COOLJARLOO MINERAL SANDS PROJECT

TiO_2 CORPORATION NL

Report and Recommendations
of the
Environmental Protection Authority

Environmental Protection Authority
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i SUMMARY AND RECOMMENDATIONS

TiO_2 Corporation NL has submitted a proposal to establish a heavy mineral sand mining and processing operation. The proposed minesite is located at Cooljarloo near Cataby, approximately 170 km north of Perth. Initial processing at the minesite would produce a heavy mineral concentrate which is proposed to be transported by road to a dry processing plant at Muchea 40 km north of Perth.

Mining of the deposits would be carried out using a single stage suction dredge to mine the upper level strands. A second dredge would then be required to strip overburden covering the deeper deposits. This would allow for each area to be mined out in one pass, so that temporary stabilisation and rehabilitation of these areas would not be required. The mining dredge would pump the ore directly to a wet concentrator plant which would float directly behind the dredge in the dredge pond.

As the dredge proceeds along the mine path a sequence of tailings placement, slime deposition and drying and rehabilitation would be carried out progressively in the wake of the dredging operations.

Following mining and initial onsite concentration the produced heavy mineral concentrate would be trucked to the proposed dry process plant near Muchea.

At Muchea, the concentrate would be dried and then passed through a complex series of electrostatic, magnetic and gravity separation processes to separate the various heavy mineral component products.

The waste materials would be stockpiled to be returned to the Cooljarloo for burial in the mined out areas. Products would be transported by rail to Kwinana for export except for the monazite which would be railed to Fremantle in containers.

The proposed minesite area at Cooljarloo consists predominantly of low dune ridges with interdunal swales subject to seasonal waterlogging. The general features are typical of the Bassendean formation which covers much of the Swan Coastal Plain.

The vegetation of the proposed minesite area consists mainly of banksia, low woodland of various types with areas of wetland heath, mixed low heath, Xanthorroea reflexa low heath (on the Gingin Scarp), and restricted occurrences of Hakea obliqua scrub heath and Eucalyptus low woodland. The southern end of the proposed minesite area has been developed for agriculture and grazing and supports only remnants of the original vegetation. A total of 305 plant species were recorded from the site.

The proposed site for the dry processing plant is located near Muchea about 40 km north of Perth. This site is flat and apart from shade trees, has been cleared of natural vegetation for many years. This site is bounded to the east by Ellen Brook although it is not on the property. The general locality is low lying, is underlain by a shallow aquifer and is prone to waterlogging. However, the site itself is slightly elevated and remains dry during the winter.

In considering the Company's initial proposal the Environmental Protection Authority determined that the potential for environmental impact was such that the proposal would require assessment under Part IV of the Environmental Protection Act, 1986, and that the level of asssessment would

be Environmental Review and Management Programme (ERMP) with a public review period of 10 weeks.

The major environmental issues considered during the assessment of this proposal were generally related to:

- dieback occurrences caused by several species of Phytophthora;
- impacts of mining operations on native flora and fauna and associated conservation values;
- rehabilitation;
- impacts of the proposal on existing and proposed conservation areas;
- hydrological impacts at the mine and processing plant sites as a result of the proposal; and
- a number of other general issues related to mining proposals as well as possible impacts of the proposed dry processing plant at Muchea.

In its assessment of the proposal the Authority carefully considered these potential impacts with respect to long and short term effects and final stability at the proposed minesite as well as impacts of proposed dry processing operations on residents and land uses in the Muchea area.

One of the major environmental concerns that was brought to light during the review of this proposal was the potential for the proposed mining operations to spread infections of dieback disease that are known to occur in the area.

A number of Phytophthora species have been recorded in the vicinity of the proposed minesite. These Phytophthorae are capable of causing serious damage to the banksia woodlands and scrub heath associations that dominate the tenement area.

Although the issue of dieback was not addressed in the ERMP for this project the Company has since acknowledged that there may be potential for proposed mining operations to contribute to the spread of Phytophthora pathogens and has further proposed to adopt necessary management programmes. This includes undertaking a survey of the tenement area to identify areas of infection.

In considering this issue the Authority believes that there must be a strong commitment by the Company to develop and implement such management proposals. A recommendation has been made to ensure that this is adequately addressed prior to commencement of mining operations on any area infected by Phytophthora pathogens.

This report addresses the various environmental issues raised during the assessment of the proposal and a number of other recommendations have also been made to ensure that adequate environmental management programmes are adopted for the project as a whole.

Upon consideration of the Environmental Review and Management Programme that was submitted for the project the Environmental Protection Authority has concluded that the proposal would be environmentally acceptable subject to the following recommendations:

RECOMMENDATION 1

The Environmental Protection Authority concludes that the proposal described in the Environmental Review and Management Programme is environmentally acceptable and recommends that it could proceed subject to the Environmental Protection Authority's recommendations in this Assessment Report and the commitments made by the proponent for environmental management including:

. implementing rehabilitation and monitoring programmes based on results obtained from pre-mining research;

. establish long-term monitoring studies to assess revegetation and recolonisation by fauna;

. strict adherence to all Western Australian regulations and Commonwealth Code of Practice relating to radiation;

. a number of commitments relating to the prevention of dieback spread;

. monitoring of groundwater levels in the vicinity of the minesite as well as the dry processing plant at Muchea; and

. adopt specific dust control measures at the Muchea dry processing plantsite.

RECOMMENDATION 2

The Environmental Protection Authority recommends that, prior to any decision being made to mine, detailed dieback research be undertaken in proposed mining areas to identify any occurences of Phytophthora spp within these areas.

RECOMMENDATION 3

The Environmental Protection Authority recommends that mining and related activities be restricted to areas that are proven to be uninfected by Phytophthora pathogens as a result of the research required in recommendation 2 until detailed dieback isolation and treatment programmes are developed and demonstrated to be effective to the satisfaction of the Environmental Protection Authority after advice from the Department of Conservation and Land Management.

RECOMMENDATION 4

The Environmental Protection Authority recommends that the proponent funds research programmes with the objectives of developing:

(a) an understanding of the epidemiology of Phytophthora spp pathogens on northern sandplain vegetation types, and effective disease management and control strategies; and

(b) cost-efficient methods of sterilization treatment of localized disease infections in the field and in industrial process water bodies where appropriate.

The results of the research programmes should be forwarded to the Environmental Protection Authority and the Department of Conservation and Land Management.

RECOMMENDATION 5

The Environmental Protection Authority recommends that the proponent submits brief annual reports to the satisfaction of the Department of Mines describing rehabilitation programmes and summarising monitoring results for rehabilitated areas.

RECOMMENDATION 6

The Environmental Protection Authority recommends that no productive mining activities are carried out in the area subject to the Environmental Protection Authority's 'Red Book' Recommendations for Badgingarra National Park (5.22) until:

(i) a review of the recommendations for this area has been carried out by the task force established for this purpose in accordance with Government initiatives relating to mining in national parks and nature conservation reserves;

(ii) implementation of the resulting recommendation has been fully approved by Government; and

(iii) access has been approved through either the revised recommendation or procedures outlined in the Government's policy for mining in national parks and nature conservation reserves.

RECOMMENDATION 7

The Environmental Protection Authority recommends that any proposal to modify the proposed dry separation process requiring the addition of chemical reagents or altering the chemical composition of the product compounds would be required to be referred to the Environmental Protection Authority for assessment prior to that process being adopted.

RECOMMENDATION 8

The Environmental Protection Authority recommends that a ground and surface water monitoring programme be developed and implemented to the satisfaction of the Water Authority of Western Australia, including regular reporting of monitoring results.

RECOMMENDATION 9

The Environmental Protection Authority recommends that an environmental management programme be prepared and implemented relating to all aspects of environmental monitoring and management requirements for mining and processing operations described in the ERMP, to the satisfaction of the Environmental Protection Authority, prior to the commencement of productive mining and processing activities.

RECOMMENDATION 10

The Environmental Protection Authority recommends that the proponent submits brief annual and comprehensive triennial reports to the Environmental Protection Authority discussing various aspects of the environmental management and monitoring of the project as detailed in the environmental management programme.

RECOMMENDATION 11

The Environmental Protection Authority recommends that any proposal to extend the mining and/or processing facilities described in the ERMP would require referral to the Environmental Protection Authority for assessment, prior to any commitments being made to develop such proposals.

1. BACKGROUND

TiO_2 Corporation NL has submitted a proposal to establish a heavy mineral sand mining and processing operation. The proposed minesite is located at Cooljarloo near Cataby, approximately 170 km north of Perth. Initial processing at the minesite would produce a heavy mineral concentrate which is proposed to be transported by road to a dry processing plant at Muchea 40 km north of Perth.

In considering initial proposals the Environmental Protection Authority determined that the proposal would require assessment under Part IV of the Environmental Protection Act 1986 and that an Environmental Review and Management Programme would be necessary to assess the environmental impacts of the proposal.

2. PROJECT DESCRIPTION

The Cooljarloo proposed minesite is located approximately 6 km north of Cataby running northwards for a distance of approximately 18 km immediately west of the Brand Highway. The mining tenements cover an area of about 60 km^2 (Figure 1).

The Cooljarloo deposits contain proven and probable ore reserves of about 288 million tonnes with an average grade of 4.4% or approximately 13 million tonnes of heavy minerals.

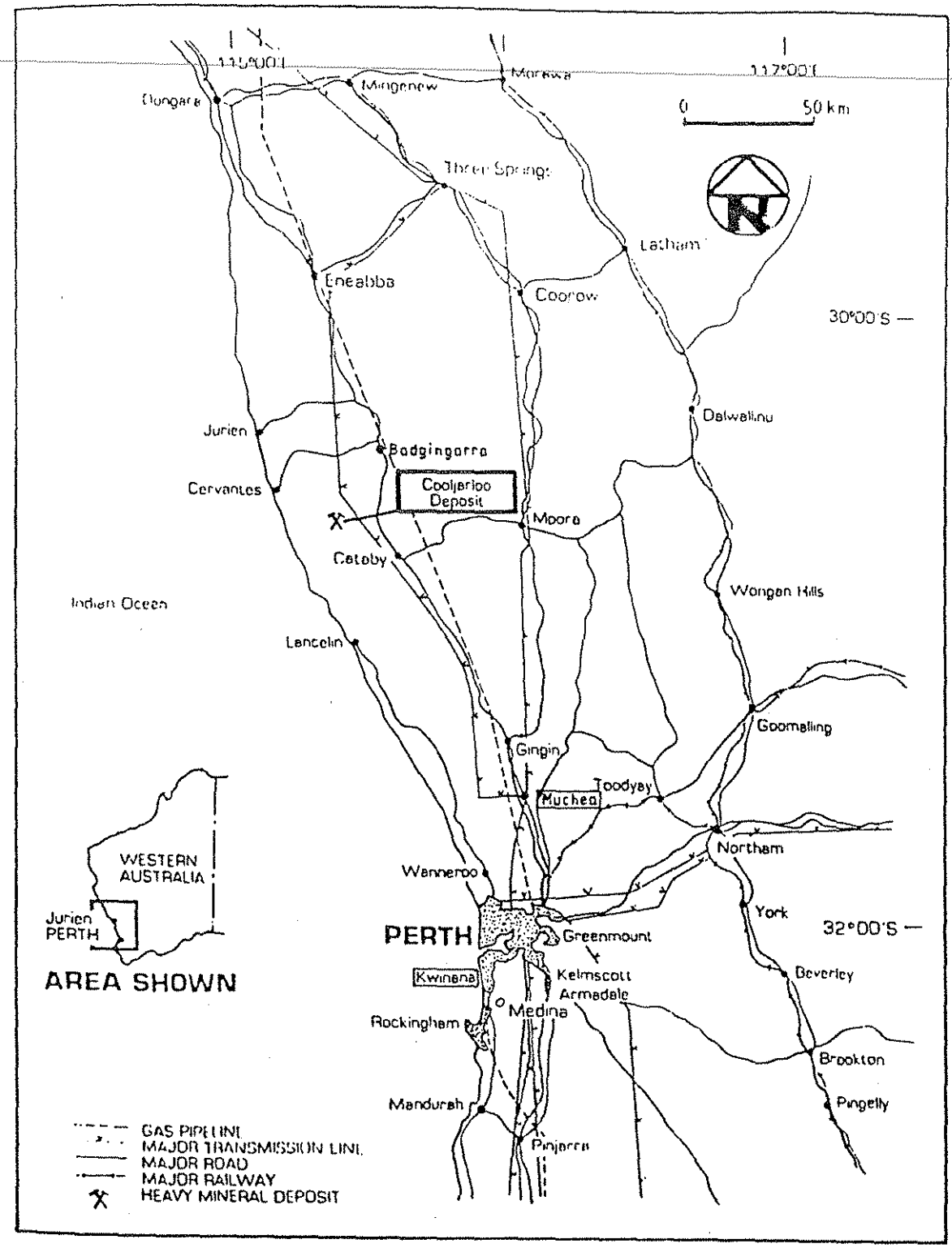
Mining of the deposits would be carried out using a single stage suction dredge to mine the upper level strands. A second dredge would then be required to strip overburden covering the deeper deposits. This would allow for each area to be mined out in one pass, so that temporary stabilisation and rehabilitation of these areas would not be required. The mining dredge would pump the ore directly to a wet concentrator plant which would float directly behind the dredge in the dredge pond.

The function of the wet process plant is to separate waste tailings and slimes in the ore from the heavy minerals and to produce a concentrate of the latter. This separation is achieved by a series of physical processes and especially gravity separation. Waste materials (eg quartz) in the ore have lower specific gravities than the heavy minerals and the two streams separate as they pass through a series of spiral concentrators. The waste would then be used to backfill the dredge pond while the wet concentrate would be stockpiled and solar dried awaiting transport to Muchea for further processing.

Mining and rehabilitation at Cooljarloo is proposed to be integrated and carried out in a progressive manner. As mining proceeds, tailings from the wet concentrator plant would be used to fill the rear of the dredge pond. A series of slimes receival ponds would then be constructed using sand tailings on the filled area and a new tailings disposal area would be established in the dredge pond.

Slimes would then be fed into the receival ponds to a depth of about 2 m. After approximately two months of drying, the pond walls would be levelled to cover the slimes with a 1 m layer of sand. The placement of slimes and sand would be varied to achieve planned contour variations. The sand would then be covered with topsoil up to a depth of 30 cm and rehabilitated.

Figure 1 Minesite Location Plan



LOCATION OF THE MINESITE (COOLJARLOO), PROCESS PLANT (MUCHEA) AND PORT (KWINANA)

As the dredge proceeds along the mine path this sequence of tailings placement, slime deposition and drying and rehabilitation would be carried out progressively in the wake of the dredging operations.

Following mining and initial onsite concentration the produced heavy mineral concentrate would be trucked to the proposed dry process plant near Muchea (Figure 2). At Muchea, the concentrate would be dried and then passed through a complex series of electrostatic, magnetic and gravity separation equipment. The various heavy mineral components of the concentrate has a unique combination of electrical and magnetic properties and specific gravities on which this process relies. Ilmenite and rutile are electrical conductors while ziron and monazite are non-conductors. Therefore, as the concentrate passes through an electrical field, the conductors and non-conductors separate and can be collected. As ilmenite is magnetic, it can be separated from the rutile by passing this stream through a magnetic field and a similar process can be used to separate magnetic monazite from non-magnetic zircon. Gravity separation is used to further refine some of the final product streams.

The waste materials would be stockpiled to be returned to the Cooljarloo for burial in the mined out areas. Products would be transported by rail to Kwinana for export except for the monazite which would be railed to Fremantle in containers.

3. EXISTING ENVIRONMENT

The proposed minesite area at Cooljarloo consists predominantly of low dune ridges with interdunal swales subject to seasonal waterlogging. The general features are typical of the Bassendean sand formation which covers most of the Swan Coastal Plain.

At the southern end, the tenements also include a small area of the Gingin Scarp which bounds the Bassendean Formation to the east. Mullering Brook and various unnamed small watercourses run off the scarp across or onto the tenements.

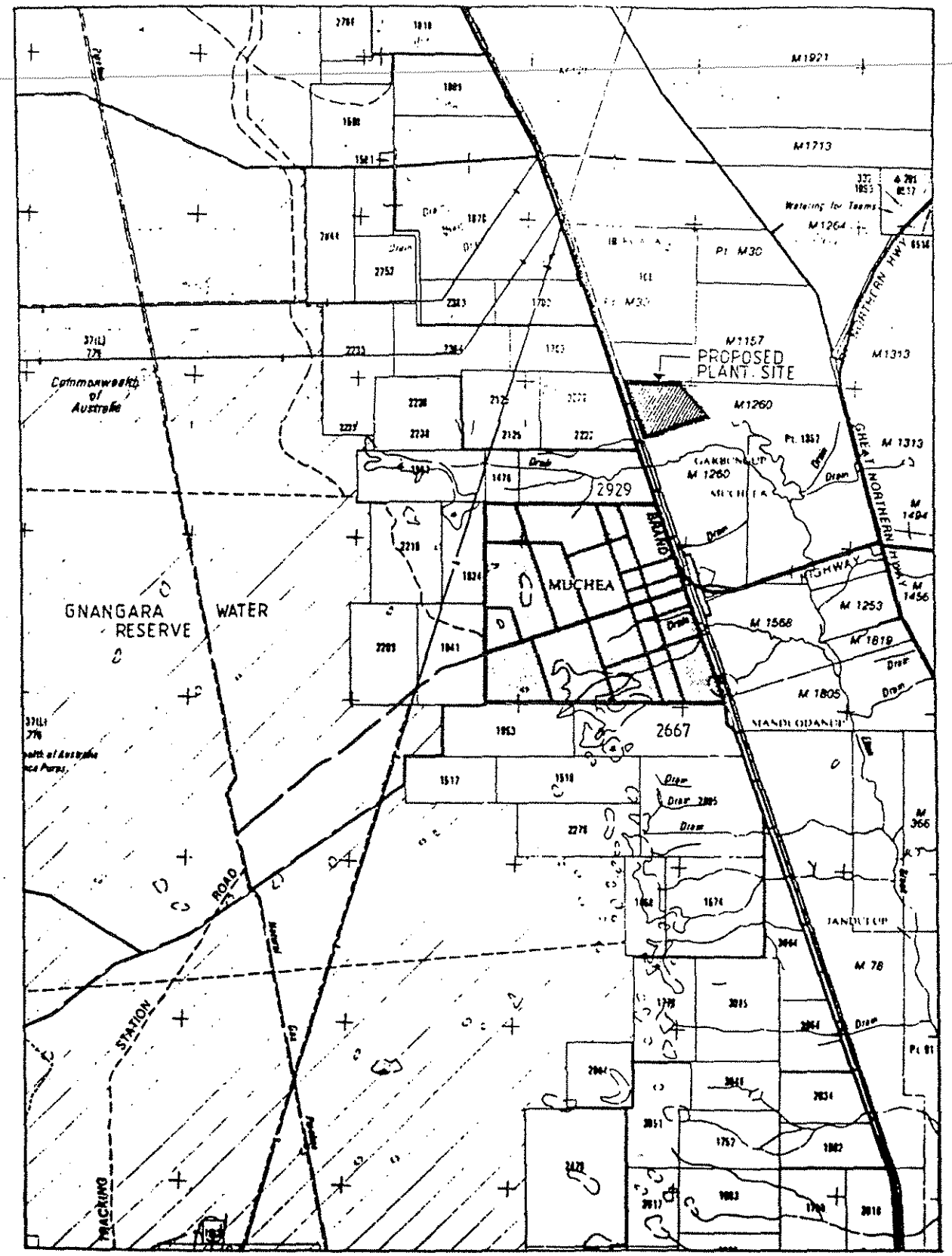
The site is underlain by a shallow aquifer which features relatively slow flow rates to the west and discontinuities caused by the presence of clay layers. The level of the groundwater appears to be determined mainly by winter rainfall and evapotranspiration losses rather than throughflow.

The vegetation of the proposed minesite area consists mainly of banksia low woodland of various types with areas of wetland heath, mixed low heath, Xanthorroea reflexa low heath (on the Gingin Scarp), and restricted occurrences of Hakea obliqua scrub heath and Eucalyptus low woodland. This area of native vegetation is considered to have a relatively high conservation value. The southern end of the proposed minesite area has been developed for agriculture and grazing and supports only remnants of the original vegetation. A total of 305 plant species were recorded from the site.

As reported in the Environmental Review and Management Programme that was prepared for the project, 6 frog, 13 reptile, 61 bird and 9 mammal species were recorded at Cooljarloo. None of these are listed as rare, restricted or endangered.

The climate at Cooljarloo features predominantly winter rainfall, high evaporation rates, and high and occasionally extreme temperatures in summer.

Figure 2 Dry Processing Plant Location Plan



Easterly winds occur in the morning throughout the year but the afternoon wind pattern is variable although south-westerlies feature in summer.

The Cooljarloo mining tenements are primarily located within an area of vacant Crown land as well as private agricultural properties. The Badgingarra National Park and two other conservation reserves are located near the proposed minesite and a proposed extension to the Badgingarra National Park overlaps part of the tenements (Figure 3).

The proposed site for the dry processing plant is located near Muchea about 40 km north of Perth. This site is flat and apart from shade trees, has been cleared of natural vegetation for many years. This site is bounded to the east by Ellen Brook although it is not on the property. The general locality is low lying, is underlain by a shallow aquifer and is prone to waterlogging. However, the site itself is slightly elevated and remains dry during the winter.

The general climate in the proposed plant site area is similar to that of Perth, with predominantly winter rainfall, relatively high evaporation, and warm to hot dry summers. Easterlies dominate the summer wind patterns with frequent south-westerly sea breezes in the late afternoon, while northerlies dominate in winter.

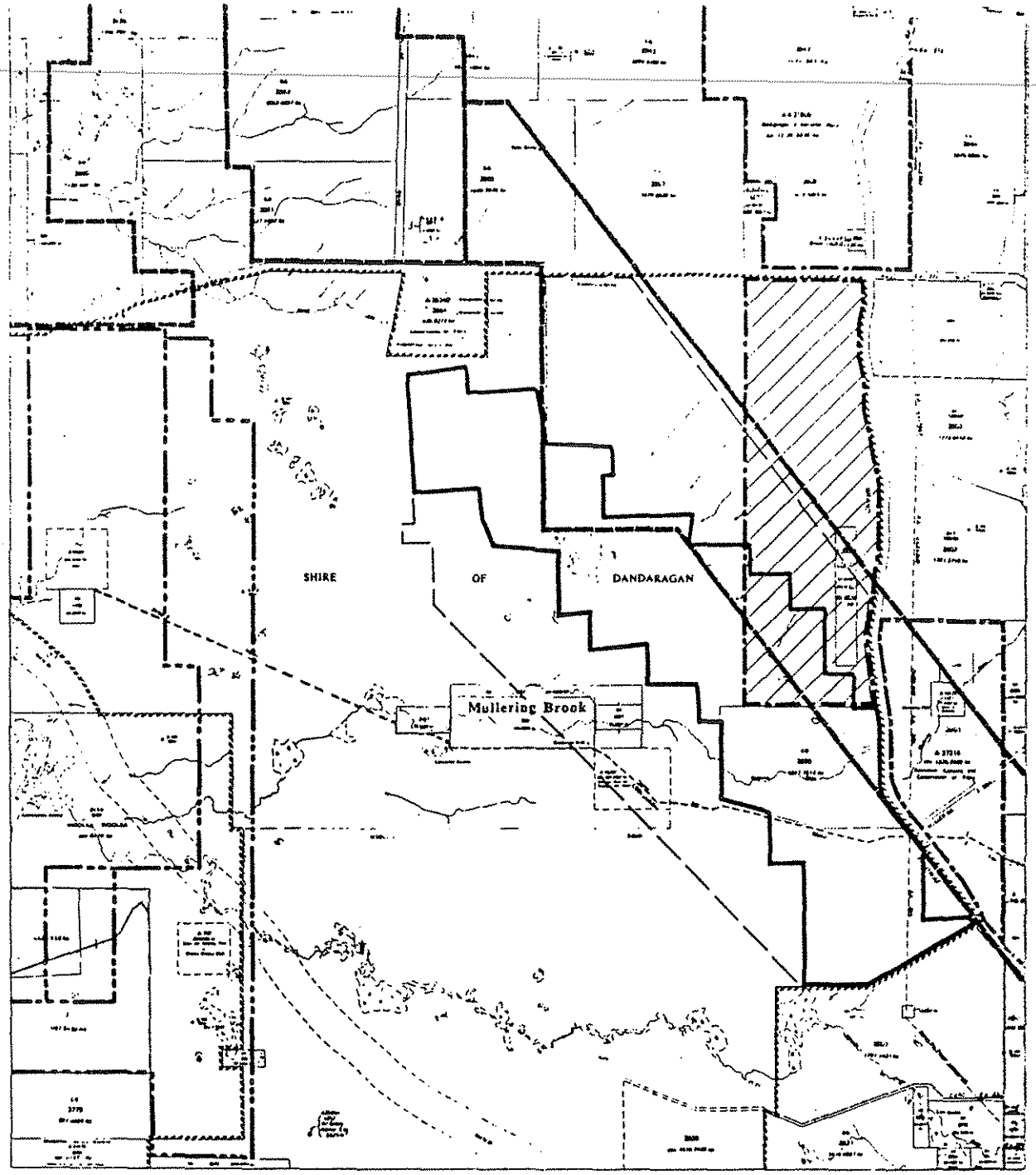
4. PUBLIC AND GOVERNMENT SUBMISSIONS

Seventeen public submissions and eleven responses from State and Commonwealth Government agencies were received during the public review period. A summary of the respondents and issues raised are provided in Tables 1 and 2.

Table 1. Summary of Submissions

ISSUE	NO OF SUBMISSIONS
Dieback (Phytophthora species)	15
Minesite Rehabilitation	15
Impacts of Mining Operations on Native flora and fauna and Associated Conservation Values	11
Radiation Hazards	10
Hydrological Impacts of Processing Plant at Muchea	8
Processing Plant Water Balance, Site Drainage and Potential for Contamination of Surface and Ground Waters	6
Hydrological Impacts of Mining Activities at Cooljarloo	6
Dust and Noise at Muchea	6
Encroachment of Proposed Mining Activities on an Area of Proposed Class "C" Extension to the Badgingarra National Park (EPA 'Red Book' Recommendation 5.22)	5
Impacts on Beekeeping	6
Fire Management	5
Aesthetic Impact of Processing Plant at Muchea	4
Monitoring Programmes and Reporting	3
Gaseous Emissions from Plant Site	3
Transportation	6
Alternate Site Selection for Processing Plant	4
Expansion Proposals - Muchea	3
Zoning - Processing Plant - Muchea	1
Workforce Accommodation at Cataby	1

Figure 3 Current and Potential Land Use in the Cooljarloo Area



0 1 2 3km

LEGEND

- TiO2 Tenement Area
- Exploration Permit Application - TiO2 Corporation NL
- Exploration Permit - Western Mining Corporation
- Exploration Permit Application - Western Titanium/Renison Ltd.
- Badgingarra National Park
- Proposed Extension to Badgingarra National Park
- Proposed Defence Area (Application Withdrawn)

Table 2. Submissions Received

LIST OF RESPONDENTS
State Energy Commission
Western Australian Museum
Health Department of Western Australia
Main Roads Department
CSIRO
Department of Conservation and Land Management
Department of Mines
Western Australian Department of Agriculture
Water Authority of Western Australia
State Planning Commission
Bush Fires Board
Shire of Dandaragan
S G Cook
W & C M Cook
R Ford
D Boase-Jelinek
A Richardson
R D Jones
Mineral Sands Submission Committee - Muchea Progress Association
A Blanchard
R Pollard
Conservation Council of Western Australia
R M Rann
E A Griffin and Associates
Western Flora
West Australian Wildflower Society
M A Barton
Australian Conservation Foundation

The predominant concerns raised in the submissions were mainly with regard to spread of dieback through mining operations, impacts of operations on native flora and fauna and associated conservation values, hydrological impacts at both the mine and proposed plant sites and impacts on the Muchea residential community associated with the proposed dry processing plant. A wide range of other issues were also raised in submissions as detailed in the review of submissions included in Appendix 1 of this report. The Company has subsequently addressed the issues raised by the public and government agencies in their submissions and by the Environmental Protection Authority. TiO_2 Corporation's response is in Appendix 2 of this report.

5. ENVIRONMENTAL ISSUES

In considering the Company's initial proposal the Environmental Protection Authority determined that the potential for environmental impact was such that the proposal would require assessment under Part IV of the Environmental Protection Act, 1986, and that the level of assessment would be Environmental Review and Management Programme (ERMP).

An Environmental Review and Management Programme was submitted for the proposal and has undergone a ten week public review period, which finished on 29 January 1988.

Following a review of the environmental aspects of the proposal, in light of public and government agencies' submissions, the Environmental Protection Authority concludes that the proposal would be environmentally acceptable, subject to a number of conditions as discussed in the following sections of this report.

RECOMMENDATION 1

The Environmental Protection Authority concludes that the proposal described in the Environmental Review and Management Programme is environmentally acceptable and recommends that it could proceed subject to the Environmental Protection Authority's recommendations in this Assessment Report and the commitments made by the proponent for environmental management including:

- **implementing rehabilitation and monitoring programmes based on results obtained from pre-mining research;**
- **establish long-term monitoring studies to assess revegetation and recolonisation by fauna;**
- **strict adherence to all Western Australian regulations and Commonwealth Code of Practice relating to radiation;**
- **a number of commitments relating to the prevention of dieback spread;**
- **monitoring of groundwater levels in the vicinity of the minesite as well as the dry processing plant at Muchea; and**
- **adopt specific dust control measures at the Muchea dry processing plantsite.**

5.1 DIEBACK (PHYTOPHTHORA SPECIES)

One of the major environmental concerns that was brought to light during the review of this proposal was the potential for the proposed mining operations to spread infections of dieback disease that are known to occur in the area.

Dieback disease occurs as a fungal pathogen known as Phytophthora, present in soils that attacks the root systems of selective plant species eventually killing the less tolerant of these species. Dieback is known to occur widely throughout the south-west of Western Australia where special management programmes have been adopted to control the spread of the disease.

A number of Phytophthora species have been isolated from dying native vegetation between Moore River and Jurien Bay.

While Phytophthora cinnamomi, which is commonly associated with dieback of jarrah in the Northern Jarrah Forest region has not been recovered north of the Moore River, it has infected banksia woodland on the east side of the Moore River National Park.

A number of other Phytophthora species have been recorded in the vicinity of the proposed minesite. These Phytophthorae are capable of causing serious damage to the banksia woodlands and scrub heath associations that dominate the tenement area.

Factors that increase the risk of infection are generally, number of susceptible hosts, presence of free water and soil type and activities which disturb the soil.

Many susceptible species are known to occur in the banksia woodland and scrub heath vegetation particularly those belonging to the Proteaceae, Epacridaceae and Myrtaceae families.

Surface water greatly increases the likelihood of the introduction and dispersal of the fungus. The proposed Cooljarloo minesite overlies a perched watertable and contains soils with low hydraulic conductivities. As a result, the minesite would be prone to flooding and roadside ponding not only in winter, but also in summer when cyclonic depressions can affect the area.

The Bassendean dune system is the predominant feature at the proposed minesite. Its heavily leached soil profile supports only a limited microflora and so competition with the fungus is reduced. Plants growing on this soil type also appear to be more susceptible to invasion by Phytophthora pathogens.

The proposed dredge mining operations would take place within a large, eight metre deep pond. The Company proposes in its ERMP to minimise clearing adjacent to the dredge pond so that remnant root systems can stabilise the side walls of the pond. If the pond becomes contaminated, then these root systems may become sporulation sites for the fungus. This would be assisted by continual exposure of newly damaged roots at the front of the trench, the mixing and aeration of the pond by the dredging process and by the warmth of the pond in summer. The pond, if infected could therefore become a source of infection.

There is also some concern that rehabilitation of the minesite may be jeopardised by the introduction of infected nursery stock.

The Company has stated in its response to submissions that it would establish a disease free nursery, using local sources of seed, near Cooljarloo to provide plants for rehabilitation.

Although the issue of dieback was not addressed in the ERMP for this project the Company has since acknowledged that there may be potential for proposed mining operations to contribute to the spread of Phytophthora pathogens and has further proposed to adopt necessary management programmes. This includes undertaking a survey of the tenement area to identify areas of infection.

An initial strategy to develop a plan for control and prevention of dieback in the tenement areas has been submitted by the Company (Appendix 4). This includes a survey of the tenement area to establish the present distribution of Phytophthora species in and around the proposed minesite. The study also is aimed towards obtaining more information on the impact of the various species of fungi on native vegetation so that the magnitude of the potential problem may be assessed.

As a result of these studies it is proposed to develop a management plan to control the spread of fungi within the minesite if they are already present, or to prevent their entry if they are not already present.

A number of other control and prevention measures are proposed in the initial management plan such as:

. quarantine, to prevent the fungi from being introduced in presently uninfected areas;

. education of workforce and contractors;

. machinery hygiene;

. controlled access routes;

. ongoing research programmes; and

. assessment of dieback resistant native species that may be suitable in rehabilitation programmes.

Routine monitoring of industrial waters for dieback infection is proposed to be carried out and a contingency plan developed in association with the Department of Conservation and Land Management for preventing the spread of dieback if infection of these waters is identified.

Vehicle access to the Cooljarloo minesite area would be controlled by the Company and adequate hygiene measures adopted, including washdown of equipment moving in and out of infected areas. There is some concern that non-company vehicle access to and from the minesite area may also have the potential to spread dieback. This could be largely overcome by closing down alternative access tracks to the tenement area.

Material sources, especially sand and gravel sources, would be checked for dieback infection prior to any cartage to the Cooljarloo site.

The Company's initial Dieback Control and Prevention proposal has been reviewed by the Department of Conservation and Land Management (CALM).

In its advice to the Environmental Protection Authority, CALM has commented on a number of points in the proposal with regard to quarantine, research, transport and road systems and contingency planning.

The road closures suggested in the Company's report as well as placement of road signs are supported by CALM. This would need to be undertaken with CALM's assistance, in consultation with the local government authority in relation to gazetted roads.

The provision of a single access to the site from the Brand Highway, and installation there, of a clean-down facility is also supported.

With respect to importation of aggregate materials on to the site it was pointed out that it would be difficult to directly check sand and gravel for Phytophthora contamination, with any confidence. These resource materials should be obtained from areas which on the basis of the condition of associated vegetation, are as far as can be determined, disease free.

It was also advised that no reliance should be placed on sterilization with chemicals as a means to remove even localized infections in field situations.

A colour code system would also need to be adopted to designate between areas of dieback and disease free areas similar to current practices used on land managed by CALM.

CALM also believe it would be desirable for the Company to fund a research programme with the objectives of developing:

(a) an understanding of the epidemiology of Phytophthora spp plant pathogens on northern sand plain vegetation types, and effective disease management and control strategies; and

(b) cost-efficient methods for sterilization treatment of localized disease infections in the field and in industrial process water bodies where appropriate.

A time frame should also be set for the development of the detailed mining plan. Ideally, the plan defining mine access, infrastructure, and proposed hygiene measures to manage known fungal pathogens should be presented now, so that its acceptability can be considered as part of the overall assessment of the proposed mining project. However, since this is impracticable, at least until the survey of Phytophthora spp distribution on the minesite and environs has been completed, as a recommendation would need to be made not to allow mining to commence until such a time as this plan is submitted.

RECOMMENDATION 2

The Environmental Protection Authority recommends that, prior to any decision being made to mine, detailed dieback research be undertaken in proposed mining areas to identify any occurences of Phytophthora spp within these areas.

RECOMMENDATION 3

The Environmental Protection Authority recommends that mining and related activities be restricted to areas that are proven to be uninfected by Phytophthora pathogens as a result of the research required in recommendation 2 until detailed dieback isolation and treatment programmes are developed and demonstrated to be effective to the satisfaction of the Environmental Protection Authority after advice from the Department of Conservation and Land Management.

RECOMMENDATION 4

The Environmental Protection Authority recommends that the proponent funds research programmes with the objectives of developing:

(a) an understanding of the epidemiology of Phytophthora spp pathogens on northern sandplain vegetation types, and effective disease management and control strategies; and

(b) cost-efficient methods of sterilization treatment of localized disease infections in the field and in industrial process water bodies where appropriate.

The results of the research programmes should be forwarded to the Environmental Protection Authority and the Department of Conservation and Land Management.

5.2 IMPACTS OF MINING OPERATIONS ON NATIVE FLORA AND FAUNA AND ASSOCIATED CONSERVATION VALUES

As a large proportion of the proposed minesite area is located over an area of vacant Crown land which is predominantly covered in native vegetation, the issue of impacts on the native flora and fauna associations needed to be addressed in the assessment of the proposal.

As discussed in Section 3 of this Report on the Existing Environment the area consists mainly of banksia low woodland of various types with areas of wetland heath and mixed low heath of relatively high conservation value.

The Wongonderrah Springs Nature Reserve is adjacent to the northern boundary of the tenements and the Mullering Brook Reserve is adjacent to the south-eastern sector on the other side of the Brand Highway.

The southern boundary of the Badgingarra National Park is also nearby to the north-east on the northern side of Wongonderrah Road. A proposal to extend the boundary of the National Park southwards was recommended by the Environmental Protection Authority in 1976 (EPA 'Red Book' Recommendation 5.22.1). This was designed primarily to increase the representation of local flora and to connect the Mullering Brook Reserve with the National Park. The issue of the mining tenements overlapping a part of this proposed extension is further discussed in Section 5.4 of this Report.

Although most of the tenement area does not have any formal reserve status, the area is recognised for its conservation values, due to the high diversity of plant species found in the area. In all a total of 305 plant species have been recorded from the Cooljarloo tenements including at least one gazetted rare species; Angiozanthus viridis s.sp. terraspectans.

Several flora and fauna surveys have been carried out over the area of vacant Crown land as referenced in the Company's response to issues raised in submissions (Appendix 2).

The Company has made a commitment to undertake more detailed vegetation surveys and mapping of the orebody including vegetation boundaries and densities as well as obtaining information on the presence of any unusual species, in advance of mining.

Following initial vegetation surveys it was reported in the ERMP that the vegetation associations which would be disturbed by mining are locally extensive and well represented in existing nearby Nature Reserves and the Badgingarra National Park. Additional representative areas could also be reserved following a review of the area's existing and proposed conservation reserve boundaries.

5.3 REHABILITATION

The general objectives of a minesite rehabilitation programme as proposed in the ERMP were:

- the duplication as near as possible of the original native vegetation associations;

- the creation of a functional pasture where pasture existed before mining; and

. the possible modification of some rehabilitated wetland heath areas so as to include permanent bodies of water suitable for waterbirds.

Approximately 80% of the total area proposed to be mined over the full term of the project would be rehabilitated to native vegetation. Within such areas, further rehabilitation objectives were stated to be:

. filling and contouring the mined areas to similar topography and soil conditions to those which existed in the natural state prior to mining;

. ensuring the establishment of the pre-mining drainage system after completion of mining;

. stabilising all new land surfaces against water and wind erosion using both physical and biological methods;

. establishing an indigenous native plant succession designed to produce an ecosystem as close as possible to that which existed under pre-mining conditions; and

. reducing all roads and tracks to a minimum required for ongoing rehabilitation work and monitoring programmes.

In its assessment of these proposals and consideration of concerns raised in submissions on the ERMP the Authority recognised that although the stated objectives are desirable, there may be some difficulty in re-establishing native vegetation associations to duplicate the pre-mining structures. However, it was considered that although the area has relatively high conservation values, these values are adequately represented in existing and proposed conservation reserves.

It is therefore considered desirable that rehabilitation programmes are designed to re-establish native vegetation communities over mined areas, as near as possible to pre-existing vegetation types, but not essential that the rehabilitated areas are exactly as they were prior to mining.

RECOMMENDATION 5

The Environmental Protection Authority recommends that the proponent submits brief annual reports to the satisfaction of the Department of Mines describing rehabilitation programmes and summarising monitoring results for rehabilitated areas.

It is also considered important that effects of dieback on rehabilitation is monitored and appropriate measures adopted to control any infections that may occur.

5.4 ENCROACHMENT OF PROPOSED MINING ACTIVITIES ON AN AREA OF PROPOSED CLASS "C" EXTENSION OF BADGINGARRA NATIONAL PARK (EPA 'RED BOOK' RECOMMENDATION 5.22)

The mining tenements for the proposed minesite at Cooljarloo impinge on an area subject to EPA 'Red Book' recommendations for Badgingarra National Park (5.22.1).

This recommendation initially provided for an area of vacant Crown land to be included in Class "A" reserve 31809. Following discussions with the Department of Mines, with respect to the area's mineral potential, only a

small section of this area has been included in the National Park. However, it was also agreed that the remaining area of vacant Crown land subject to this recommendation be set aside as Class "C" reserve for the purpose of "National Park" and vested in the National Parks and Nature Conservation Authority. The intention was to provide a degree of protection and management for the area whilst allowing conditional access for mineral exploration. No progress has been made towards implementing this recommendation.

As a result of recent Government initiatives towards adopting a policy for exploration and mining in National Parks and Nature Reserves it has been proposed that a task force be established to accelerate the implementation of and review the outstanding EPA 'Red Book' recommendations. Such a review would need to consider boundaries of recommendation areas with the objective of determining ecologically sensible and manageable boundaries while maintaining the values and area of the proposed reserve system. Prospectivity of these areas would also need to be taken into account and highly prospective areas avoided wherever this can be accomplished without compromising conservation objectives.

This issue was addressed by the Company in its ERMP where studies were undertaken to assess the relative conservation values of the recommendation area affected by the proposal. The objective of these studies were to ensure that conservation values which may be lost through mining are adequately represented and preserved outside of the area to be mined.

In considering this issue the Authority believes that the proposed Government mechanism for implementing and reviewing 'Red Book' recommendations is the prooper means of addressing this issue.

RECOMMENDATION 6

The Environmental Protection Authority recommends that no productive mining activities are carried out in the area subject to the Environmental Protection Authority's 'Red Book' Recommendations for Badgingarra National Park (5.22) until:

(i) a review of the recommendations for this area has been carried out by the task force established for this purpose in accordance with Government initiatives relating to mining in national parks and nature conservation reserves;

(ii) implementation of the resulting recommendation has been fully approved by Government; and

(iii) access has been approved through either the revised recommendation or procedures outlined in the Government's policy for mining in national parks and nature conservation reserves.

5.5 HYDROLOGICAL IMPACTS OF MINING ACTIVITIES AT COOLJARLOO

Hydrological impacts of the proposed dredge mining at Cooljarloo were considered in the assessment of this proposal.

As described in Section 2 of this report mining of the deposits would be carried out using a suction dredge coupled to a floating wet concentration plant. The dredging and plant facilities would be situated in a dredge pond that would move progressively along the deposit. Course sand tailings and

slimes (fine clay fraction) would be sequentially deposited in mined out areas in the wake of the dredge.

Hydrological changes to the groundwater regime would be likely to occur as a result of increased water levels through maintenance of the dredge pond and changes in the clay/sand content throughout the soil profile as a result of tailings discharge practices.

Some concern was expressed in submissions on the proposal that such hydrological changes may effect vegetation adjacent to the mining areas as well as rehabilitation.

In addressing likely hydrological impacts in its response to submissions the Company has made a number of commitments to monitor these impacts and modify operating practices accordingly to ameliorate undesirable effects.

5.6 GENERAL MINESITE ENVIRONMENTAL ISSUES

A number of general issues related to the proposed minesite and mining activities were also considered during the assessment of the proposal.

Beekeeping is an important landuse within the mining tenements and is reliant on the floral characteristics of the native vegetation. Some concern was expressed regarding the destruction of large areas of vegetation through mining as well as further losses of vegetation through spread of dieback.

This issue has been addressed by the Company in its response to submissions and the Company has undertaken to ensure that access to beekeeping sites is maintained as far as possible and to liaise with the beekeepers involved. It is also proposed that in order to control spread of dieback infection, all vehicles entering the tenements area including those of beekeepers and Government departments would need to use the Company's washdown facilities.

Proposed minesite rehabilitation to re-establish native vegetation should restore honey production potential after mining.

Fire management at the proposed minesite was also considered in the assessment of the proposal. The Authority notes that a commitment has been made by the Company to develop in consultation with the Department of Conservation and Land Management and the Central West Coast Fire Protection Committee, a comprehensive fire management plan for the Cooljarloo tenements. This would have the objectives of providing protection to rehabilitation and of encouraging ecological diversity and vigour. A fully equipped fire truck and trained personnel would be maintained on site for the purpose of fire supression.

5.7 TRANSPORTATION OF MATERIALS

Environmental issues related to transport of materials between the Cooljarloo minesite and the proposed dry processing plant at Muchea were considered in the assessment of the proposal with respect to the following:

- increased accident risks as a result of increased heavy vehicle usage of the Brand Highway;
- dust and noise problems related to transportation of mined and processed material, and
- transport of radioactive monazite product and petroleum fuel.

It has been determined that there would be a 50% increase in heavy vehicle traffic on this section of the Brand Highway as a result of the proposal. It is, therefore, important that particular attention needs to be given to entry and exit points where accidents would be most likely to occur. The Authority notes that design and construction of these points would need to be to a standard approved by the Main Roads Department.

Some concern was expressed over impacts on residents particularly in the Muchea area, from dust and noise as a result of transport of mined and processed materials. The entrance to the proposed dry processing plantsite has been relocated to a point further north of the site to allow more room for stockpiling of materials. Although there will be some increase in truck movements north of the Muchea townsite it is not envisaged that there would be a significant increase in noise and dust nuisances from these transport operations. However, in the event that noise or dust from the operations becomes a problem, the provisions of Part V of the Environmental Protection Act, 1986 for the control of pollution would apply.

Monazite is one of the products that would be produced at the proposed dry processing plant. As this product has a low specific radiation level special transport requirements would apply. Likewise transport of petroleum fuel would need to be in accordance with the Flammable Liquids Regulations and Dangerous Goods (Road Transport) Regulations which are administered by the Department of Mines.

5.8 HYDROLOGICAL IMPACTS OF PROCESSING FACILITIES AT MUCHEA, PROCESSING PLANT WATER BALANCE, SITE DRAINAGE AND POTENTIAL FOR CONTAMINATION OF SURFACE AND GROUND WATERS

Issues relating to management of water and pollution control at the proposed dry processing plant at Muchea were considered by the Authority in its assessment of the proposal.

These issues were generally related to the following aspects:

- drawdown of the water table through abstraction of water from bores for the processing plant;
- design and operation of plant site drainage and evaporation ponds to ensure that contaminated water does not flow indirectly into adjacent watercourses such as Ellen Brook;
- monitoring of surface and groundwaters for contamination;
- potential contamination of domestic water supplies obtained from roof catchments and held in rainwater tanks from airborne emissions; and
- impacts on flora and fauna (particularly wetlands) through contaminated water from the plantsite.

Water requirements for the dry processing plant at Muchea were reported in the ERMP as being approximately 240 kilolitres of process water and 60 kilolitres of potable water each day. As there is no reticulated water supply in the Muchea area the majority of the area's supplies are drawn groundwater bores or rainwater storage. Some concern was expressed that abstraction of water from bores for processing operations would result in a lowering of the groundwater table and jeopardise domestic groundwater supplies.

The Company has indicated that it intends to draw its water supply from the Leederville formation aquifers. More detailed testing of this water supply and likely effects on the superficial aquifer are currently being assessed.

The Authority notes that any abstraction of groundwater would require licencing by the Water Authority of Western Australia under the Rights in Water and Irrigation Act.

The Authority also considered issues relating to the control of drainage and evaporation ponds at the plant site to ensure that surface waters are not contaminated. Current proposals for separation of the individual heavy mineral components from the mineral sand concentrate do not require the addition of chemicals. The concentrates themselves have little potential for contamination as they would be thoroughly washed prior to being transported to site. It is also important to note that the separation process is by physical means and does not alter the chemically stable compounds as they exist in nature.

The Company has undertaken to construct all plant site drainage so that any potentially contaminated runoff is collected and pumped to the evaporation pond. It was also reported that overflow from the evaporation pond may only occur as a consequence of episodic rains, and would be relatively clean water.

RECOMMENDATION 7

The Environmental Protection Authority recommends that any proposal to modify the proposed dry separation process requiring the addition of chemical reagents or altering the chemical composition of the product compounds would be required to be referred to the Environmental Protection Authority for assessment prior to that process being adopted.

RECOMMENDATION 8

The Environmental Protection Authority recommends that a ground and surface water monitoring programme be developed and implemented to the satisfaction of the Water Authority of Western Australia, including regular reporting of monitoring results.

Potential for contamination of domestic rainwater supplies through dust and gaseous emissions was also considered by the Authority. This issue is further discussed in Section 5.9 of this report on dust, noise and gaseous emissions from the proposed processing plant facility.

5.9 DUST, NOISE AND GASEOUS EMISSIONS FROM THE PROPOSED DRY PROCESS PLANT AT MUCHEA

Dust control at the proposed dry processing plant site was identified as an important issue with respect to both occupational health aspects and impacts on the local community at Muchea.

The Company has recognised this in their response to issues raised in submissions and have made a commitment to install and operate dust control systems including:

. dust collection system in the exhaust gas stream from the dryer;

- enclosure of the area containing the circuit from the drier transfer point through to and including the upper floor primary high tension circuit and installing an adequate dust extraction system for this area;

- vacuum system for dust collection throughout the plant;

- allowance made for other plant circuits to be enclosed and ventilated as required; and

- baghouse dust collection system.

Other factors in controlling dust emissions would be:

- washing of concentrates free of dust material prior to transport;

- storing incoming concentrates in an enclosed shed; and

- collection of dust from baghouses and other sources to be slurried and transported back to the mine with other reject material.

Noise and dust levels from operations in the Muchea must be within standards set by pollution control regulations under the Environmental Protection Act, 1986.

Gaseous emissions from the plant would consist of carbon dioxide from the burning of natural gas, water vapour and heated air from the drier. It is not expected that these would have any adverse impacts on nearby residents or primary land based enterprises in the Muchea district.

5.10 RADIATION HAZARDS

Radiation hazards associated with the proposal were considered with regard to both occupational and public health aspects.

Areas where there is transport or storage of radioactive substances (or irradiating apparatus) come under the Radiation Safety Act. Accordingly the provisions of this Act must be complied with respect to the following aspects of the proposal:

- Monazite transport to Fremantle;

- Monazite storage at Muchea;

- On-site gauges using radioactive sources; and

- On-site X-ray analysis equipment.

The proponent would also be required comply with relevant Codes of Practice. (eg Mineral Sands, Mining, Transport, Gauges, Transport, X-ray apparatus).

Other responsibilities would include:

- Education of the workforce about radiation safety (including dust); and

- Ensuring that, at the eventual cessation of mining and processing, all radiation levels are reduced to levels which existed prior to mining.

As it is recognised that inhalation of radioactive dust presents the most significant hazard, exposure to radiation can be adequately controlled through the dust control measures described in the previous section of this report.

The Authority has also noted that the Company has made a commitment to strictly adhere to all Western Australian regulations and Commonwealth Codes of Practice relating to radiation protection including:

- a comprehensive radiation level monitoring programme at both the minesite and dry process plant and their environs and of monazite transport units;
- isolation of the monazite process circuit into a separate building;
- comprehensive dust suppression measures; and
- specific precautions in the handling, storage and transport of the monazite product.

5.11 GENERAL ISSUES RELATING TO THE PROPOSED DRY PROCESSING PLANT AT MUCHEA

The following general issues were considered by the Authority in its assessment of the proposal and the Authority notes the Company's responses to those issues in Appendix 2 of this report.

- Aesthetic impact of processing plant at Muchea.
- Alternate site selection for the processing plant.
- Zoning for the processing plant at Muchea.
- Impacts on flora and fauna at Muchea.

5.12 MONITORING PROGRAMMES AND REPORTING

To ensure that environmental management programmes for this proposal are being carried out in an appropriate manner the Authority believes that a comprehensive system of monitoring and reporting of results to Government needs to be established.

RECOMMENDATION 9

The Environmental Protection Authority recommends that an environmental management programme (EMP) be prepared and implemented relating to all aspects of environmental monitoring and management requirements for both mining and processing operations described in the ERMP, to the satisfaction of the Environmental Protection Authority, prior to the commencement of productive mining and processing activities.

RECOMMENDATION 10

The Environmental Protection Authority recommends that the proponent submits brief annual and comprehensive triennial reports to the Environmental Protection Authority discussing various aspects of the environmental management and monitoring of the project as detailed in the environmental management programme.

5.13 EXPANSION OF PROPOSED FACILITIES

RECOMMENDATION 11

The Environmental Protection Authority recommends that any proposal to extend the mining and/or processing facilities described in the ERMP would require referral to the Environmental Protection Authority for assessment, prior to any commitments being made to develop such proposals.

6. CONCLUSION

Upon assessment of the TiO_2 Corporation NL proposal the Environmental Protection Authority has concluded that the proposed Cooljarloo Mineral Sands Project would be environmentally acceptable subject to the operations being carried out in accordance with the commitments in the Environmental Review and Management Programme and subsequent correspondence (Appendix 3) and the Environmental Protection Authority's Recommendations.

REVIEW OF SUBMISSIONS

1. DIEBACK (Phytophthora species) (15 submissions)

A number of submissions have expressed concern at the absence of information in the Environmental Review and Management Programme relating to the occurrence and measures to control the spread of Phytophthora pathogens that have been identified in the area.

Further information is required and should address the following points:

- documentation of current infestations of Phytophthora detailing affected areas and identification of particular species of pathogens infecting these areas;
- potential for the Phytophthora to be spread through proposed mining activities particularly through ground and surface water movement associated with dredging;
- potential for spread of Phytophthora through topsoil handling as part of the minesite rehabilitation;
- potential for Phytophthora to be spread through modification of surface drainage;
- likely success of proposed rehabilitation using native plant species with respect to Phytophthora;
- introduction of Phytophthora through contaminated nursery stock, and
- impacts on nearby National Parks such as Nambung and Badgingarra through spread of dieback as a result of mining operations.

2. MINESITE REHABILITATION (15 submissions)

Several submissions referred to the rehabilitation proposals discussed in the Environmental Review and Management Programme. Many of these concerns were with respect end land uses and success in re-establishing native vegetation.

The following points were identified as requiring further discussion.

- Alterations in the soil profile mainly with regard to the clay/sand ratio at varying depths for different locations and reestablishment associated vegetation communities. It was pointed out that this ratio is important to moisture and nutrient retention in the soil and may be a factor effecting vegetation distribution.
- Desirability in the use of cover crops for initial stabilisation of ground surface. Cover crops may suppress growth of native plants.
- Demonstrated ability to adequately rehabilitate mined areas through undertaking trials using various prescriptions.

- Commencement of mining activities on cleared private land areas to enable rehabilitation trials to be undertaken prior to disturbance of areas of native vegetation.

- Damage to rehabilitated areas through grazing by kangaroo's and rabbits etc and control measures to be adopted.

- Rehabilitation of areas mined for shallow deposits where deeper deposits may be mined at a later date.

- Mining operations and rehabilitation being carried out in such a manner as to minimise the area "open" at any one time.

- Rehabilitation plans being prepared for mining areas at at least 3 year intervals to be submitted to Government.

- Monitoring of rehabilitated areas and reporting of results at regular intervals.

- Detailed mapping of soil types and vegetation communities prior to mining.

- Further detail regarding perceived end land uses with regard to present land uses such as beekeeping and flower picking.

- Further details on plans for wetlands to be created a part of proposed rehabilitation programmes.

- Detail of workforce and equipment to be dedicated to rehabilitation.

- Introduction and control of weeds in rehabilitated areas.

- Areas and methods for seed collection.

3. IMPACTS OF MINING OPERATIONS ON NATIVE FLORA AND FAUNA AND ASSOCIATED CONSERVATION VALUES (11 submissions)

The following issues should be addressed:

- effects from dust generated from mining activities on surrounding vegetation;

- further information on fauna studies such as the time of year that they were undertaken as well as methods employed were not discussed in the Environmental Review and Management Programme;

- original fauna assemblages should thoroughly documented prior to mining so that post mining recolonisation can be assessed;

- additional information is required on soil and vegetation associations;

- gazetted rare species such as Angiozanthus viridis s.sp. terraspectans were not acknowledged in the ERMP particularly for the area of vacant Crown land not subject to reserve proposals;

- effects on vegetation through disturbance and modification of the ground water regime was not adequately addressed;

- more detailed vegetation surveys should be undertaken for areas of vacant Crown land to be disturbed by mining operations, and

- general loss of conservation values associated with natural wetland vegetation communities.

4. RADIATION HAZARDS (10 submissions)

The following issues were identified in a number of submissions as requiring further discussion.

- Radiation Safety Act needs to be acknowledged with respect to;

  (a) Monazite transport to Kwinana
  (b) Monazite storage at Muchea and Kwinana
  (c) On-site gauges using radiation sources
  (d) On-site X-ray analysis equipment

- Ensuring that radiation levels at the minesite are no greater at the cessation of mining activities than the levels which existed prior to mining;

- Ensuring that any radioactive waste or effluent is disposed of in an appropriate manner;

- Public exposure to radioactivity, particularly in the vicinity of the plant site, and

- Further information on desirability of monazite storage at Muchea with regard to alternative storage at Kwinana.

5. HYDROLOGICAL IMPACTS OF PROCESSING PLANT AT MUCHEA (8 Submissions)

Several submissions expressed concern with regard to hydrological impacts on groundwater in the Muchea area associated with the proposed dry processing plant. The primary concern was that abstraction of water from bores from the processing plant may cause a draw down of the unconfined ground water effecting the availability of this water to current users. It is important to recognise that this area is not serviced by scheme water.

6. PROCESSING PLANT WATER BALANCE, SITE DRAINAGE AND POTENTIAL FOR CONTAMINATION OF SURFACE AND GROUND WATERS (6 submissions)

Further hydrological impacts as a result of water abstraction and number submission expressed concern with regard to pollution of water resources in the Muchea area.

The following points were raised in the submissions to be considered by the Company in its response to submissions:

- whether the proposed evaporation pond areas are large enough to contain plant effluents particularly during periods of high rainfall;

- plant site drainage needs to be carefully designed and managed so that contaminated run-off does not flow directly into adjacent water courses such as Ellen Brook;

- monitoring of surface and ground waters for contamination would need to be undertaken. Further information on monitoring programmes required;

- many residences in the Muchea area rely on roof catchments and rainwater tank storage for domestic water supplies. Some concern was expressed over the potential for dust or other airborne emissions contaminating this water supply; and

- impacts on flora and fauna (particularly wetlands) through contaminated water from the plant site.

7. HYDROLOGICAL IMPACTS OF MINING ACTIVITIES AT COOLJARLOO (6 submissions)

A number of submission discussed issues relating to changes in the surface and ground water regimes and associated impacts through mining operations.

The following points need to be addressed with respect to this issue:

- effects on existing swamps and wetland areas adjacent to the proposed operations area through changes in the water table;

- potential for increase in salinity through waterlogging as a result of clearing and other activities causing a change in ground water levels;

- details on proposed ground water monitoring impacts on flora and fauna through changes in groundwater levels particularly in adjacent wetland areas;

- impacts on existing wetland areas and vegetation associated with existing water courses through modification of surface water flows;

- hydrological impacts as a result of changes in the clay/sand content throughout the soil profile particular with regard to reconstruction of wetlands;

- details of proposed surface water monitoring programmes;

- details of existing groundwater quality; and

- percentage of slimes (clay fraction) in discharged tailings.

8. DUST AND NOISE AT MUCHEA (6 submissions)

Several submissions expressed concern of dust and noise related impacts on the local community at Muchea.

The following points were raised in these submissions to be addressed in the Company's responses.

- consideration of alternative processing techniques such as wet processing to reduce dust emissions from the proposed Muchea plant;

- radiation hazards associated with dust;

- further consideration needs to be given to exhaust ventilation for the processing plant;

- dust from unloading of vehicles;

- dust control from process waste stockpiles for return to minesite;

- dust and noise with respect to actual plant site distance from the townsite (distances of 2 km and 1 km are quoted at different places in the ERMP;

- more detailed information on noise levels should be obtainable from similar dry process plants currently in operation;

- background noise levels in Muchea (range);

- what distance are the nearest residences to the mine site; and

- noise nuisance from trucks associated with the proposed operations, particularly in Muchea area.

9. ENCROACHMENT OF PROPOSED MINING ACTIVITIES ON AN AREA OF PROPOSED CLASS 'C' EXTENSION TO BADGINGARRA NATIONAL PARK (EPA RED BOOK RECOMMENDATION 5.22) (5 submissions)

Several submissions expressed concern over the above issue generally with respect to the conservation values that may be lost, as a result of these activities, that are not adequately represented in existing reserves.

More specific concerns were related to the following:

- considered inappropriate that a rationalisation of proposed reserve boundaries be undertaken as a result of this proposal; and

- considered that lowlands with deep sands and some wetlands found within this area are inadequately represented within existing conservation reserves.

10. GENERAL ISSUES

A number of more general environmental issues were raised in submissions to the EPA on this proposal that need to be addressed by the Company.

10.1 IMPACTS ON BEEKEEPING INDUSTRY (6 submissions)

- relating to success of rehabilitation;

- loss of flora resource; and

- relating to spread of dieback.

10.2 FIRE MANAGEMENT (5 submissions)

- fire management programme to be integrated with overall Fire Protection Plan for the "Central West Coast" area;

- single fire crew and fire unit unlikely to be adequate to provide effective fire control; and

- more detail required on location and extent of firebreak system required.

10.3 AESTHETIC IMPACT OF PROCESSING PLANT AT MUCHEA (4 submissions)

. relative to site selection; and

. landscaping.

10.4 MONITORING PROGRAMMES AND REPORTING (3 submissions)

. Reporting of mining and rehabilitation plans to the State Mining Engineer on a triennial basis.

. Reports should be supplemented by annual reports detailing results of rehabilitation and monitoring for the previous year and indicating proposed programmes for the coming year.

. monitoring generally related to:

(a) surface and ground water at plant site;
(b) surface and ground water at mine site;
(c) radiation;
(d) dust;
(e) noise; and
(f) gaseous emissions.

10.5 GASEOUS EMISSIONS FROM PLANT SITE (3 submissions)

. impacts of nearby residents;

. impacts on existing land uses eg agriculture, beekeeping, poultry farming, horticulture, viticulture and pastoral activities; and

. nature of emissions.

10.6 TRANSPORTATION (6 submissions)

. insufficient stacking room between the Brand Highway and the railway at the proposed Muchea processing plant entrance;

. envisaged that there would be 50% increase in heavy vehicle traffic on this section of the Branch Highway as a result of the proposal;

. increase accident risks on Brand Highway particular attention needs to be given to entry and exist points;

. deterioration of the Brand Highway through increased heavy vehicle usage;

. dust and noise related to transportation of mined and processed materials; and

. transport of radioactive monazite and petroleum fuel would need to be in accordance with the Flammable Liquids Regulations and Dangerous Goods (Road Transport) Regulations.

10.7 ALTERNATE SITE SELECTION FOR PROCESSING PLANT (4 submissions)

. Probable plant site locations at a further distance from Muchea;

. Narngulu alternative more environmentally acceptable;

. Proximately to local Muchea population and established agricultural industries; and

. Alternative of establishment processing plant near minesite.

10.8 EXPANSION PROPOSALS - MUCHEA (3 submissions)

. further details relating to proposed expansion of facilities such a synthetic rutile and titanium pigment plants; and

. suitability of Muchea site for expansion of facilites.

10.9 ZONING - PROCESSING PLANT, MUCHEA (2 submissions)

. Plant site is not yet zoned industrial.

10.10 IMPACTS ON FLORA AND FAUNA - MUCHEA (1 submission)

. impacts of discharge of pollutants, including gaseous emissions on native flora and fauna as a result of dry processing near Muchea.

10.11 WORKFORCE ACCOMMODATION AT CATABY (1 submission)

Proposed single quarters would need to be located in a gazetted townsite.

REVIEW OF SUBMISSIONS TO ENVIRONMENTAL PROTECTION AUTHORITY

RESPONSES BY TIO2 CORPORATION

1. Dieback (Phytophthera Species)

TIO2 is working under a covenant that requires the organisation to liaise with the Department of Conservation and Land Management (CALM) on the prevention of dieback spread.

TIO2 agrees that the very much preferred system is for the mining operation to be free of dieback infection. To this end a survey of infections in and near the ore body will be conducted in the Autumn of 1988. As part of TIO2's educational programme, staff will be instructed to take all prescribed precautions to avoid the spread of dieback.

A study will be commissioned to determine a cost effective mechanism of sterilising spots of dieback infection. The resulting procedure will be used to treat infections in the mining path and others which may affect the mining operation.

Material sources, especially sand and gravel sources, will be checked for dieback infection prior to any cartage to the Cooljarloo site. Infected sources will be rejected.

The Company will routinely monitor industrial waters for dieback infection and will develop a contingency plan in association with the Department of Conservation and Land Management to prevent the spread of dieback if there is an infection and to return the waters to a dieback free condition in line with their recommended solution.

TIO2 will install an access road at Cooljarloo along which all vehicles entering the tenement on lawful business will be required to travel. This will have a dieback control facility through which all vehicles will be required to pass. Earthmoving equipment entering or re-entering the site will be subject to stringent cleaning for dieback control. TIO2 cannot be responsible for non-company vehicles entering the tenement area from other directions. But, in liaison with the Government, TIO2 will discuss the possibility of closing off all other tracks which enter the tenement area.

Given the degree of control of dust required at Muchea (see Section 4B below) TIO2 believes that a dieback control facility is not at present warranted. TIO2 will however install this if the necessity can be demonstrated.

A disease free nursery, using local sources of seed, will be established near Cooljarloo to provide plants for rehabilitation.

2. Minesite Rehabilitation

In Section 7.2.2 of the Draft EIS/ERMP, the Company states that detailed soil profile, topographic and vegetation maps will be made prior to disturbance. This will cover approximately 200ha per year. Vegetation boundaries, densities and information on the presence of any unusual species will be featured. These will be used in rehabilitation planning to determine:

" . Tailings disposal and the placement of slimes (post mining soil profile)

. Post mining contours and surface drainage

. The ultimate vegetation types and species composition intended for each site after mining".

TIO2 intends to mine each area only once, so temporary rehabilitation will not be required.

TIO2 will consult with the appropriate government departments to develop the different and most appropriate methods required for rehabilitation of areas to native vegetation and to return cleared areas to farming. For technical reasons it is not currently feasible to commence the mining operation on the farmland.

Experience in rehabilitation at Eneabba has indicated that without nutrient addition plant growth is very slow. Species diversity is still increasing after 5 years and, according to Dr Bell of the Botany Department, University of WA, can be expected to increase for the next 20 years.

TIO2 will be undertaking and promoting research into the propagation and establishment of those native species which grow on the tenement. TIO2 will report its mining and rehabilitation plans, and the results of its rehabilitation research to the State Mining Engineer on an annual and triennial basis as requested.

3. Impacts of Mining Operations on Native Flora and Fauna and Associated Conservation Values

Copies of the references:

Dunlop J. & Bamford M.J. (1987). An assessment of the Vertebrate Fauna of the Cooljarloo Project Area 1986/87. Unpublished report to TIO2 Corporation NL.

Elkington J. (1986). Report on the Proposed Extension of the Badgingarra National Park and Overlap on to Mining Leases 70/132 and 70/283. Unpublished report to TIO2 Corporation NL.

Elkington J. (1987). Report on the Vegetation of Cooljarloo. Unpublished report to TIO2 Corporation NL.

were listed in the Draft ERMP and available to all. They were only requested once. They have been supplemented by a further report.

Elkington J. (1987). List of rare and restricted plant species encountered within the Cooljarloo Project Area 1986-7 unpublished report to TIO2 Corporation NL.

The incorporation of rare species into rehabilitation plans will be given careful attention (see 2 above).

4. Radiation Hazards

A. Health

(i) Radiation Safety Act

TIO2 recognises the operations areas which are subject to regulation under this Act, and will abide by the requirements of the Act or any amendments made to that Act.

In regard to transport of monazite to Fremantle, application of the Commonwealth Code of Practice for the Safe Transport of Radioactive Substances is referred to in the Draft ERMP (Section 7.4.9). It is now the intention for containers to be transported by rail, thus avoiding the use of public roads.

(The Health Department letter refers to monazite transport to Kwinana. Presumably the intention was to refer to Fremantle as described in the Draft.)

(ii) Importance of Radiation Protection

TIO2 has paid particular attention to radiation protection, and to the control of dust emissions and this is reflected in the discussion contained in the Draft.

TIO2 has undertaken to abide by the Commonwealth Code of Practice. Referring to the Radiation Safety Officer, that Code requires that person to have "qualifications and experience acceptable to the appropriate authority." (Clause 9[19]).

(iii) Company Responsibilities

(a) The standards, guidelines and regulatory responsibilities foreshadowed by TIO2 as applicable to this project are described in the Draft (7.4.2, 7.4.3 and 7.4.9). In addition as stated above, TIO2 recognises the need to observe the Radiation Safety Act.

(b) TIO2 has stated its intentions in regard to workforce education on radiation safety in the Draft (7.4.7).

(c) TIO2 states in the Draft (7.4.8), that checks will be carried out to ensure that rehabilitation both at the mine and plant (upon closure) is effective in eliminating residual incremental radiation.

(d) Wastes containing radioactive residues will be disposed of to standards approved by the appropriate authority. Wastes from the process will be returned to the mine and buried. This includes residuals collected in lined, evaporative storage ponds at the plant, stockpile residuals, baghouse dust (after slurrying), and process circuit non-commercial rejects.

B. Dust at Muchea and Public Exposure to Radioactivity (including comment in Section 8)

The Commonwealth Code of Practice requires TIO2 to manage its operations so that outside its site boundaries, incremental radiation arising from its operations meets the standards required for protection to a member of the public. If that does not occur or if from monitoring results, a trend towards non-compliance is exhibited, the appropriate authority can take action ranging from requiring process modifications in particular areas within a specified timetable, to shutdown of either some sections or all of the plant. Thus TIO2 must both plan its operations so that compliance is assured and monitor incremental radioactivity at or outside plant boundaries to demonstrate compliance.

Recognising that the inhalation of radioactivity as airborne dust presents the most severe operating restriction in terms of occupational and public health considerations, TIO2 has taken the following steps to maintain compliance with statutory requirements:

(i) Concentrates will be washed free of dust material prior to transport to Muchea. This will greatly reduce dust loads reaching the plant compared to past industry practices.

(ii) An enclosed shed will be provided to store incoming concentrates.

(iii) A dust collection system will be installed in the exhaust gas stream issuing from the drier immediately before entering the exhaust system.

(iv) The area containing the circuit from the drier transfer point through to and including the upper floor primary high tension circuit will be enclosed and dust extraction equipment installed.

(v) A vacuum system for dust collection throughout the plant will be provided.

(vi) In the design, allowance will be made for other circuits to be enclosed, if unexpected operational circumstances arise.

(vii) Dust collected from baghouses and other sources will be slurried and transported back to the mine with other reject material.

During start-up and progressive commissioning of the circuits, commencing with the ilmenite circuit, some product stockpiling will be required on site. Dust suppression from these stockpiles will be provided either by water spraying, or sealants. These procedures will also apply to any residual stockpiling of material which may result from operational procedures from time-to-time.

Dust emissions from offloading of moist concentrate from the minesite will be minor and no special dust suppression provisions are considered necessary. If dust suppression is subsequently found to be required, TIO2 will install water sprinklers. Tailings from the process will be stockpiled for subsequent transfer back to the minesite. On these stockpiles, some surface drying may occur and any potential dust arising will be controlled by water sprays or sealants.

Routine hygiene measures will be conducted outside the plant buildings to suppress dust.

In addition to the above, monitoring of pre and post operational levels of radioactivity in the air, will be carried out in consultation with the appropriate authority. It is expected that the results of these programmes will be made available on a regular basis through the Shire, to local residents.

Summarising, TIO2 has taken specific and positive measures in reducing the dust load coming to the plant, and controlling emissions within the plant; so that outside the plant boundaries and further out to residential areas, compliance with the Code of Practice will be achieved. Compliance will be the subject of routine monitoring.

C. Storage of Monazite at Kwinana rather than Muchea

The Port of Fremantle is the only export point for monazite in WA (refer to response 4 A(i) above). The monazite will be loaded into shipping containers at Muchea and transported by rail to Fremantle for direct loading onto vessels without intermediate storage. It would be quite impracticable to unload the containers and store them in Fremantle prior to delivery to the wharf for shipment.

D. Options for Wet Processing

Differing electrical conductivity between various mineral grains is basic to the separation processes. Thus it is essential to maintain warm to hot, dry conditions for efficient separation. There is no alternative wet process technique available to the industry.

5. Hydrological Impacts of Processing Plant at Muchea

TIO2 has recently commissioned the drilling of a bore to the Leederville formation at this site. More comprehensive responses will be available when this bore has been tested in April.

6. Processing Plant Water Balance, Site Drainage and Potential for Contamination of Surface and Groundwaters

TIO2 believes it can adequately demonstrate to the satisfaction of the Water Authority and the EPA that Ellen Brook will not become polluted due to the company's operations. Current plans are not to use chemicals in the dry mill operation. Overflow from the evaporation pond, which will only occur as a consequence of episodic rains, will be clean water.

Further information can be supplied after the quality of the water from the bores presently being drilled are available. The Company will make the data available to the Water Authority and the EPA.

7. Hydrological Impacts of Mining Activities at Cooljarloo

Ten water table monitoring bores will be installed at the Cooljarloo site. Sampling will commence in Autumn 1988. These bores will be supplemented as the project grows. Results of drilling, tests and monitoring will be submitted to the EPA and the Water Authority.

Variation between years in natural water flows across the tenement have probably been and will continue to be considerable. Without an historic record it would be difficult to relate any variation in the water table level, or flow direction to vegetation effects. TIO2 will monitor groundwater levels and water flows and changes in the vegetation of the tenement area.

8. Dust and Noise at Muchea

TIO2 has already stated its commitment to control dust at Muchea (see 4 B above).

The proposed plant is located more than 1km from the nearest occupied dwelling within the townsite. TIO2 does not expect any difficulty meeting the noise control levels required by the EPA for this form of industrial facility.

9. Encroachment of Proposed Mining Activities on an Area of Proposed Class 'C' Extension of Badgingarra National Park (EPA Red Book Recommendation 5.22)

TIO2 commissioned a specific study by J. Elkington (see Section 3 above). This independent consultant's conclusion was that there was adequate representation of the vegetation within the area of the proposed extension, which will be subject to mining, in areas not proposed to be mined and the Wongonderrah Springs Conservation of Flora Reserve.

In accordance with standard practice TIO2 has highlighted in the ERMP the potential conflict between mining the mineral resource and the proposed extension to the National Park. It has made the submission in the ERMP that the EPA should reconsider the proposed boundaries of the National Park Extension. TIO2 understands that the prime purpose of the extension is to provide a strip of diverse flora along the Brand Highway. This will not be affected by mining the mineral claim. The boundaries of the proposed extension could be modified to include the majority of vegetation types which are found within the area of the proposed extension of the National Park which it proposes to mine.

10. General Issues

10.1 Impacts on Beekeeping Industry

TIO2 is prepared to ensure that access to beekeeping sites is maintained as far as possible and to liaise with the beekeepers involved. However it is stressed again that if the tenement is to be kept free of dieback infection then all vehicles including those of beekeepers and government departments will have to use TIO2's washdown facilities.

TIO2 is confident of its future success in flora rehabilitation and believes that the honey production potential of the area will be restored after mining.

10.2 Fire

TIO2 will join or liaise with the Central West Coast Fire Protection Committee, as considered appropriate. This liaison will involve the provision of equipment and the integration of Company resources into regional fire control activities. A single specialised firefighting unit is planned, but other firefighting equipment will be mounted on all site vehicles servicing operations during the bushfire season.

10.3 Aesthetic Impact of Processing Plant at Muchea

TIO2 intends to save all remnant vegetation on this site. As soon as the site development plans have been finalised, a plant screening landscape plan will be developed and implemented.

10.4 Monitoring Programmes and Reporting

See Section 2. In addition, post-mining monitoring will include all effects of outside intrusions into the minesite such as the potential for weed invasions, plant and animal diseases, feral animals and rubbish accumulations. This monitoring will be reported annually.

10.5 Gaseous Emissions From Plant Site

The emissions will be carbon dioxide from burning natural gas, water vapour and heated air from the drier. These should produce no adverse impacts on the primary land-based enterprises in the Muchea district.

10.6 Transportation

The proposed entries and exits to both the minesite and the processing plants have been designed by the Main Roads Department and are acceptable to TIO2. The entry to the Muchea site has now been moved to the northern boundary of the site, ie further away from the town. For dust and noise see also 4B and 8 above. It is now proposed to transport the monazite by rail. TIO2 will obey the law on all matters, including transportation of flammable liquids.

10.7 Alternative Site Selection for Processing Plant

Section 3.3 of the Draft EIS/ERMP reports on the assessments performed by TIO2 in evaluating alternative sites for the dry process plant. Having selected Muchea as a better location than Narngulu, TIO2 then explored alternative sites near Muchea. A major criterion was that the proposed site had been selected to be rezoned for industrial purposes by the Shire of Chittering. Moving the plant north from Muchea is expected to cause workers to travel greater distances, without adding countervailing benefits.

10.8 Expansion Proposals Muchea

If these are proposed then TIO2 will notify the EPA.

10.9 Zoning Processing Plant at Muchea

The Shire of Chittering and the State Planning Commission have approved the rezoning application subject to EPA assessment.

10.10 Impacts on Flora and Fauna at Muchea

See Sections 4B, 8 and 10.5. TIO2 intends to enhance the flora and fauna on the Muchea site (see Section 10.3) and does not expect any effects on flora and fauna outside its boundaries.

10.11 Workforce Accommodation at Cataby

The matter should shortly be resolved with the Shire of Dandaragan.

APPENDIX 3

ENVIRONMENTAL MANAGEMENT COMMITMENTS

TIO2 Corporation NL will undertake the following commitments with respect to the Cooljarloo Mineral Sands Project:

1. TIO2 Corporation NL is committed to achieve a very high standard of mine-site rehabilitation and in particular to:

   . carry out detailed soil profile analyses, and flora and vegetation studies in front of the mine path to provide site specific information for rehabilitation planning;

   . supplement rehabilitation measures by seeding and planting using local indigenous species;

   . consult closely with Government agencies and especially the Rehabilitation Section of the Department of Mines;

   . establish long-term monitoring studies to assess revegetation and recolonisation by fauna;

   . encourage independent research programmes into rehabilitation methods.

2. TIO2 Corporation NL will develop, in consultation with the Department of Conservation and Land Management and the Central West Coast Fire Protection Committee, a comprehensive fire management plan for the Cooljarloo tenements. This will have the objectives of providing protection to rehabilitation and of encouraging ecological diversity and vigour generally. A fully equipped fire truck and trained personnel will be maintained on site for this purpose.

3. A commitment is also made to maintain groundwater levels at Cooljarloo within naturally occurring seasonal levels so as to reduce risks of adverse impact on vegetation due to drawdown. Should monitoring detect indications of drawdown, the proponents will take action to restore groundwater levels. Surface hydrological features will also be maintained by the reconstruction of Mullering Brook after mining and by incorporating wet depressions in the rehabilitation in appropriate places.

4. Install water table monitoring bores at the Cooljarloo site. Results of drilling, tests and monitoring will be submitted to the EPA and Water Authority.

5. TIO2 will assess changes in vegetation in the vicinity of the minesite with respect to variations in the water table.

6. As monazite is radioactive, strict adherence to all Western Australian regulations and the Commonwealth Code of Practice relating to radiation protection will be adopted as described in Section 7.4. This will include specifically:

   . a comprehensive radiation level monitoring programme at both the minesite and dry process plant and their environs and of monazite transport units;

- isolation of the monazite process circuit into a separate building;
- comprehensive dust suppression measures;
- specific precautions in the handling, storage and transport of monazite product.

7. TIO2 Corporation is committed to a high level of environmental management and monitoring as an integral part of the Cooljarloo project. It intends to conduct its operations with the highest level of corporate social responsibility and is firmly committed to the principle that mining should involve a transient impact on the environment.

8. Liaise with the Department of Conservation and Land Management on matters relating to the prevention of dieback spread.

9. Conduct a survey of dieback infested areas occurring within the mining tenements.

10. Develop and implement, as part of a staff education programme, precautions to avoid the spread of dieback.

11. Commission a study to determine a cost effective mechanism of sterilising spots of dieback infection and apply the resulting procedures to treat dieback infections in the mining path and others which may affect the mining operation.

12. Material sources, especially sand and gravel sources, will be checked for dieback infection prior to any cartage to the Cooljarloo site. Infected sources will be rejected.

13. The Company will routinely monitor industrial waters for dieback infection and will develop a contingency plan in association with the Department of Conservation and Land Management to prevent the spread of dieback if there is an infection and to return the waters to a dieback free condition in line with their recommended solution.

14. TIO2 will install an access road at Cooljarloo along which all vehicles entering the tenement on lawful business will be required to travel. This will have a dieback control facility through which all vehicles will be required to pass. Earthmoving equipment entering or re-entering the site will be subject to stringent cleaning for dieback control. TIO2 cannot be responsible for non-company vehicles entering the tenement area from other directions. But, in liaison with the Government, TIO2 will discuss the possibility of closing off all other tracks which enter the tenement area.

15. A disease free nursery, using local sources of seed, will be established near Cooljarloo to provide plants for rehabilitation.

16. TIO2 will be undertaking and promoting research into the propagation and establishment of those native species which grow on the tenement. TIO2 will report its mining and rehabilitation plans, and the results of its rehabilitation research to the State Mining Engineer on an annual and triennial basis as requested.

17. TIO2 recognises the operations areas which are subject to regulation under the Radiation Safety Act, and will abide by the requirements of the Act or any amendments made to that Act.

18. TIO2 has undertaken to abide by the Commonwealth Code of Practice. Referring to the Radiation Safety Officer, that Code requires that person to have "qualifications and experience acceptable to the appropriate authority." (Clause 9(19))

19. Wastes containing radioactive residues will be disposed of to standards approved by the appropriate authority. Wastes from the process will be returned to the mine and buried. This includes residuals collected in lined, evaporative storage ponds at the plant, stockpile residuals, baghouse dust (after slurrying), and process circuit non-commercial rejects.

20. Recognising that the inhalation of radioactivity as airborne dust presents the most severe operating restriction in terms of occupational and public health considerations, TIO2 has taken the following steps to maintain compliance with statutory requirements:

(i) Concentrates will be washed free of dust material prior to transport to Muchea. This will greatly reduce dust loads reaching the plant compared to past industry practices.

(ii) An enclosed shed will be provided to store incoming concentrates.

(iii) A dust collection system will be installed in the exhaust gas stream issuing from the drier immediately before entering the exhaust system.

(iv) The area containing the circuit from the drier transfer point through to and including the upper floor primary high tension circuit will be enclosed and dust extraction equipment installed.

(v) A vacuum system for dust collection throughout the plant will be provided.

(vi) In the design, allowance will be made for other circuits to be enclosed, if unexpected operational circumstances arise.

(vii) Dust collected from baghouses and other sources will be slurried and transported back to the mine with other reject material.

"DIEBACK"

CONTROL & PREVENTION

1.0 GENERAL

TIO2 Corporation NL accepts that mineral sand extraction operations have a potentially large impact on the localized area where mining is carried out. In developing the feasibility of the Cooljarloo Project the company has made responsible commitments to ensure the environmental impacts are carefully assessed and that well constituted environmental management programs will be put into effect. By the measures it has developed and a commitment to forthright future planning, the Company believes it will minimise the levels of impact and rehabilitate the area to a high standard acceptable to the community in general and to the Government.

As a matter of policy the Company is developing an environmental education program designed to elicit the active participation of all its employees, contractors and sub-contractors in implementing the ideals of good environmental management or enforcing adherence where necessary. The primary aim of this programme will be to minimise the potential for introduction and spread of dieback on the minesite.

Officers of the Department of Conservation and Land Management (CALM) have detected the occurrence of Phytophthora fungus in the Wongonderrah Nature Reserve, the Wandamurra Spring area and one site within an area potentially to be included within the Company's tenements where there is little known economic mineral occurring (See attached map).

Three species of the fungus have been identified: Phytophthora megasperma var. megasperma, Phytophthora cryptogea (A1) and Phytophthora citricola. The Company understands little is known of the impact of these species unlike the well documented Phytophthora cinnamomi "jarrah dieback".

The natural drainage system from the infected area trends north-west away from the tenements along Mount Jetty Creek.

It is therefore considered an essential priority for Government to assist TIO2 to control access south off the Wongonderrah Road towards the tenements. TIO2 has instructed all its employees and contractors not to use access tracks from Wongonderrah road but has no control of private or government vehicles.

TIO2 will take other positive steps to assess the impact and control the spread of the infections.

2.0 SURVEY

TIO2 has engaged the services of Dr Ray Hart of Hart, Simpson & Associates to carry out preliminary investigations. The following is an extract from the Service Contract covering the work.

"

SERVICE CONTRACT

1.0 DESCRIPTION OF SERVICES TO BE PERFORMED BY CONTRACTOR

1.1 WORK SUMMARY

The project is divided into three sections.

1.1.1 A survey to establish the present distribution of Phytophthora species in and around the mine site, and a review of other known infections in the region.

1.1.2 More information on the impact of the species of fungi on native vegetation so that the magnitude of the potential problem can be assessed.

1.1.3 A management plan to control the spread of the fungi within the mine site if they are already present, or to prevent their entry if they are not already present.

1.2 PROPOSED WORK

1.2.1 Field Survey: The only information on known infections in surrounding areas is held by the Department of Conservation and Land Management (CALM).

This information will be sought from the appropriate officers prior to the field survey. Also prior to this survey, the contractor will acquire a general knowledge of the mining proposal (Nov. 1987 ERMP) and become familiar with the environmental studies done on the site by others.

All survey methods used and subsequent laboratory analyses must satisfy the quality standards set and used by CALM officers and other contemporary workers in mycology.

The field search will be carried out methodically with areas being given priority as follows:

- Any area of dead plants identified on aerial photographs.
- Areas adjacent to any known infections.
- Low-lying areas, particularly where these have drainage from outside the mining area.
- Along all access roads, seismic lines and tracks in and around the mining area.
- Along grid lines installed for exploration.
- Other areas where there is no particular indication that an infection could be present.

The actual areas to be searched will be determined by the mine path, location of infrastructure and access tracks to be developed.

Field work will be made up by an initial survey to gauge the extent of the problem and to collect samples for laboratory testing so that some results are to hand when further field work is carried out.

1.2.2. Impact Assessment: This is necessary as a basis for determining environmental strategies.

The extent of infections found and the degrees of damage are indications of the potential impact of the fungi. These impacts can be expected to vary with vegetation, soil, wetness, species of fungus, season and other factors. Detailed study of any infected areas found could be desirable.

Regional data may be available from CALM. These results may not be sufficient to indicate the real potential of the fungi in a disturbed mining environment.

1.2.3 Management Plan: This will include recommendations for the three phases of exploration, construction and mining, the latter including the integrated rehabilitation activities.

The thrust of the management plan will depend on whether the fungi are already present within the area of mining activity, or absent from this area. In either case the essential points will be:

- Identification of the problem and solutions.
- Quantification of the problem, particularly in rehabilitation.
- Development of operational plans.
- Quarantining of areas because they are clean or infected.
- Control of access and use of tracks.
- Control of access by non-Company personnel to the area.
- Provision of information for staff training.
- Providing input into mine planning and management so that the management of the problem is integrated with other operations.

1.3 TIMING

All field work will be carried out in April/May, 1988.

A report to the Principal will be completed in June 1988.

It may not be possible to identify all the isolates by June 1988, but such laboratory continutions will not delay the preparation of a report in June.

"

TIO2 is committed to detailed on going surveys (Section 7.2.2 of the ERMP) of soil profile, topography and vegetation. Maps detailing vegetation boundaries densities and information on the presence of unusual species will be produced before any mining disturbance.

It is envisaged this will cover in the order of 200ha per annum. The occurrence of "dieback" in any proposed mine path will thus be identified. Further general surveys to monitor areas of known infection will be conducted.

3.0 QUARANTINE

TIO2 will close all tracks heading north from the tenements. It is considered essential for the Company to receive cooperation from Government to close access from Wongonderrah Road. Relevant signposts should be placed at strategic positions to make the general public aware of the damage that can occur due to casual intrusions.

3.2 If and when considered necessary, access from Wongonderrah Road could be provided by:

(a) Constructing a dry culvert across the Wondamurra Spring at the SEC power line, and/or,

(b) Constructing graded access around the western boundary of flora Reserve 26248, including a dry culvert across the Mount Jetty Creek.

3.3 The provision of a principal access to the site from the Brand highway at the northern boundary of CG3906. This access will have a dieback control facility through which all vehicles will be required to travel. Earthmoving equipment entering or re-entering the tenements will be cleaned down and sterilized.

3.4 The closing of other access tracks as and when considered advisable from the monitoring program. Of particular need for attention will be tracks emerging from the southern wet areas of the Minyulo Brook.

3.5 Material sources, such as sand and gravel, will be checked for dieback infection prior to any cartage to the mine site. Infected sources will be rejected.

3.6 Should further infections be identified culverts will be formed around the site and access restricted until viable methods sterilizing or controlling the site are developed.

3.7 Should it prove necessary a colour coded system of designating areas will be adopted.

e.g. infected areas - yellow designation
clean areas - red designation

Each area or track will then be clearly signposted and access restricted as required. Enforcement provisions will be enacted to ensure compliance.

3.8 When necessary, Clean-down will be carried out on plant and equipment to remove accumulations of earth and root material at internal designated sites to restrict the spread of infection to clean areas.

4.0 EDUCATION

The Company is developing its site education package. The emphasis will be to present material in such a way that site personnel are encouraged to participate in the environmental management strategy.

As is now the case, included in the conditions of a Service Contract is the following schedule:

"

FOURTH SCHEDULE

SPECIAL CONDITIONS
ENVIRONMENTAL GUIDELINES

INTRODUCTION:

The Cooljarloo site lies close to the Badgingarra National Park, the Wongonderrah Spring Reserve and the Mullering Brook Recreation Reserve. The environmental programme of the Company aims to prepare the area for a projected post-mining land use compatible with these existing reserves. This preparation will be the result of thorough site management and sophisticated mine rehabilitation activities.

These guidelines aim to help all contractors working on the site meet the environmental programme requirements. Non-adherance to these requirements will be viewed very seriously by the Company.

These guidelines cover the general objectives of the programme, but may not cover all areas of potential environmental damage. If any doubt exists on a particular field activity, the principal's environmental representatives should be consulted.

ISOLATION REQUIREMENTS

The important theme running through a number of these guidelines is the requirement of isolation from the effects of outside intrusions into the mine site and immediate surrounds. These effects can usually be defined under the following headings:-

(a) Introduction of plant diseases such as dieback.
(b) Introduction of animal diseases such as hydatid tape worm.
(c) Invasions of weed species, whether of noxious plants, fireweeds or serious competitors to wildflowers, such as Veldt grass.
(d) Populations of pest feral animals or insects harmful to native ecosystems. Feral cats are serious predators of small native mammals.

DIEBACK DISEASES

Phytophthora cinnamomi "Jarrah Dieback" has not been identified in the area. However other species of this disease have been located in the Wongonderrah Nature Reserve and the Wandamurra Spring area both of which lie in the winter wet lands immediately north of the Cooljarloo tenements.

This disease has the potential to cause serious damage to flora and subsequently fauna in the area and once established is almost impossible to eradicate. The natural spread of the disease is slow, but is greatly enhanced by the use of vehicles and machinery, particularly earthmoving equipment, which can carry large quantities of contaminated soil or infected root material over considerable distances. Water will also greatly assist disease spread if allowed to run (for example along tracks or wheel ruts) from contaminated areas into uninfected areas.

Because of the implications associated with the known infections entrance to the site cannot under any circumstances be made via the Wongonderrah Road.

BASIC INSTRUCTIONS

1. Machinery Hygiene: All vehicles, earth moving machines, tractors and similar must be cleaned, particularly of mud deposits, before entering the Cooljarloo site. If such machines have been working in dieback areas (designated as such by CALM), the cleaning must be done before leaving that area.

   The final washdown water to be used is a fungicide treatment. An effective treatment is 100mls of sodium hypochlorite (a common swimming pool additive) per 200 litre drum of water (o.05% v/v). The hypochlorite dosage must be renewed if left for 24 hours, ~~or more or subjected to vigorous agitation~~.

   Wastes such as oil derived from the servicing of vehicles must be collected and not allowed to disperse over soil or vegetation. Machinery with excessive oil leaks must be reported and repairs carried out as quickly as practical.

   All equipment requires the Principal's clearance before proceeding onto the site.

2. Nominated Access Routes: All tracks entering the tenement area will have a designated status based on seasonal variations surface conditions and disease implications. Access to and within the site will be limited to routes and conditions from time to time advised by the Principal.

   Persons entering the site shall ensure that only these routes are used and any conditions applying are strictly observed.

3. Vegetation and Soil: Unnecessary disturbance of vegetation and wildlife shall be avoided. Vehicles are to be restricted to established tracks wherever possible and use of a minimum number of tracks is required. Direct "beelines" by "scrub bashing" between activity sites must be avoided. When unrestricted, they will quickly lose recoverable topsoil and vegetation of a site and greatly increase costs in the subsequent rehabilitation work. Such diversions can also result in the spread of dieback disease.

4. Blading: Blading, bush cutting or blazing of trees in the course of laying out survey or drill lines must be avoided. Use of the ground cover vegetation for traction along such lines is allowable but the use of grader or dozer blades is to be avoided wherever possible.

5. Firebreaks: Topsoil collection by scraper and mulch collection by forage harvester are the preferred methods for opening up firebreaks. Mulch collection can also be used with advantage along survey and drill lines.

6. Fire Break-outs: Observance of all fire restrictions current at the time of the work is required and, if necessary, seek the advice of the local Fire Control Officer (Mr Rick Allen of C G 3902, east side of Brand Highway. Any welding activity on site must be carefully monitored.

7. Rubbish and other Waste Disposal: Remove all rubbish from the site. Under no circumstances should chemicals and/or their containers be dumped.

8. Feral Animals: Introduction of domestic pets to the area is to be avoided other than on a firm working association. This ban particularly applies to cats, or the feeding of any of the same that may be present.

9. Local Farmers: Respect fences and gates and comply with signs posted by land occupiers. Leave gates as they are found. Minimise disturbance to livestock.

10. Shooting Ban: No firearms shall be taken on to reserves or the Cooljarloo site.

11. Activity Sites: There is an Aboriginal campsite, several registered apiary sites and wildflower picking activities within the general area. These must not be disturbed.

12. Excavations: Where pits or costeans are necessary, the excavation shall be minimised by using appropriate equipment.

13. Wildflowers: Observance and enjoyment of the many wildflowers on the site is encouraged. However they should not be picked or unnecessarily disturbed.

14. Fauna: Assistance is sought in our biological studies by reporting any UNUSUAL fauna sightings to the Principal's environmental section. Please include the following information:

. Description of animal.
(size, colour, distinctive markings)
. Date and time of sighting.
. Location of sighting.
(Grid reference if possible)
. Description of animals activity.
(eg. nesting, feeding, mating)

This information may be of great assistance in our monitoring of environmental impact and the success of rehabilitation programmes.

"

Provision is made in the contract to expand on the above conditions should the necessity arise.

The Company will produce a small Environmental handbook which will be issued to all personnel entering the site on lawful business. The booklet will emphasise the Company's objectives in environmental management.

The front page will be removed from the booklet on issue after the recipient has signed for its receival. In this way the Company may assume all personnel are aware of the rules covering behaviour on environmental matters and hence be able to enforce by penalty the adherence to policy should it prove necessary from time to time.

5.0 RESEARCH

TIO2 will actively promote research aimed at developing methods of:

(a) sterilizing spots of "dieback" infection.
(b) sterilizing industrial waters that may become infected.
(c) Understanding significant features of Phytophthora species, other than cinnamomi, that occur on the site.

The methodology of the research efforts will be closely discussed with CALM as there will no doubt be overlaps in endeavours and perhaps a joint programme could be appropriate.

6.0 TRANSPORT AND ROAD SYSTEMS

TIO2 is developing its mining plan. When this is completed the necessary access routes will be determined.

It is proposed that all entry to the tenements will be via a main entrance located off the Brand Highway at the northern boundary of CG3906. The principal clean down or "dieback" control facility will be located near this entrance.

The facility will contain all equipment and chemicals necessary to carry out routine hygiene control on all vehicles including provision to remove accumulates in wet or dry conditions in the most suitable manner at that time, e.g. providing treated high pressure water or compressed air and brushes.

Any water will be treated with sodium hypochlorite (stock solution 13.5% free chlorine; 0.5 l/1000l of water) or any other fungacide which may gain acceptance from time to time.

From the entrance road a spine road will service the mining operation. Concentrates will be collected from an area, adjacent to the Concentrator which will be relocated periodically as the mining sequence progresses.

There are several options under consideration, for example:

(a) provide a sealed road for concentrate transport, use of which would be restricted to the haulage vehicles and the dedicated loader servicing the haul trucks. Site vehicles would travel on an adjacent gravel road.

(b) Provide a gravel road with all the required hygiene provisions necessary for all vehicles.

7.0 CONTINGENCY PLANNING

Should it follow from current Phytophthora infections, or the subsequent mining operations, that the whole or parts of the mining tenements become severely infected, the company will set in operation a contingency plan for dieback resistant re-vegetation.

The current land use other than mining involves nature conservation, wildflower picking and beekeeping. The Company believes that all these uses can be maintained through a suitable choice of dieback resistant species indigenous to the Cooljarloo area. Though the potential for full rehabilitation growth and variety may be reduced somewhat under permanent Phytophthora presence, there are many precedents for Australian flora recovery under such conditions. These precedents will be used to develop such contingency plans.

Management strategies, particularly those with reference to drainage control, have always played a large part in damage control arising from Phytophthora infections. The Company believes that the post-mining rehabilitation landscape created will be more resistant to recurring Phytophthora infections than the current landscapes for the following reasons:

1. Terrestrial areas now dominated by large Banksia species will be more positively sloped and drained.

2. Winter-wet areas will be more closely associated with drainage channels than they are at present. This is a necessary rehabilitation practice to ensure good revegetation.

3. Any proposed permanent wetlands would consist of discreet and permanent bodies of water surrounded by positively sloped riverine vegetation.