985).
To comply with Environmental Protection (Goldfields residential areas) (sulphur dioxide) Policy 1992.

Before construction	During construction and operation	Decommission
Tasks		
• Design acid plant to ensure emission levels are less than 50 mg/m³ sulphuric acid mist and less than 423 mg/m³ sulphur dioxide.*	• Cover electrowinning anodes and cathodes with woven filter bags. • Cover free-surface of electrowinning electrolyte with floating plastic balls or other structure to minimise fume generation. • Ensure the pH is maintained above 3.2 by adding ammonia or sodium hydroxide to the cobalt-rich solution from the solvent when necessary. • Vent mixing tank fumes and scrub gases. • Ensure vehicles/plant comply with design standards for emissions	• Decommission acid plant and rehabilitate as per rehabilitation guidelines.*
Monitoring	• Monthly monitoring of sulphur emissions and volume of sulphuric acid produced.* • Quarterly monitoring of ground-level sulphur dioxide concentrations.* • Annual monitoring of atmospheric emissions relevant to the project.*	
Deliverables/Compliance Criteria	• Atmospheric emissions will not exceed the levels set in the National Health and Medical Research Council Guidelines (1985) and operating conditions required by Part V of the EP Act.* • Sulphur emissions from the operation will not exceed 2 kg/t of sulphuric acid produced.* • No measurable increase in the ground-level concentrations of SO_2 immediately adjacent to the plant site or within the City of Kalgoorlie-Boulder as a result of operation of the BLNP.* • Personnel will not be exposed to airborne nickel concentrations of greater than 0.05 mg/m³.	• Decommissioned and rehabilitated acid plant site.*
Corrective Action	• Upgrade acid plant, improve process as necessary to achieve performance objectives.*	• Decommission and rehabilitate acid plant.*

* *Redundant if Acid purchased*

5.3 DUST MANAGEMENT

Policy: To minimise dust nuisance to potentially affected areas.

Before construction	During Construction and Operation	After Operation
Tasks		
• Design stockpiles to present minimum surface area, particularly to prevailing winds and thus minimise dust generation. • Specify dust control measures required during construction in any sub-contract documents. • If burning is required obtain a permit to burn from the relevant fire brigade/authority and observe the conditions of the permit.	• Maintain external roads used by the mine in a condition equal to or better than they were prior to commencement of construction (agreement date to be set). • Rehabilitate stockpiles as rapidly as possible to prevent dust generation. • Wet stockpiles (e.g. overburden, ore, limestone, sulphur) as required. • Water unsealed roads/dust sources causing dust problems. • Use a dust coagulant/suppressant to dust control waters, where necessary. • Impose speed limits on unsealed roads in sensitive areas and minimise traffic movements. • Grade and water roads regularly. • Use water sprays at the conveyor transfer points at the mill if required. • Deliver, transfer and store quicklime in sealed pneumatic tankers.	• Ensure regeneration of disturbed areas will reduce dust emissions to acceptable levels.
Monitoring		
• Determine background dust fallout levels (mg/m^2/day) around the mine by establishing dust deposit gauges or similar equipment at appropriate locations.	• Monitor dust fallout levels to determine compliance.	
Deliverables/Compliance Criteria	• Dust generated by the BLNP will not increase the background dust fallout levels by more than 130 mg/m^2/d. • Mining contract to include a 'shutdown' clause in the event of failure to adequately control the generation of dust. • See also Appendix B, Section 4.0.	
Corrective Action	• Increase frequency of watering. • Screened/hooded/filter dust sources as necessary to comply with policy.	

5.4 SURFACE AND GROUNDWATER QUALITY/QUANTITY MANAGEMENT

Policy: To comply with the *Environmental Protection Act 1986.*

To ensure that the water quality in natural receiving water bodies does not breach the State Water Quality Guidelines Bulletin 711 as a consequence of the mine during construction, operation or decommission.

Before Construction	During construction and operation	Decommission
Tasks		
• Develop a final water quality/quantity monitoring programme in final EMP. Monitoring programme to include surface and ground water monitoring objectives, frequency, locations, parameters to be monitored and anticipated costings. • Complete ECPs prior to works. • Design hazardous materials storage areas in accordance with AS1940. • Specify in sub-contracts that concrete trucks wash down off-site. • Prepare and have approved a site-list of hazardous chemicals.	• Conduct a hydrological study to determine the effects of the Kanowna Belle and BLNP withdrawal from the North Yindarlgooda Palaeochannel • Install sufficient observation bores to determine ground water draw-down and water quality. • Install rain gauge on site. • Implement ECP • Use only approved chemicals on site. • Service, refuel and repair (wherever possible) machinery off-site. • Prohibit discharge of untreated wastes except as permitted by the Environmental Protection Act 1986.	• Dispose of debris collected at a suitable off-site area (eg. landfill).
Monitoring	• Daily monitoring of rainfall and main weather variables on site. • Monthly monitoring of ground water usage from the Yindarlgooda Palaeochannel. • Continuous monitoring of the wastewater disposal rate to the evaporation ponds. • Weekly monitoring main drainage lines when flowing for pH, conductivity, metals, nutrients, suspended solids upstream and downstream of proposed development. • Event monitoring of suspended solids at sedimentation basin discharges during/immediately following rainfall events (i.e. > 50 mm rainfall/d). • Monthly monitoring of the condition of sediment basins to ensure design capacity maintained. • Monitor suspended solids and pH whenever >2,000 L/d to be discharged from sedimentation basins. Sample petroleum hydrocarbon samples if oil/grease visually evident. • Monitor sewage effluent quality in compliance with guidelines from the local authority.	
Deliverables/Compliance Criteria		
• Baseline water quality results.	• Water quality indicators will not breach State Guidelines for natural receiving water bodies as a consequence of the mine construction, operation or decommission. • Saline ground water usage by the mine (from the North Yindarlgooda Palaeochannel) will not exceed 6 kL/d. • The rate of disposal of wastewater to the evaporation ponds will not exceed 7,500 kL/d. • Draw-down of the palaeochannel groundwater is estimated to be to a maximum of 20 m in the first year of pumping to supply the mine. • Draw-down of the palaeochannel groundwater is estimated to be to a maximum of 26 m after the first fifteen years of pumping. • See also Appendix B, Section 4.0.	
Corrective Action	• Desilt sedimentation basins when necessary. • Stabilise eroding areas and trap sediment/pollutants as necessary to comply with the performance indicators. • Modify site activities or management, as necessary to comply with the stated policy. • When runoff water in sedimentation basins is > 100 mg/L suspended solids dose with gypsum, allow to settle prior to discharge. • Whenever > 2,000 L/d is to be discharged from sediment basins sample for suspended solids. Analyse for pH prior to discharge. If pH <6.5 or > 9.0 then adjust pH. • Dispose of contaminated soil in consultation with regulatory authorities.	

5.5 LEACH RESIDUE

Policy: To operate and rehabilitate the leach residue disposal facility such that it will create minimal environmental impact, (density of leach residue very conservatively estimated from test work).
To rehabilitate (after completion of use) the leach residue disposal facility to Department of Minerals and Energy and Department of Environmental Protection requirements.

Before construction	During construction and operation	Decommission
Tasks		
• Conduct baseline invertebrate fauna monitoring in surface waters and sediment potentially affected by proposed residue storage facility. • Determine migratory fauna requirements of Lake Yindarlgooda. • Characterise ground and surface water quality in vicinity of proposed residue storage facility (in progress).	• Conduct research to optimise the mechanical stability of the stored leach residue to enable successful rehabilitation within two years of project inception. • Conduct rehabilitation trials to determine optimum methods for establishment of native species on residue piles and evaporation ponds. • Install sufficient ground water observation bores to enable on-going monitoring of ground water levels and quality. • Ensure the reclaim pond will continue operation to allow the upstream toe drain and decant outfall to discharge waters still being released from the system. • Blank the decant outfall pipe with a suitable end cap after flows cease.	• Stabilise beaches against wind and water erosion and shape to shed rainfall outwards. If possible, use mine waste to cover the residue beaches, and apply topsoil, seed and fertiliser. • Cap the residue with a layer of clay or similar impermeable material (as a capillary break) over which a layer of free-draining material will be placed. Spread topsoil in a layer 200-300 mm deep to resurface the area. Cover the capped residue with shallow-rooted, salt-tolerant vegetation. • Cover the crystallised evaporation pond with waste rock or some other suitable material to minimise salt rise. Cover the waste rock with clay/overburden and revegetate.
Monitoring		
• Baseline monitoring in Lake Yindarlgooda, described above.	• Monitor water from constructed seepage drains on a monthly basis. • Field monitor ground water pH and electrical conductivity on a monthly basis. • Sample ground water for laboratory analyses of pH and electrical conductivity and all potential contaminants (including heavy metals) on a quarterly basis. • Protect the residue storage embankment slope with waste rock to ensure it remains stable. • In the final year of operation allow the supernatant on the leach disposal pond to dry and install wick drains if necessary.	
Deliverables/Compliance Criteria		
• Baseline information from fauna and water quality surveys.	• Maximum area of disturbance to Lake Yindarlgooda will not exceed 100 ha in the first 15 years of operation.	• Creation of a non-polluting and structurally stable landform which is resistant to erosion and visually compatible with the surrounding landscape. • Maximum bank slope of 20% according to DOME requirements.
Corrective Action		
• Conduct surveys.	• Develop management plans to ensure Lake Yindarlgooda is not adversely affected by the residue storage.	• Rehabilitate storage area as necessary.

5.6 NATIVE FLORA AND FAUNA MANAGEMENT

Policy: To comply with the *Wildlife Conservation Act 1950* and the Wildlife Conservation (Rare Flora) Notice 1995 and minimise disturbance and loss of locally and regionally significant flora and fauna.
To minimise disturbance of existing natural vegetation required for the construction activity.
To minimise disturbance of existing natural vegetation by disposal of leach residue on the Lake Yindarlgooda salt plan.

Before Construction	During construction and operation	Decommission
Tasks		
• Resolute Resources Ltd will carry out baseline biological surveys at Golden Hind and Half Moon. Weather prevented the survey being made at the same time as for the other areas. • Inspect all locations of finalised infrastructure for the presence of Declared Rare and Priority listed species. • Clearly demarcate on plans and on the ground areas to be preserved from disturbance. • Conduct environmental assessment of proposed potable water supply pipeline route and develop an environmental management plan for construction and operation of the pipeline.	• Minimise area of disturbance during construction. • Install pressure-reduction sensors and automatic shut down valves in the main bore-lines from the saline palaeochannel supply. • Prevent introduction of exotic flora and fauna and destroy declared plants if encountered. • Rehabilitate areas if affected by ruptured/leaking saline water delivery. • Collect seed from on-site native vegetation for rehabilitation trials. • Chip/mulch cleared vegetation (up to 15 cm diameter) wherever practical for use in rehabilitation programs. • Retain large vegetation (e.g. logs) and spread over rehabilitated areas to provide fauna habitat. • Prohibit dogs from site. • Prohibit use of vehicles off formed access roads unless prior approval is obtained from the land holder. • Notify CALM prior to clearing of vegetation for sandalwood and saleable timber removal from the site.	• Rehabilitate disturbed areas as per rehabilitation. • Maintain Erosion and Sedimentation controls until vegetation established.
Monitoring		
• Prior to construction of the potable water supply pipeline and 33 kV power line, baseline biological surveys will be conducted.	• Monitor site for introduction of exotic flora/fauna monthly. • Establish permanent vegetation monitoring plots or transects adjacent to each ground-water supply bore for the mine. • Conduct long-term (2-3 year) study of the migratory birds and macro-invertebrates (e.g. crustacea) inhabiting Lake Yindarlgooda in the wet. The study will begin immediately a commitment is made to proceed with the project.	• Monitor the condition of landscaping, flora and fauna up to the end of the decommissioning period.
Deliverables/Compliance Criteria		
• Flora assessments.	• No effect on any protected flora or fauna species without prior assessment and authorisation from CALM. • No net increase in the diversity or abundance of exotic flora and fauna on the site.	
Corrective Action		
• Where practical, modify infrastructure locations to reduce potential impacts.		

5.7 SOLID AND LIQUID WASTE MANAGEMENT

Policy: To comply with the waste transportation guidelines of the *Health Act 1911*
To comply with Government Policy on waste minimisation.

Before construction	During construction and operation	Decommission
Tasks		
• Ensure designs minimise material usage and wastage. • Specify recyclable packaging where economical (e.g. containers for liquids). • Determine the quantity and quality of sewage effluent likely to be produced on site.	• Conduct research to determine the impact of nutrient release into Lake Yindarlgooda in the event of leakage of wastewater from the leach residue pond. • Provide on-site bins/skips for collection and storage of all wastes, other than natural earth, rocks or vegetation. • Provide facilities to enhance waste reuse and ensure appropriate disposal. • Ensure special wastes stored and disposed in accordance with regulations. • Construct sewage treatment plant (e.g. package plant) to the requirement of the local council environmental health by-laws. • Recycle waste oils. • Recycle wastes (e.g. tyres, fuels) or remove from site (e.g. landfill) (i.e. prevent on-site burning of wastes).	• Ensure no refuse (other than mine overburden) remains on-site.
Monitoring	• Monitor the performance of the EMP for waste minimisation.	
Deliverables/Compliance Criteria		
• Waste disposal bins will be present on site before accumulation of any general refuse.	• Pit burial (of non-compostible wastes) shall not occur on site. • Unused timber shall not be burnt on the site without approval from the relevant fire brigade/authority	• Site left in a stable condition such that wastes remaining will not create environmental nuisance or damage.
Corrective Action	• Modify work practices/procedures to comply with policy. • Provide waste disposal facilities or other measures as necessary	• Rehabilitate site as necessary to comply with performance criteria.

5.8 COMMUNITY AND PUBLIC CONSULTATION

Policy: To keep the community well informed about relevant aspects of construction of the mine.
To respond promptly to potential complaints from leaseholders during construction of the mine.

Before construction	During construction and operation	Decommission
Tasks		
• Designate a member of staff to act as liaison officer with the community. • Prepare a list of potentially affected stakeholders.	• Consult with affected leaseholders including Conservation Council of WA when conducting any activity which may potentially affect them (including development of decommission criteria for the mine). • Maintain record of complaints, investigations and corrective actions. • Restrict major haulage activities to daylight hours as much as possible. • Where new access tracks are required, consult with the pastoral leaseholder about their development.	• Consult with relevant landowners to determine final completion criteria.
Monitoring	• Investigate, monitor if necessary, and report on justifiable complaints (e.g. erosion, dust,)	
Deliverables/Compliance Criteria		
• Contact name for community liaison.	• All justifiable complaints will have been investigated, recorded and remedial measures taken where economically feasible • See also Appendix B, Section 4.0	
Corrective Action		
• Nominate staff member to conduct consultation.	• Take required action to ameliorate the complaint or comply with the relevant legislation.	

5.9 NOISE

Policy: To comply with the Noise Abatement (Neighbourhood Annoyance) Regulations 1979.
To maintain noise levels at levels acceptable to landholders at the boundary of adjacent sensitive areas.
To comply with the *Occupational Health, Safety and Welfare Act 1984* requirements.

Before construction	During construction and operation	Decommission
Tasks		
• Design plant building with suitable insulation barriers. • Fit all equipment with best current practice noise control and attenuation devices.	• Insulate plant building in accordance with the design criteria. • Limit noisy work to 0700 to 1900 (Mon-Fri) wherever possible. • Conduct work in accordance with current best practice for reducing noise. • Supply all personnel working in noisy areas with appropriate protective equipment.	
Monitoring		
• Inspect equipment on site for excessive noise.	• Annual monitoring of plant noise levels and noise levels at the nearest sensitive locations to determine compliance with the performance criteria. • Annual monitoring of noise levels within 1 m of noisy equipment to determine compliance with the *Occupational Health, Safety and Welfare Act 1984* requirements.	
Deliverables/Compliance Criteria		
• Plant and equipment designed to operate within best management practice for noise emissions.	• Noise emissions will be controlled such that noise levels (resulting from the project) at the nearest noise-sensitive location (Hampton Hill Station) will not exceed 40 dB(A) during Monday to Friday between 0700 hours and 1900 hours, 35 dB(A) during Monday to Friday between 1900 hours and 2200 hours and on weekends and public holidays between 0700 hours and 2200 hours, and 30 dB(a) always between 2200 hours and 0700 hours as per the Noise Abatement (Neighbourhood Annoyance) Regulations 1979. • The maximum noise level at a distance of 1 m from any item of equipment will not exceed the requirements of the *Occupational Health, Safety and Welfare Act 1984.* • See also Appendix B, Section 4.0.	
Corrective Action	• Determine source of excessive noise and apply appropriate control measures / alter activities schedule as necessary. • Repair/upgrade machinery to ensure noise compliance. • Use silencers where necessary.	

Appendix 5

Analysis of leach residue liquor

Quantity and characteristics of leach residue liquor

Hydrochemical characteristic	Leach residue liquor to dam
Volume (kL^3/d)	6,750
pH	7.4
Sodium	36,900
Magnesium	13,110
Calcium	3,880
Chloride	81,430
Sulphate	48,360
Iron	<1
Manganese	35
Nickel	11.8
Chromium	<1
Cobalt	<1
Copper	<0.1
Cadmium	<0.01
Lead	<0.02
Arsenic	<0.1
Aluminium	<1
Zinc	<0.1
Ammonium sulphate	11,380
Kerosene	–

Note: Unit of measurement is in mg/L, except pH (dimensionless) and volume.