BEMAX Resources Limited
Snapper Mineral Sands Project

Project Application

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EXECUTIVE SUMMARY

This document is a Project Application for the proposed Snapper Mineral Sands Project (the Snapper Mine). It has been prepared in accordance with Part 3A of the *Environmental Planning and Assessment Act, 1979* and the *Environmental Planning and Assessment Regulation, 2000*. Part 3A of the *Environmental Planning and Assessment Act, 1979* provides an approval process that is particularly adapted for major infrastructure and other projects.

In accordance with *Steps in the Assessment and Approval of Major Projects under Part 3A* (DIPNR, 2005a), the Project Application includes a Preliminary Assessment which identifies key environmental assessment issues, and provides:

- an analysis of the likely extent of potential impacts;
- an analysis of the likely nature of those potential impacts; and
- identification of the level and scope to be undertaken for the Environmental Assessment.

The Preliminary Assessment includes consideration of the cumulative impact of the Snapper Mine in combination with the nearby Ginkgo Mineral Sands Project and the Broken Hill Mineral Separation Plant, where appropriate. The assessment has been undertaken generally in accordance with the draft *Guideline: What is the Level and Scope of Assessment for Major Projects? Preliminary Assessment* (DIPNR, 2005b).

The purpose of the Preliminary Assessment is to provide the Director-General with information to enable the development of Environmental Assessment Requirements (EARs).

The key potential environmental issues associated with the construction and operation of the Snapper Mine identified by the Preliminary Assessment are summarised below along with the key proposed EARs.

Key Environmental Issues, Key Potential Impacts and Proposed Environmental Assessment Requirements

Key Environmental Issue	Key Potential Impacts	Proposed Environmental Assessment Requirements
Hydrogeology	• Potential impacts resulting from groundwater abstraction and aquifer recharge on the Darling River, surrounding groundwater users and naturally occurring groundwater features (e.g. The Salt Lakes).	• Modelling of potential impacts on the natural groundwater levels and flows, including potential cumulative impacts that may arise from the combined operation of the Snapper and Ginkgo Mines. • Development of a site water balance. • Measures proposed to minimise impact on natural groundwater features and landholder water supply.
Aboriginal cultural heritage	• Potential impacts resulting from disturbance to places and items that are of significance to Aboriginal people.	• Assessment of potential impacts on Aboriginal cultural heritage.
Management of back-loaded MSP waste materials	• Potential impacts associated with the transport of back-loaded MSP waste materials from the MSP to the Snapper Mine.	• Assessment of the potential impacts associated with transport, handling and disposal of back-loaded MSP waste materials.

Key Environmental Issues, Key Potential Impacts and Proposed Environmental Assessment Requirements (Continued)

Key Environmental Issue	Key Potential Impacts	Proposed Environmental Assessment Requirements
Flora	• Potential impacts resulting from vegetation clearance and modification.	• Assessment of potential impacts on critical flora habitats, threatened flora species, populations, ecological communities and native vegetation, including potential cumulative impacts that may arise from the combined operation of the Snapper and Ginkgo Mines. • Measures to ensure that there is no net loss of flora values in the area in the medium to long term, including a comprehensive vegetation offset strategy.
Fauna	• Potential impacts resulting from fauna habitat clearance and modification.	• Assessment of potential impacts on critical fauna habitats, threatened fauna species, populations, ecological communities and native vegetation, including potential cumulative impacts that may arise from the combined operation of the Snapper and Ginkgo Mines. • Measures to ensure that there is no net loss of fauna values in the area in the medium to long term.
Rehabilitation Materials Management	• Potential impacts resulting from an increase in salinity of overburden and sand residue material due to slurrying with saline groundwater.	• A justification for the proposed final land form and use in relation to the strategic land use objectives. • A detailed description of how the site would be progressively rehabilitated and integrated into the offset strategy for the project. • Measures which would be put in place for the long –term management of the site (and any offset areas) following cessation of mining.
Noise	• Potential impacts resulting from the use of mining equipment.	• Assessment of potential noise impacts, including road traffic noise and potential cumulative impacts that may arise from the combined operation of the Snapper and Ginkgo Mines.
Air Quality	• Potential impacts resulting from the use of mining equipment. • Potential greenhouse gas emissions resulting from the combustion of diesel fuel and indirect greenhouse gas emissions resulting from the use of electricity.	• Assessment of potential air quality impacts, including potential cumulative impacts that may arise from the combined operation of the Snapper and Ginkgo Mines. • Assessment of potential greenhouse gas emissions.
Road Transport	• Potential impacts resulting from increased road traffic movements associated with haulage of Snapper Mine HMC and back-loaded MSP waste materials.	• Assessment of potential traffic impacts, including transport infrastructure requirements.

Other environmental issues that are considered to result in lower risk levels relative to the above key issues include non-Aboriginal cultural heritage, socio-economics, surface hydrology, land resources and visual aspects.

1 INTRODUCTION

1.1 PURPOSE OF THIS DOCUMENT

This document is a Project Application for the proposed Snapper Mineral Sands Project (the Snapper Mine). It has been prepared in accordance with Part 3A of the *Environmental Planning and Assessment Act, 1979* (EP&A Act) and the *Environmental Planning and Assessment Regulation, 2000* (EP&A Regulation). The EP&A Act and EP&A Regulation set the framework for planning and environmental assessment in New South Wales. Part 3A of the EP&A Act provides an approval process that is particularly adapted for major infrastructure and other projects.

In accordance with *Steps in the Assessment and Approval of Major Projects under Part 3A* (the Draft Major Project Guideline) (DIPNR, 2005a), this Project Application provides the information outlined in Table 1.

Table 1
Draft Major Project Guideline Requirements – Reference Summary

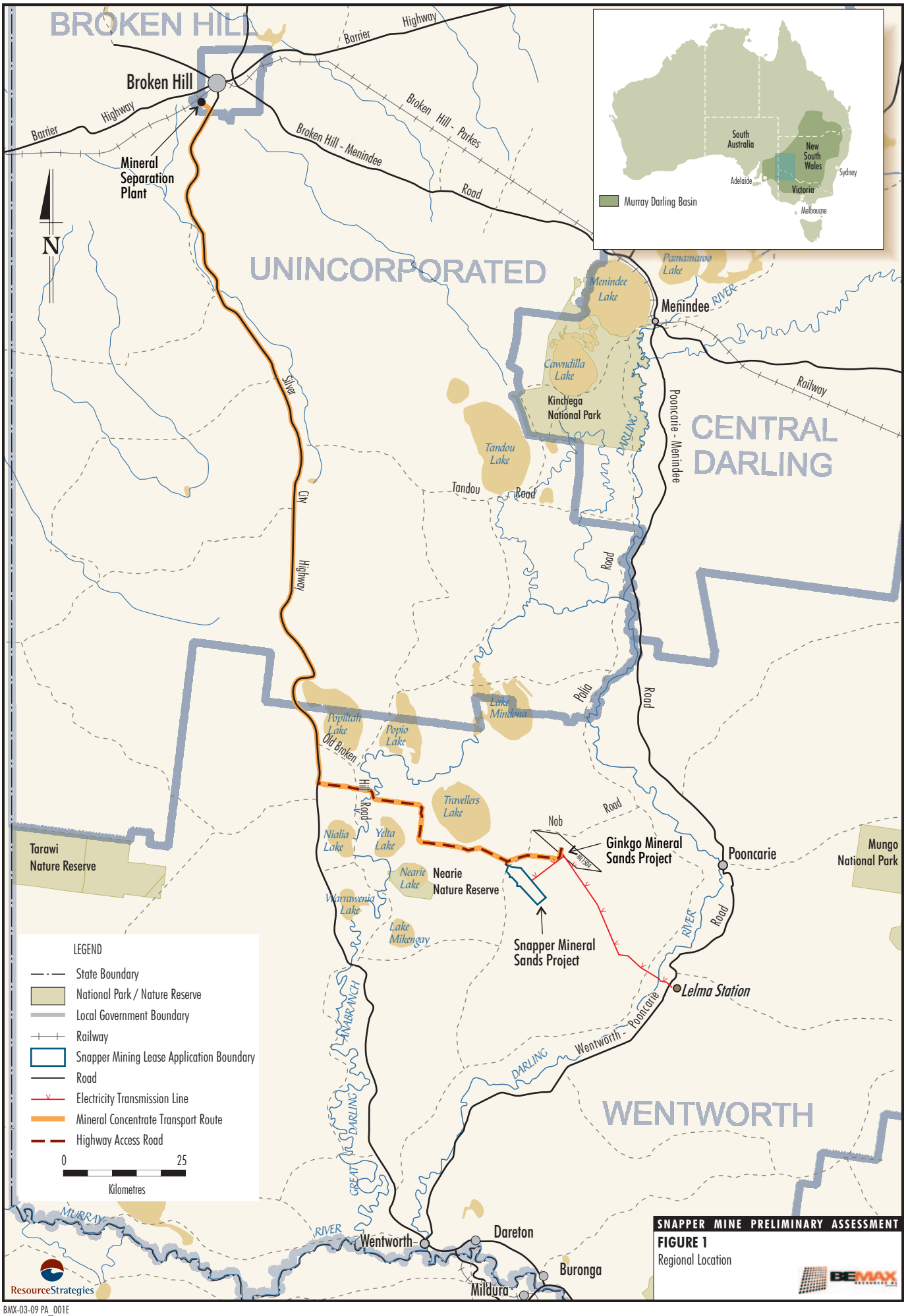
Draft Major Project Guideline Requirement*	Project Application Reference
Information to confirm that the project is a project to which Part 3A of the EP&A Act applies.	Section 2
Information to confirm whether a Concept Plan will be required or authorised by the Minister.	Section 2
A description of the project and any ancillary components.	Section 1.3
The location and a map identifying the site.	Section 1.3.1 and Figures 1, 2 and 3
The capital investment value and other relevant information in relation to parameters set out in the *State Environmental Planning Policy (Major Projects), 2005* or any relevant order relevant for determining whether Part 3A applies to the Project.	Sections 1.3.2 and 1.3.4
The planning provisions applying to the site.	Section 2
The views of other agencies, local council or the community if known.	Section 3
Any other approvals required. In particular, if a licence from the Department of Environment and Conservation (DEC) is required under the *Protection of the Environment Operations Act 1997* (POEO Act).	Section 2.1
Justification as to why the project should be considered to be a major project under Part 3A of the EP&A Act, taking into consideration the relevant criteria.	Section 2
A Preliminary Assessment to identify the likely environmental issues.	Section 4

* Adapted from DIPNR (2005a)

The Preliminary Assessment (Section 4) identifies key environmental assessment issues, and provides:

- an analysis of the likely extent of potential impacts;
- an analysis of the likely nature of those potential impacts; and
- identification of the level and scope to be undertaken for the Environmental Assessment (EA).

The Preliminary Assessment includes consideration of the cumulative impact of the Snapper Mine in combination with the nearby Ginkgo Mineral Sands Project (the Ginkgo Mine) and the Broken Hill Mineral Separation Plant (the MSP), where appropriate. The assessment has been undertaken generally in accordance with the draft *Guideline: What is the Level and Scope of Assessment for Major Projects? Preliminary Assessment* (the Draft Preliminary Assessment Guideline) (DIPNR, 2005b).



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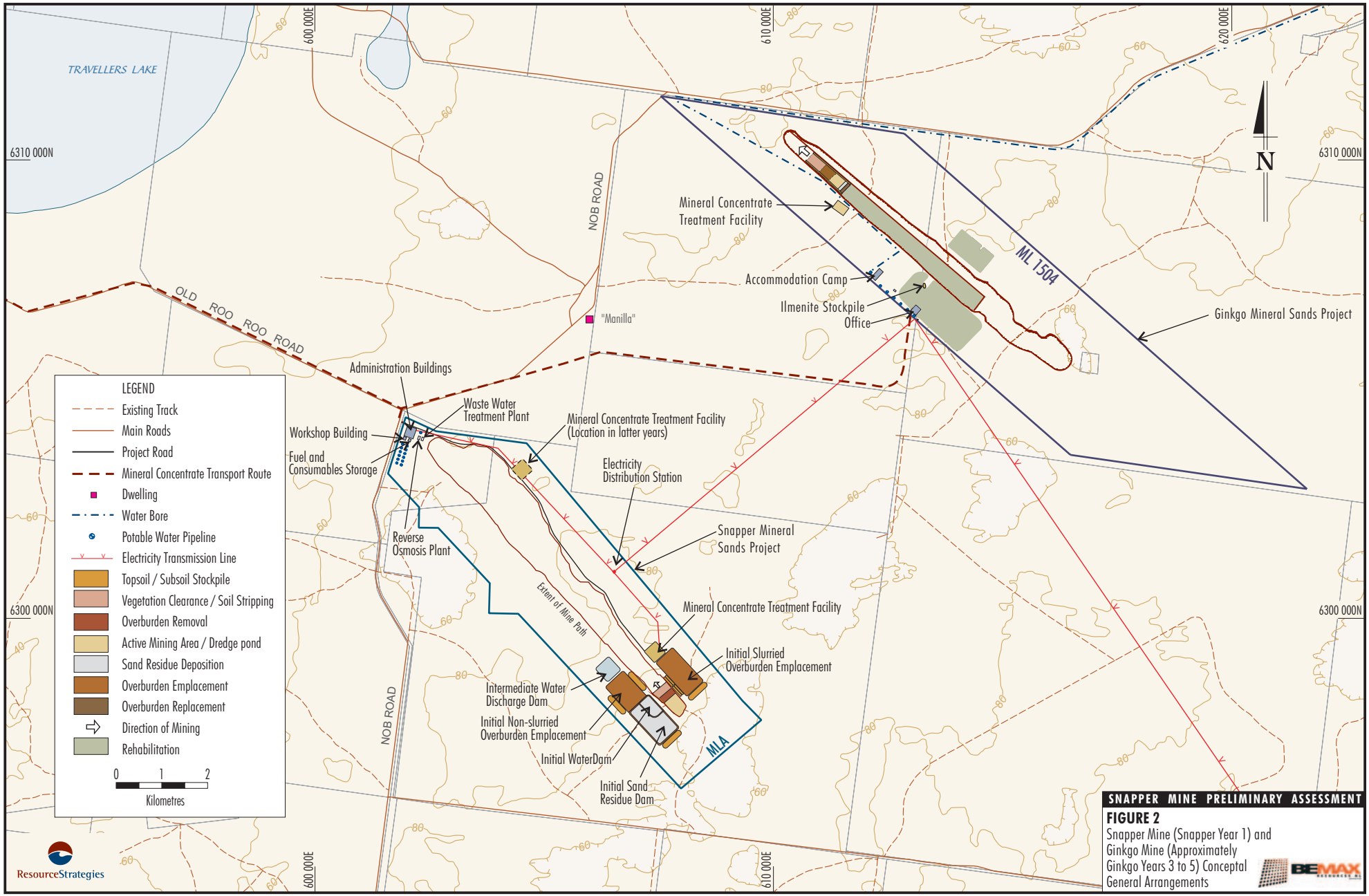

SNAPPER MINE PRELIMINARY ASSESSMENT

FIGURE 2
Snapper Mine (Snapper Year 1) and Ginkgo Mine (Approximately Ginkgo Years 3 to 5) Conceptal General Arrangements

BEMAX

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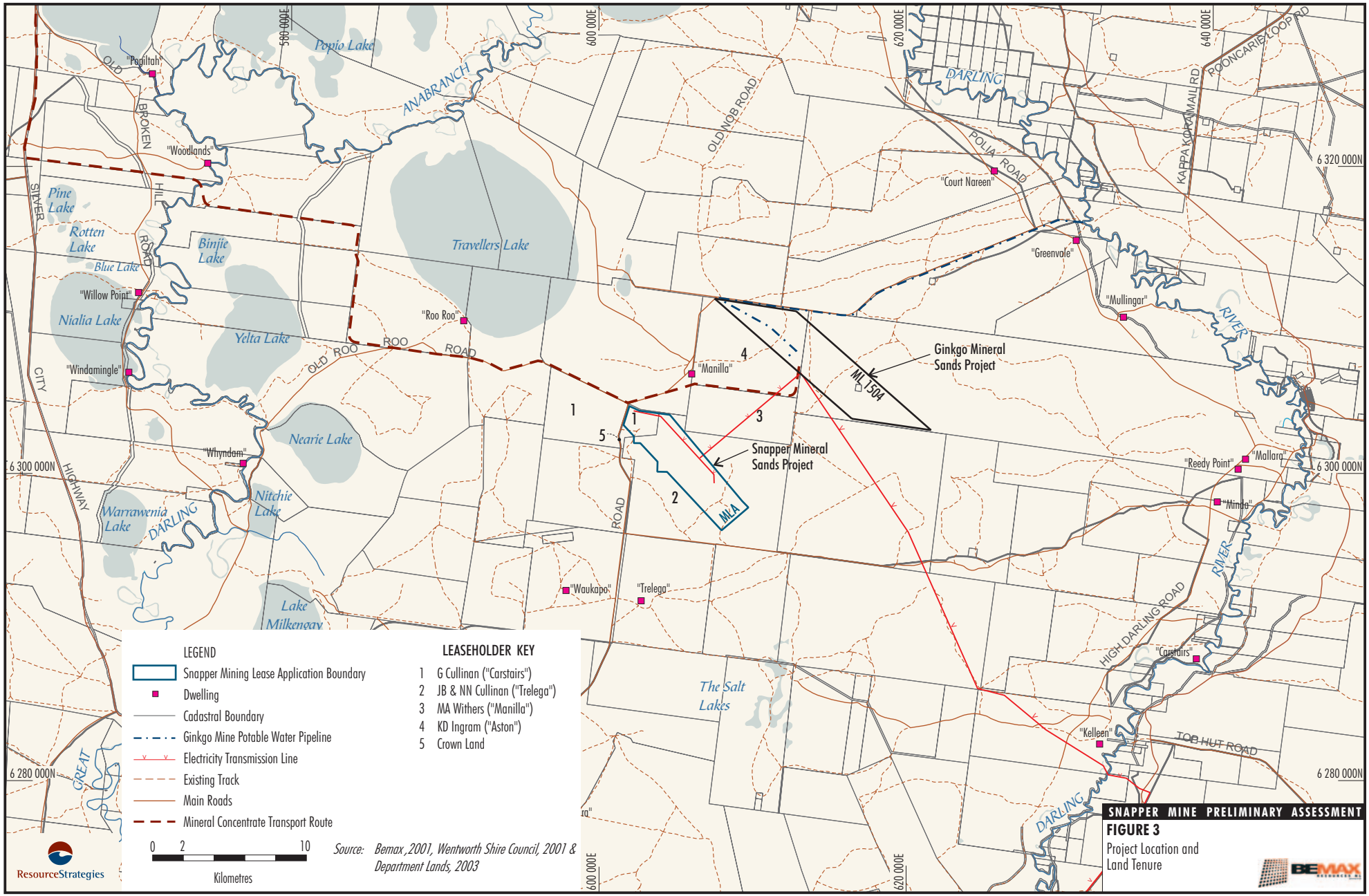

SNAPPER MINE PRELIMINARY ASSESSMENT

FIGURE 3

Project Location and Land Tenure

BEMAX

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1.2 BACKGROUND

The Snapper Mine involves the construction and operation of a mineral sands mine located approximately 10 km to the south-west of the existing Ginkgo Mine and approximately 170 km south of the MSP (Figure 1).

The Ginkgo mineral sands orebody is the first BEMAX Resources Limited (BEMAX) prospect to be mined in the Murray Basin of NSW, with heavy mineral concentrates (HMC) from the Ginkgo Mine being separated and treated on site or at the MSP. The following Sections 1.2.1 to 1.2.3 provide a brief summary of these related existing projects, as well as the exploration history associated with the Snapper Mine.

1.2.1 Ginkgo Mineral Sands Project

In September 2001, BEMAX submitted a Development Application (DA 251-09-01) for the Ginkgo Mine to the Minister. DA 251-09-01 was accompanied by the *Ginkgo Mineral Sands Project Environmental Impact Statement* (BEMAX, 2001a) (the Ginkgo Mine EIS). The Minister approved DA 251-09-01 on 30 January 2002. The Ginkgo Mine is located approximately 40 km west of the township of Pooncarie in western NSW and includes the Ginkgo Mine located on Mining Lease (ML) 1504, a mineral concentrate transport route (transport route from the Ginkgo Mine to the MSP), electricity transmission line (ETL) and potable water pipeline. The Ginkgo Mine Development Consent (S00/01704) has been modified on three occasions: 3 September 2003, 17 May 2005 and 29 April 2006.

1.2.2 Broken Hill Mineral Separation Plant

In November 2001, BEMAX submitted a Development Application (DA 345-11-01) for the MSP to the Minister. DA 345-11-01 was accompanied by the *Broken Hill Mineral Separation Plant Environmental Impact Statement* (BEMAX, 2001b) (the MSP EIS). The Minister approved DA 345-11-01 on 27 May 2002. The MSP is located on the south-western outskirts of Broken Hill in western NSW and includes the mineral separation plant, ETL and water supply pipeline. The MSP Development Consent (S01/02182) was modified on 4 February 2006.

1.2.3 Snapper Mineral Sands Project Exploration History

The Snapper deposit was first identified as a mineral sands prospect in August 1999.

Since that time, BEMAX has undertaken a drilling programme, resource modelling, resource optimisation and mine planning, which have identified a resource of approximately 112 Mt of mineral sands ore (measured and indicated) at an average grade of approximately 5.8% heavy minerals. This represents some 6.5 Mt of heavy minerals comprising the valuable components of ilmenite, altered ilmenite (leucoxene), rutile and zircon. Reserves based on detailed mine planning have not been calculated at this stage, however based on experience at the Ginkgo Mine it is expected that 4.5Mt of HMC would be produced from the Snapper Mine deposit.

1.2.4 Project Integration

Although both the Ginkgo and Snapper Mines would be economically viable as stand-alone operations (BEMAX, 2003a), the publicly-announced Pooncarie Project (which incorporates the Snapper and Ginkgo Mines and the MSP) would benefit from both mines operating in conjunction for maximum economic viability (i.e. development of the Snapper Mine would allow BEMAX to recoup significant infrastructure costs incurred during the development of the Ginkgo Mine in 2005). That is, proximity of the two projects and similarity in orebody characteristics allows for a significant economic advantage to be gained through extensions/sharing of major ancillary infrastructure as well as shared use of the MSP.

Therefore, the Snapper Mine has been designed to integrate with Gingko Mine ancillary infrastructure and facilities as much as possible. For example, major ancillary infrastructure for the Snapper Mine comprises extensions/sharing of the existing Ginkgo Mine electricity transmission line (ETL), the mineral concentrate transport route and highway access road (HAR) and sharing the Ginkgo Mine accommodation camp to accommodate Snapper Mine workers (Figure 2). Further, the schedule for the Snapper Mine complements the schedule for the Ginkgo Mine (i.e. operations at the Snapper Mine would begin when ore grades at the Ginkgo Mine start to decline).

1.3 PROJECT DESCRIPTION

The Snapper Mine would incorporate a mineral sands mine utilising both dry and wet (dredge) methods of mining, and would include the major mine activities presented below.

- Clearance of vegetation and stripping of soils on a campaign basis ahead of the advancing mine operation.
- Overburden stripping and slurrying.
- For dredge mining, assembly of the floating dredge and primary concentration unit, and subsequent flooding of the dredge pond.
- For dry mining, assembly of the ore slurrying system and primary concentration unit.
- Dredge mining by a conventional floating bucket wheel/cutter suction dredge.
- Ancillary dredge mining (i.e. external to the main dredge pond).
- Dry mining by conventional mobile equipment (i.e. dozers and/or scrapers) feeding an ore slurrying system.
- Primary minerals concentration in the primary concentration unit.
- Salt washing utilising desalinated water.
- Separation through the wet high intensity magnetic separator (WHIMS) circuit on site or at the MSP.
- Stockpiling of HMC.
- Transport of HMC to the MSP.
- Placement of sand residues at the rear of the active mining area as mining advances along the mine path.
- Transport and placement of back-loaded waste from the MSP.
- Replacement of overburden on top of the wet plant sand residues.
- Staged replacement of soils and rehabilitation of the mine path behind the advancing mining operation.

The combined operation of the Snapper and Ginkgo Mines would maintain up to 715,000 tonnes per annum (tpa) feed rate of concentrate to the MSP during the life of the two mines.

1.3.1 Location

The mine site would be located within the Western Division of NSW which encompasses approximately 40% of NSW (325,000 km^2) in the far west of the state. The majority of rural lands within the Western Division are pastoral leases administered under the jurisdiction of the Western Lands Commissioner appointed by the Department of Natural Resources (DNR).

The mine site would be located on two pastoral leases ("Trelega" and "Carstairs"). Land tenure of the Project area is summarised in Table 2 and shown on Figure 3.

Table 2
Land Tenure Summary

Lot/DP	Landholder	Lease Name
1929/763907	J.B. and N.N. Cullinan	Trelega
1927/763905	G.C. and S.L. Cullinan	Carstairs

The Snapper Mine is located on lands designated Zone 1(a) (General Rural Zone) under the *Wentworth Local Environmental Plan 1993* (Wentworth LEP).

1.3.2 Project Snapshot

Key Snapper Mine information is summarised in Table 3.

Table 3
Project Snapshot

Project Development Component	Summary Description
Proponent	BEMAX.
Tenement Status	BEMAX has applied for two overlapping mining leases (MLA 210 and MLA 272) which cover portions of BEMAX's exploration licences (EL5474 and EL6024.
Mining	Dry and wet (dredge) mining producing approximately 8.2 Mtpa of ore.
Mineral Concentration	Mineral concentration to be undertaken in a primary concentration unit (comprising trommel, surge bin and wet concentrator). HMC produced would either be separated through the WHIMS circuit on site or at the MSP. WHIMS would separate the mineral concentrate into an ilmenite concentrate, leucoxene concentrate, a non-magnetic concentrate (containing zircon and rutile) and waste products. Concentrates would be further separated and treated at the MSP to produce the saleable minerals ilmenite, leucoxene, rutile and zircon.
Concentrate Transport	Double road train transportation of material between the Snapper Mine and the MSP via the mineral concentrate transport route (triple road trains may be used later following further economic assessment and after relevant approvals have been obtained).
Life of Mine	Approximately 14 years.

Table 3 (Continued)
Project Snapshot

Project Development Component	Summary Description
Site Infrastructure Components	Major mine site components would comprise: • Ore slurrying system (dry mining), floating dredge (dredge mining) and primary concentration unit for dry mining and primary minerals separation. • Borefield supplying water to the overburden slurrying facility, ore slurrying system (dry mining), dredge pond (dredge mining) and primary concentration unit. • Overburden slurrying and pumping system. • Salt washing facility. • Reverse osmosis (RO) plants for salt washing facility and potable water. • WHIMS circuit. • Administration and workshop buildings (including ablutions). • A waste water (including sewage) treatment plant. • Project roads. • Overburden, soil and mineral concentrate stockpiles. • Fuel and consumables storage facilities. • Initial water supply dam. • Initial sand residue dam. • Initial overburden emplacements. • Intermediate water dam.
Overburden Replacement	Replacement of the deeper Loxton-Parilla Sand overburden would be undertaken by slurrying and then pumping via a slurry pipeline to behind the active mining area (dry mining) or dredge pond (dredge mining) and placing on top of the sand residues. Replacement of shallow Quaternary/Recent overburden would be undertaken by removing it using conventional earthmoving equipment. For the initial period during start-up, Loxton-Parilla Sand overburden slurry would be deposited in the northern initial overburden emplacement. During this initial period, non-slurried Quaternary/Recent overburden would be placed in the southern initial overburden emplacement. The Loxton-Parilla Sand overburden material would be covered by an appropriate depth of non-slurried material, to provide a suitable revegetation medium.
Sand Residue Management	Sand residues from the primary concentration unit would be placed in an initial sand residue dam for the first nine months of operation. For the remainder of the mine life, sand residues would be returned to the rear of the active mining area (dry mining) or dredge pond (dredge mining).
Waste Management	Following transport from the MSP, back-loaded waste would be deposited in a designated stockpile, adjacent to the mineral concentrate stockpiles. This waste would be placed in a shore based hopper, mixed with waste water from the reject water dam, then transported to the primary concentration unit via a slurry pipe. This slurry would join the sand residue stream and be deposited on the sand residue beach. The slurry would be covered under a minimum of 10 m (up to 35 m) of overburden.
Access	An access road linking the mine site with the existing mineral concentrate transport route would comprise an all weather road with a gravel pavement some 10 m wide.
Water Management	Water demand would be generated by the: • overburden slurrying facility; • ore slurrying system (dry mining); • requirement to maintain the level of the dredge pond in order to maintain dredge access to the orebody (dredge mining); • primary concentration unit; • RO plants • salt washing facility; • WHIMS; and • potable water.

Table 3 (Continued)
Project Snapshot

Project Development Component	Summary Description
Water Management (Cont.)	Water demand would be met by supply from the: • borefield; • reject water pond; and • return water collected from overburden replacement areas.
Mine Site Electricity Distribution	The existing ETL from Lelma Station to the Ginkgo Mine would be extended by approximately 10 km to service the Snapper Mine site.
Rehabilitation Works	Progressive rehabilitation as mining advances. Rehabilitation trials would be undertaken to assess the effectiveness of rehabilitation techniques and the success of different plant species over the life of the Snapper Mine.
Proposed Timing*	Mining at the Snapper Mine would commence approximately between the third and fifth years of the Ginkgo Mine schedule.
Employment	Construction workforce of up to 145 employees. Approximately 25-50% of the construction phase workforce would also be working at the Ginkgo Mine. Operational workforce of up to 100 employees. Approximately 50% of the operational phase workforce would also be working at the Ginkgo Mine.
Establishment cost	The initial capital cost for the Snapper Mine is estimated to be approximately $114 million.
Likely inter-relationships between the Ginkgo and Snapper Mines	Extensions/sharing of existing Ginkgo Mine infrastructure to the Snapper Mine site. These extensions/sharing involve: • an extension of the existing ETL from the Ginkgo Mine substation; • shared use of the existing mineral concentrate transport route from the Ginkgo Mine to the MSP in Broken Hill; • shared use of the accommodation camp at the Ginkgo Mine to accommodate Snapper Mine workers; and • shared use of the administration office, warehouse and some workshop facilities at the Ginkgo Mine.

* Subject to Project approval

1.3.3 Proponent

The Project is being developed by BEMAX. The Registered principal office of BEMAX is:

BEMAX Resources Limited
Level 14
133 Mary Street
BRISBANE QLD 4000

Telephone: (07) 3210 7900

1.3.4 Capital Investment

The estimated total capital cost for the Snapper Mine is AUD $114 million to produce up to 715,000 tonnes per annum of heavy mineral concentrate.

2 PLANNING PROVISIONS AND PROJECT APPROVAL CONSIDERATIONS

New South Wales Environmental Planning and Assessment Act 1979

Approval for the Snapper Mine would be sought under Part 3A of the EP&A Act. The EP&A Act and EP&A Regulation set the framework for planning and environmental assessment in New South Wales. Part 3A of the EP&A Act provides an approval process that is particularly adapted for major infrastructure projects. The proposed Snapper Mine is considered a project to which Part 3A of the EP&A Act applies under Schedule 1, Group 2 of the *State Environmental Planning Policy (Major Projects), 2005*:

> ***Group 2 Mining, petroleum production, extractive industries and related industries***
>
> *5 Mining*
>
> *(1) Development for the purpose of mining that:*
>
> *(a) is coal or mineral sands mining…*

Given the advanced planning stage of the Snapper Mine, it is considered it does not require concept approval, and therefore a Concept Plan is not required.

Commonwealth Environment Protection and Biodiversity Conservation Act, 1999

The Snapper Mine would be referred to the Commonwealth Minister for the Environment and Heritage. Approval would be sought from the Minister if the proposal is considered a "Controlled Action".

Wentworth Local Environmental Plan 1993

The Project is located within Zone 1(a) (General Rural Zone) within the Wentworth local government area. The objectives of this zone include "*protecting, enhancing and conserving*" agricultural land, soil stability, forests, valuable deposits of minerals, vegetation on sensitive lands, water resources and areas of significance for nature conservation.

Part 2, Clause 9 of the *Wentworth Local Environmental Plan, 1993* provides:

> *Except as otherwise provided by this plan, the Council must not grant consent to the carrying out of development on land to which this plan applies unless the Council is of the opinion that the carrying out of the development is consistent with the objectives of the zone in which the development is proposed to be carried out*.

However, the combined operation of Clause 9 and the objectives of the 1(a) zone is negated by *State Environmental Planning Policy 45 (Permissibility of Mining)* (SEPP 45). Specifically Clause 5(2) of SEPP 45 states:

> *…if mining is permissible on land with development consent in accordance with an environmental planning instrument if the consent authority is satisfied as to certain matters specified in the instrument, mining is permissible on that land with development consent without the consent authority having to be satisfied as to those specified matters*.

2.1 APPROVALS AND LICENCES

Other approvals and licences which are likely to be required include:

- a mining lease under the *Mining Act, 1992*;
- an Environmental Protection Licence under Chapter 3 of the POEO Act for the purposes referred to in Section 43 of the POEO Act; and
- a consent to undertake works on or over a public road under Section 138 of the *Roads Act, 1993*.

3 STAKEHOLDER CONSULTATION

State and Local Government

Consultation with relevant NSW Government agencies commenced in mid 2003.

A Planning Focus Meeting was held on 20 August 2003. The meeting was attended by representatives of the following agencies/bodies:

- Department of Planning (DoP);
- Environment Protection Authority (EPA) (now incorporated within the DEC);
- NSW National Parks and Wildlife Service (NPWS) (now incorporated within the DEC);
- Department of Mineral Resources (now Department of Primary Industries – Mineral Resources [DPI-MR]);
- NSW Agriculture (now Department of Primary Industries – Agriculture [DPI-Agriculture]); and
- Department of Land and Water Conservation (DLWC) (now DNR).

The objective of the Planning Focus Meeting was to familiarise government stakeholders with the development proposal and to identify key issues that should be addressed in the EA. From this consultation, Director-General's requirements were issued for the Project.

Since the time of the Planning Focus Meeting, changes have been made to the assessment and approvals regime which apply to major projects where the Minister has made a declaration relating to the specific development. As stated in Section 2, approval for the Snapper Mine would be sought under Part 3A of the EP&A Act. Accordingly, under Section 75F of the EP&A Act, the Director-General will prepare EARs, which will become the relevant requirements for the Snapper Mine EA.

With respect to local government, the Snapper Mine would be located within the local government area of Wentworth Shire. Wentworth Shire Council have been informed of the proposal for the Snapper Mine and have been informally consulted with regard to land tenure and heritage.

Public Consultation

BEMAX has been engaged in extensive consultation with the local community since the initiation of the Ginkgo Mine exploration programme in 1998. With respect to the Ginkgo Mine, BEMAX has developed a formal ongoing programme of public consultation, on a quarterly basis, with all stakeholders. This programme commenced in July 2001. Further, BEMAX has implemented the *Ginkgo Mineral Sands Project Community Consultation Plan*, in accordance with Ginkgo Mine Development Consent Condition 10.1. The Ginkgo Mineral Sands Project Community Consultation Plan outlines the mechanisms for ongoing consultation, regarding the Ginkgo Mine, with local residents.

At the MSP, consultation with local landholders commenced in September 2001. Further, in accordance with MSP Development Consent Condition 5.3, BEMAX has established a Community Consultation Program to liaise with the community (for the life of the MSP) on matters affecting the local community and the environmental performance of the MSP. The MSP Community Consultation Program involves:

- regular (at least annually) public meetings during which the environmental performance of the MSP is discussed;
- public newsletters issued every 6 months which report on environmental management at the MSP;
- publication of a formal procedure for the MSP to receive public comment and/or complaints; and
- occasional representation by the DoP, DEC, DNR and Broken Hill City Council (BHCC), to discuss issues related to the areas of regulation, operation or interest.

Informal consultation with the local community regarding the Snapper Mine commenced with the initiation of the exploration programme in 1999.

The Snapper Mine is within the Paakantyi (or Bakandji) Aboriginal tribal territory which extends north from the Murray River along the Darling River as far as Bourke. Aboriginal people in the vicinity of the Snapper Mine are represented by the Dareton Local Aboriginal Land Council (LALC), the Barkindji Elders Committee and the Pooncarie Wiimpatya Paakantyi Aboriginal Corporation. These Aboriginal Groups were involved with archaeological surveys associated with the Snapper Mineral Sands Project Proposed Groundwater Bores and Dams Cultural Heritage Assessment (Cupper, 2006), and would continue to be consulted and involved with the Snapper Mine as appropriate.

Formal stakeholder consultation (including the local and broader community) will commence for the preparation of the EA following lodgement of this Project Application.

4 PRELIMINARY ASSESSMENT

This Preliminary Assessment of environmental issues has been undertaken generally in accordance with the draft *Guideline: What is the Level and Scope of Assessment for Major Projects? Preliminary Assessment* (DIPNR, 2005b). Section 4.1 presents key environmental issues and other lower risk environmental issues which have been identified as being relevant to the assessment. With respect to each of the issues presented in Section 4.1, Sections 4.2.1 to 4.2.14 provide:

- a description of the existing environment, where appropriate;
- an analysis of the likely extent and nature of potential impacts; and
- identification of the level and scope proposed for the EA.

This Preliminary Assessment includes consideration of the cumulative impact of the Snapper and Ginkgo Mines and the MSP, where appropriate. In undertaking this preliminary assessment, BEMAX has drawn on:

- experience from key environmental management and impact assessment issues at the operational Ginkgo Mine, located approximately 15 km to the north-east of the Snapper Mine;
- experience from key environmental management and impact assessment issues at the operational MSP, located approximately 170 km to the north of the Snapper Mine; and
- the Snapper Mine Planning Focus Meeting held on 20 August 2003

The Snapper Mine would be a similar development to the Ginkgo Mine, in terms of:

- type of resource to be mined (i.e. mineral sands);
- mining method (i.e. Ginkgo Mine utilises dredge mining;,the Snapper Mine would also utilise dredge mining [at least in part] in combination with dry mining);
- amount of HMC to be obtained from the mine;
- rehabilitation;
- management of sand residues;
- management of back-loaded waste from the MSP; and
- management of overburden.

Further, as stated in Section 1.2.3, the Snapper Mine has been designed to integrate with Gingko Mine ancillary infrastructure and facilities as much as possible. For example, major ancillary infrastructure for the Snapper Mine comprises extensions/sharing of the existing Ginkgo Mine ETL, the mineral concentrate transport route and HAR and sharing the Ginkgo Mine accommodation camp to accommodate Snapper Mine workers. Also, the schedule for the Snapper Mine complements the schedule for the Ginkgo Mine (i.e. operations at the Snapper Mine would begin when ore grades at the Ginkgo Mine start to decline).

4.1 ISSUE IDENTIFICATION

The main activities associated with the development of the Snapper Mine are described in Section 1.

The key potential environmental issues associated with the construction and operation of the Snapper Mine identified by this Preliminary Assessment are summarised in Table 4.

Table 4
Key Environmental Issues and Key Potential Impacts

Key Environmental Issue	Key Potential Impacts
Hydrogeology	• Potential impacts resulting from groundwater abstraction and aquifer recharge on the Darling River, surrounding groundwater users and naturally occurring groundwater features (e.g. The Salt Lakes).
Aboriginal cultural heritage	• Potential impacts resulting from disturbance to places and items that are of significance to Aboriginal people.
Management of back-loaded MSP waste materials	• Potential impacts associated the transport of back-loaded MSP waste materials from the MSP to the Snapper Mine.
Flora	• Potential impacts resulting from vegetation clearance and modification.
Fauna	• Potential impacts resulting from fauna habitat clearance and modification.
Rehabilitation materials management	• Potential impacts resulting from an increase in salinity of overburden and sand residue material due to slurrying with saline groundwater.
Noise	• Potential impacts resulting from the use of mining equipment.
Air Quality	• Potential impacts resulting from the use of mining equipment. • Potential greenhouse gas emissions resulting from the combustion of diesel fuel and indirect greenhouse gas emissions resulting from the use of electricity.
Road Transport	• Assessment of potential traffic impacts, including transport infrastructure requirements.

Other environmental issues that are considered to result in lower risk levels relative to the above key issues include non-Aboriginal cultural heritage, socio-economics, surface hydrology, land resources and visual aspects.

The Snapper Mine is not likely to adversely affect any “environmentally sensitive areas” as defined under the EP&A Regulation.

4.2 KEY ISSUES

4.2.1 Hydrogeology

Existing Environment

The Snapper Mine deposit lies within a large aquifer that extends west to the Great Darling Anabranch, east to the Darling River and south to the Murray River. Groundwater within the aquifer is saline (BEMAX, 2001a). Recharge to the aquifer is thought to come from the Murray Basin margins and leakage from rivers, streams and lakes (Golder Associates Pty Ltd, 2001). The broad, regional surface discharge zone occurs in a 50 km wide corridor north of Lake Victoria to Lake Popiltah and east of the Great Darling Anabranch (*ibid*.). There is a smaller area of discharge in areas of low ground near the southern end of the Darling River (*ibid*.). A surface discharge zone called The Salt Lakes exists about 8 km south of the Snapper Mine site (*ibid*.).

The Snapper and Ginkgo Mines are both underlain by the same aquifer. The Ginkgo Mine's current groundwater licence entitlement permits the extraction of water from the aquifer via a borefield which comprises six production bores. A total of 812 ML of water may be accessed annually by each of these licensed bores.

Likely Extent and Nature of Potential Impacts

During the life of the Snapper Mine, groundwater would be required to supply the:

- overburden slurrying facility;
- ore slurrying system (dry mining);
- requirement to maintain the level of the dredge pond in order to maintain dredge access to the orebody (dredge mining);
- primary concentration unit;
- RO plants;
- salt washing facility;
- WHIMS; and
- potable water.

A hydrogeological assessment of the groundwater aquifer conducted for the Ginkgo Mine (Golder Associates Pty Ltd, 2001) found that:

- the predicted drawdown generated in the vicinity of the Darling River and Great Darling Anabranch river systems would be negligible;
- there would be a small net reduction in the water table over a large area between the Darling River and the Great Darling Anabranch as a result of mining operations, in the order of centimetres;
- the slight reduction in the water table in the vicinity of the site would ultimately have the effect of slightly reducing the flux of saline groundwater to areas of discharge; and
- there would be no increase in the flux of saline groundwater discharging to any surface water bodies as a result of the proposed dredge mining of the orebody, nor would there be any significant changes in the loss of surface water from the Great Darling Anabranch or Darling River to the sand aquifer as a result of the project.

Although the hydrogeological assessment for the Ginkgo Mine predicted small or negligible potential impacts, there may be cumulative impacts on the hydrogeological regime which change the Ginkgo Mine findings described above.

Proposed Level and Scope of Assessment

A hydrogeological impact assessment of the Snapper Mine would be conducted for the EA. The proposed scope of this assessment is described below.

- Examination of the existing groundwater environment, including level, flow direction and quality. Existing hydrogeological investigations in the vicinity of the Snapper Mine would be drawn on.
- Characterisation of the existing hydrogeological regime, including description of features which are not groundwater related (e.g. Traveller's Lake).

- Assessment of the cumulative effects of the Ginkgo and Snapper Mines on the aquifer, including the potential drawdown from and discharge to naturally occurring groundwater features, the Darling River and the Great Darling Anabranch.
- Assessment of potential impacts on the local and regional groundwater regime (including other water users), including the application of numerical modelling, and consideration of the two methods of mining (i.e. dry mining and dredge mining).
- Assessment of the potential impacts (during or after mining) to adjacent and rehabilitated vegetation resulting from the replacement of overburden and sand residues containing entrained saline groundwater. This would be undertaken in collaboration with a flora/rehabilitation specialist.
- Development of a site water balance.
- Development of measures to manage/mitigate/avoid potential impacts.

4.2.2 Aboriginal Cultural Heritage

Existing Environment

Some of the earliest evidence of human occupation of Australia comes from southwestern New South Wales (Bowler *et al*., 1970, 2003; Thorne *et al*., 1999). Stone artefacts found at Lake Mungo, about 100 km to the east of the Snapper mineral sands exploration area, have been dated to around 47,000 years ago. The burials of a male and female at Lake Mungo are 40,000 years old (Bowler *et al*., 2003). People were also at nearby Lake Menindee from 45,000 years ago (Cupper and Duncan, *in press*) and at Lake Victoria on the Murray River by around 21,000 years ago (Gill, 1973).

Aboriginal people of the Barkindji language group occupied the Lower Darling region at the time of first contact with Europeans (Sturt, 1833, 1984 [1844-6]; Mitchell 1839; Eyre, 1985 [1842]; Krefft 1865). This language group comprised people who spoke the sub-dialects Barindji, Barkindji, Danggali, Maraura and Wiljakali (Allen, 1974; Tindale, 1974; Hardy, 1976). These tribes shared similar language and kinship systems, notably the division of members into matrilineal moieties (two-part social classification) known as Mukwara (wedge-tailed eagle) and Kilpara (raven) (Blows, 1995).

The Barkindji were hunter-fisher-gatherers and appear to have had a semi-sedentary lifestyle. Early accounts by the European explorer Gerard Krefft (1865) suggest that the Barkindji lived along the Lower Darling and Murray Rivers during the warmest months of the year, with people moving away from the rivers into the dunefields to collect food after winter rains.

The material record of this occupation is preserved in the archaeological sites of the Lower Darling region, most of which date to the period since the last Ice Age (after around 18,000 years ago) (Hope, 1981; Balme and Hope, 1990; Balme, 1995). All that remains at many of these sites are flakes of stone debris from the making and resharpening of stone tools. These were made both at Aboriginal open habitation areas (camp sites) or special activity areas such as stone knapping sites. As well as being the sites of manufacture and maintenance of stone implements, open habitation areas usually contain evidence of domestic and other activities such as cooking and food preparation. Camp fires or oven hearths are common, marked by calcrete, baked clay, ferricrete, sandstone and silcrete heat retaining stones or hearthstones and charcoal. Organic remains consist of burnt animal bones, emu and aquatic bird eggshell and freshwater mussel shell.

Aboriginal cultural heritage consists of places and items that are of significance to Aboriginal people because of their traditions, observances, customs, beliefs and history (DEC, 2005a). Types of Aboriginal cultural heritage sites which have been previously recorded in the region of the Snapper Mine, and which therefore might be expected to occur in the proposed development areas include (Cupper, 2006):

- open campsites (represented by scatters of stone artefacts);
- hearths (consisting of lumps of burnt clay or stone cobble hearth stones);
- freshwater shell middens (i.e. deposits of shell and other food remains accumulated by Aboriginal people as food refuse);
- earth mounds (which may have been used by Aboriginal people as cooking ovens or as camp sites);
- quarry sites and stone sources (i.e. locations where Aboriginal people obtained raw material for their stone tools or ochre for their art and decoration);
- scarred trees (resulting from slabs of bark having been cut from trees or cuts having been made for toe holds);
- stone arrangements, ceremonial grounds and natural sacred sites; and
- burial grounds.

Cupper (2006) reported that the Australian Heritage Information Management System (AHIMS) database has five registered Aboriginal cultural heritage sites in the vicinity of the Snapper Mine. These sites are presented in Table 5 and shown on Figure 4. These sites are isolated finds of silcrete stone artifacts (DEC site numbers 39-3-0054 to 39-3-0058) recorded by Cupper (2003) during a cultural heritage assessment of the ETL which services the Ginkgo Mine. The closest of these isolated finds is approximately 2 km direction from the proposed extended ETL and approximately 8 km from the Mining Lease Application (MLA) area.

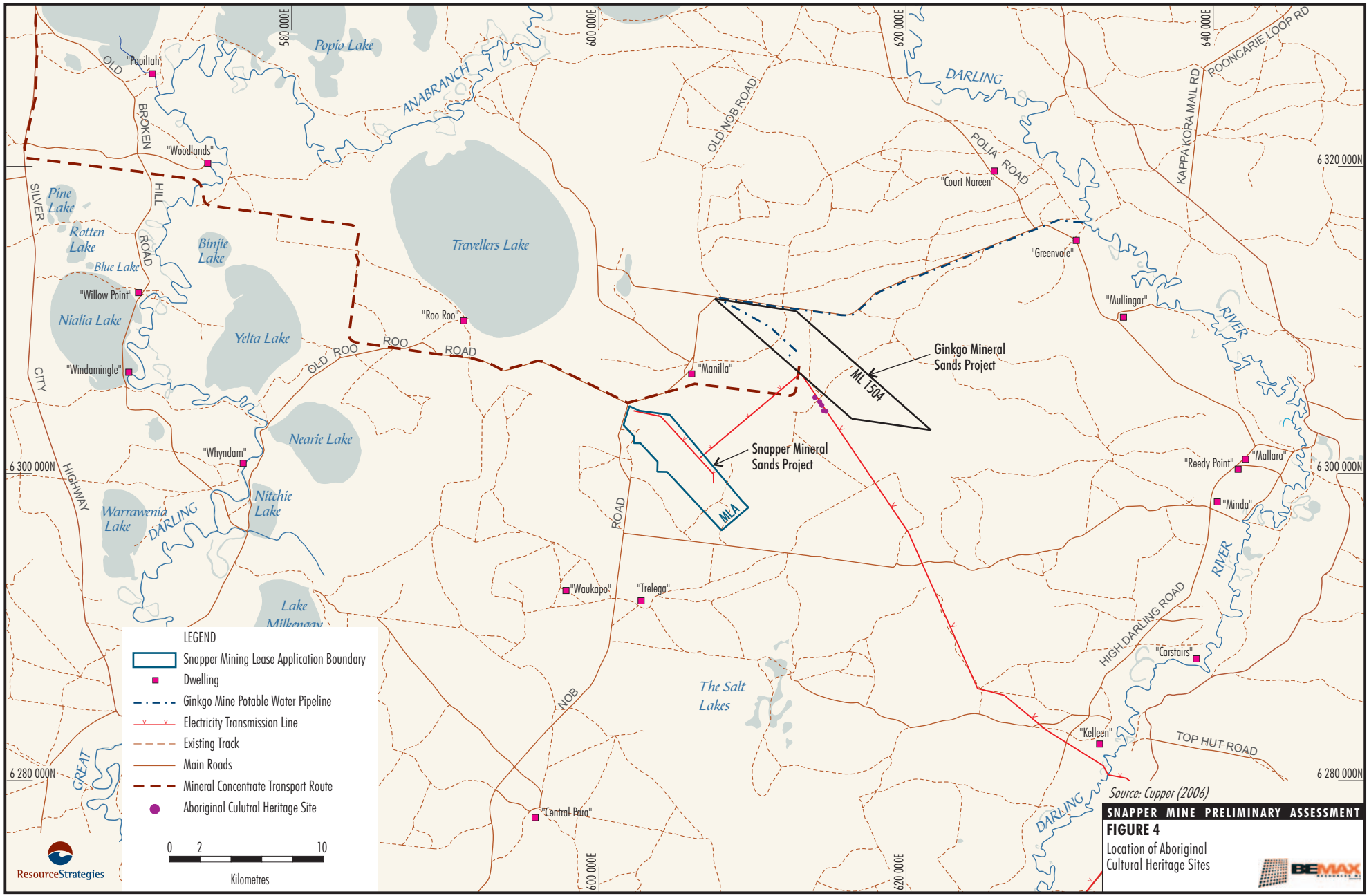
Table 5
Summary Data of AHIMS Aboriginal Archaeological Sites
near the Proposed Snapper Mine Area

DEC Site Number	Type	GDA (mE)	GDA (mN)
39-3-0054	Isolated find of stone artefacts.	614620	6304110
39-3-0055	Isolated find of a stone artefact.	614070	6304970
39-3-0056	Isolated find of stone artefacts.	614380	6304690
39-3-0057	Isolated find of stone artefacts.	614520	6304460
39-3-0058	Isolated find of stone artefacts.	614790	6304070

Source: Cupper (2006)

Likely Extent and Nature of Potential Impacts

Potential impacts on Aboriginal cultural heritage include disturbance to places and items (such as those mentioned above) within the Snapper Mine area.



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Proposed Level and Scope of Assessment

The Aboriginal cultural heritage survey and assessment of the Snapper Mine area would be conducted in accordance with the *Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation* (the Draft Guideline) (DEC, 2005a). The assessment process would also be undertaken with consideration of the *Aboriginal Cultural Heritage Standards and Guidelines Kit* (DEC, 1997). The proposed scope of the Aboriginal cultural heritage assessment is described below.

- A review of DEC databases and any relevant past studies.
- A field survey of the Snapper Mine disturbance area (including the MLA area, ETL route and the mineral concentrate transport route) and surrounds to identify places or items of Aboriginal cultural heritage significance.
- An assessment of any Aboriginal cultural heritage items or places found during the field survey. Assessment would be conducted in accordance with the relevant guidelines.
- Consultation with relevant Aboriginal groups. Consultation would be undertaken prior to, during and following the completion of the field survey component of the Aboriginal cultural heritage assessment. Guidance on consultation with Aboriginal people and communities contained in the *Interim Community Consultation Requirements for Applicants* (DEC, 2004a) would be considered.
- Preparation of an Aboriginal cultural heritage impact assessment report for the EA. The report would include development of measures to manage/mitigate/avoid potential impacts.

4.2.3 Management of Back-loaded MSP Waste Materials

Likely Extent and Nature of Potential Impacts

Waste materials generated from the processing of ore (from both the Snapper Mine and Ginkgo Mine deposits) at the MSP would include silica and quartz from the feed preparation circuit, monazite and silicate minerals from the ilmenite and altered ilmenite (leucoxene) circuits and silicate materials from the zircon and other dry circuits. The monazite fraction of the MSP waste would control the total radiation activity levels of MSP waste.

Based on studies undertaken for the separation and treatment of mineral concentrate from the Ginkgo Mine at the MSP, and given the similarity of the characteristics of the mineral concentrate from the Ginkgo and Snapper Mines, the combined waste materials generated from the MSP is anticipated to be classified as hazardous and/or industrial wastes (i.e. total activity would be more than 100 Becquerels per gram [Bq/g]) under the *Environmental Guidelines: Assessment, Classification and Management of Liquid and Non-liquid Wastes* (DEC, 2004b).

The waste material produced at the MSP would be transported from the MSP in double road trains via the mineral concentrate transport route to the Snapper in the same manner it is transported to the Ginkgo Mine (i.e. in accordance with the *Code of Practice for the Safe Transport of Radioactive Materials, 2001*). The requirement to adhere to this code is specified in Section 25 of the *Radiation Control Regulation 2003*.

The management measures, programmes, policies, procedures, monitoring and reporting documented in the *Ginkgo Mineral Sands Project and Broken Hill Mineral Separation Plant Traffic Code of Conduct*, *Ginkgo Mineral Sands Project and Broken Hill Mineral Separation Plant Transport of Hazardous Materials Plan*, *Ginkgo Mineral Sands Project Landfill Environmental Management Plan*, *Broken Hill Mineral Separation Plant Waste Management Plan* and the *Broken Hill Mineral Separation Plant Emergency Response Plan* would be relevant to Snapper Mine haulage activities.

Proposed Level and Scope of Assessment

Characterisation and assessment of the back-loaded MSP waste materials would be conducted. The scope of the assessment would include:

- a review of available data from radiation testwork conducted to date;
- additional testwork on representative samples;
- characterisation of back-loaded MSP waste materials to be disposed of at the Snapper Mine;
- assessment of the potential impacts associate with transport, handling and disposal of back-loaded MSP waste materials; and
- development of measures to manage/mitigate/avoid potential impacts.

Clause 13 of State Environmental Planning Policy (SEPP) No. 33 (Hazardous and Offensive Development) requires the consent authority, in considering a Development Application for a potentially hazardous or a potentially offensive industry, to take into account:

> *(c) in the case of development for the purpose of a potentially hazardous industry – a preliminary hazard analysis prepared by or on behalf of the applicant…*

Clause 3 of SEPP No. 33 defines potentially hazardous industry as follows:

> ***potentially hazardous industry*** *means a development for the purposes of any industry which, if the development were to operate without employing any measures (including, for example, isolation from existing or likely future development on other land) to reduce or minimise its impact in the locality or on the existing or likely future development on other land, would pose a significant risk in relation to the locality:*
>
> *(a) to human health, life or property, or*
>
> *(b) to the biophysical environment,*
>
> *and includes a hazardous industry and a hazardous storage establishment.*

A Preliminary Hazard Analysis (PHA) would be conducted as part of the EA. The PHA would evaluate the hazards associated with the Snapper Mine (including the hazards associated with transport of waste material from the MSP) in accordance with the general principles of risk evaluation and assessment outlined in the NSW Department of Urban Affairs and Planning (DUAP) *Multi-Level Risk Assessment Guidelines* (1999). The PHA would also address the requirements of SEPP No. 33 and would be documented in general accordance with *Guidelines for Hazard Analysis: Hazardous Industry Planning Advisory Paper No. 6* (DUAP, 1992a).

Assessed risks (including those associated with transport of waste material from the MSP) would be compared to the risk assessment criteria developed in accordance with Australian Standard/New Zealand Standard (AS/NZS) 4360:2004 *Risk Management*. Further, the PHA would consider the criteria provided in *Risk Criteria for Land Use Planning: Hazardous Industry Planning Advisory Paper No. 4* (DUAP, 1992b).

4.2.4 Flora

Existing Environment

Landforms found on and near the study area include low hills, sand ridges, depressed open plains and playa plains (Bower pers. comm. May 2006). Land use in the study area is predominantly livestock grazing of native pastures by sheep and cattle on a Western Lands Lease.

The MLA area comprises of the following vegetation communities and flora habitat (Bower pers. comm. May 2006) (Figure 5):

- Black Box Woodland;
- Belah – Rosewood - Wilga Woodland;
- Mallee - Chenopod Shrubland;
- Mallee - Triodia Shrubland;
- Turpentine Shrubland;
- Bluebush Shrubland; and
- Austrostipa Grassland.

It is considered that these vegetation communities may provide potential habitat for threatened flora species based on:

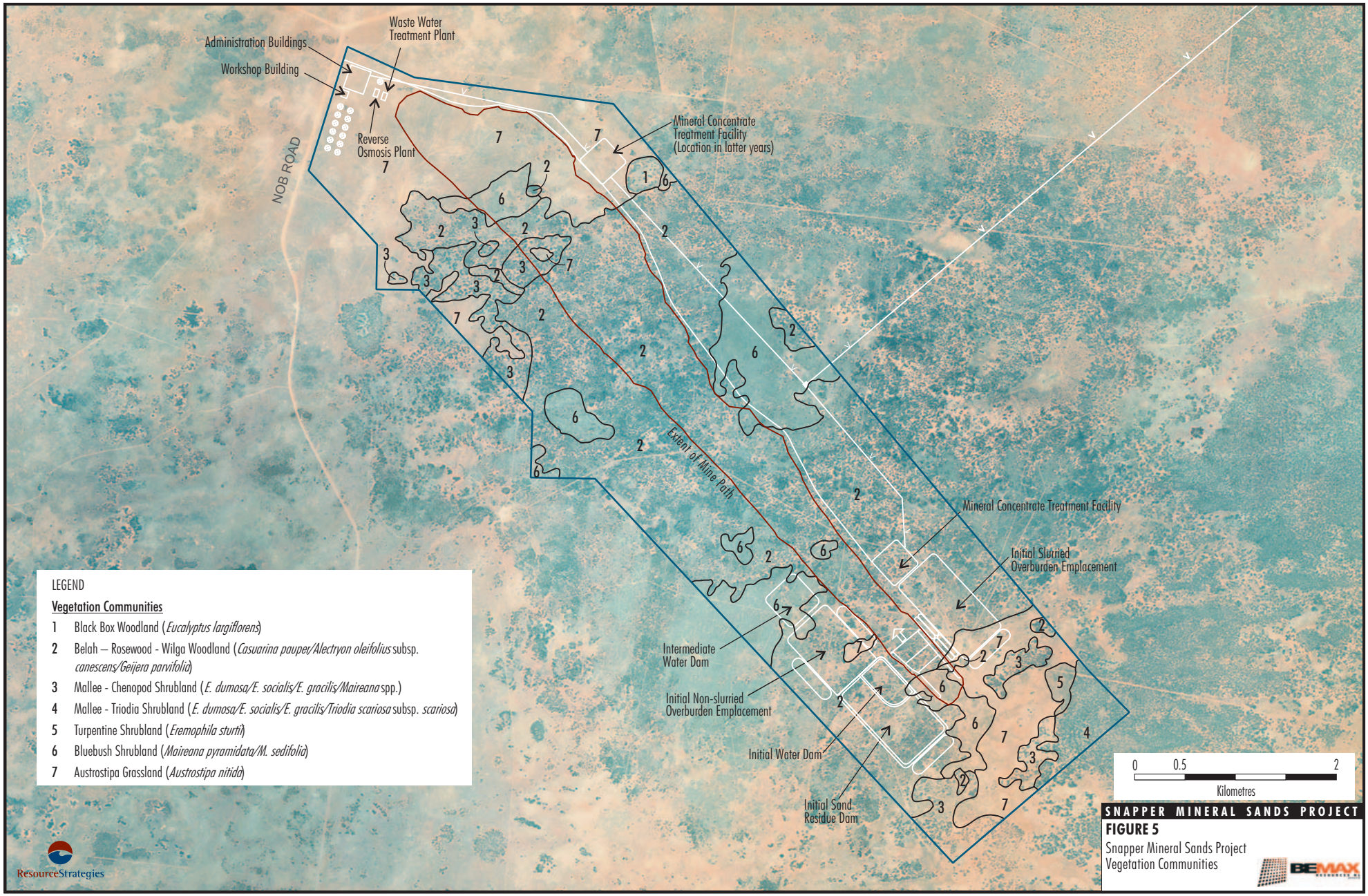
- the schedules of the NSW *Threatened Species Conservation Act, 1995* and Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999*;
- Preliminary and Final Determinations of the NSW Scientific Committee;
- the DEC Atlas of NSW Wildlife (Popiltah, Cuthero, Pooncarie, Bunnerungee, Para and Arumpo 1:100,000 map sheets); and
- the Sydney Royal Botanic Gardens (using a search area of approximately 400 km^2 surrounding the study area).

However, it is noted that the above references do not contain any threatened flora species within approximately 30 km of the study area. In addition, no threatened ecological communities have been recorded within the study area (Bower pers. comm. May 2006).

Likely Extent and Nature of Potential Impacts

Potential impacts on flora include:

- vegetation clearance and modification – limited to mine and infrastructure areas which are predominantly Belah – Rosewood - Wilga Woodland;
- potential for weed introduction without control measures in place;
- potential for impacts from dust generation without control measures in place;
- potential for impacts on threatened flora species; and
- effects on vegetation and flora (e.g. Black Box Woodland) due to changes in hydrogeology /hydrology.



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Proposed Level and Scope of Assessment

Flora specialists (FloraSearch) have been engaged by BEMAX and have recently conducted a flora survey and assessment in accordance with the DEC *Draft Guidelines for Threatened Species Assessment* (DEC, 2005b). FloraSearch would undertake a targeted survey for threatened flora species in spring for species which may be unlikely to occur in autumn. Upon completion, the flora assessment would include the list below.

- Identification of vegetation communities present within the study area.
- Mapping the distribution of vegetation communities by ground survey and Air Photo Interpretation.
- Comprehensive listing of flora species within the study area compiled according to community.
- Targeted searches for threatened flora species, threatened ecological communities and critical habitat (as listed under the schedules of the NSW *Threatened Species Conservation Act, 1995* and Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999*), that may potentially occur in the study area.
- Assessment of the condition of the vegetation.
- Threatened species assessment conducted in accordance with the DEC *Draft Guidelines for Threatened Species Assessment* (DEC, 2005b). It would assess of the magnitude, extent and significance of impacts as related to the conservation importance of habitat, individuals and populations.
- Measures to manage/mitigate/avoid potential impacts.

4.2.5 Fauna

Existing Environment

It is considered that the vegetation communities described in Section 4.2.4, may provide potential habitat for a number of threatened fauna species based on:

- the schedules of the NSW *Threatened Species Conservation Act, 1995* and Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999*;
- Preliminary and Final Determinations of the NSW Scientific Committee;
- the DEC Atlas of NSW Wildlife (Popiltah, Cuthero, Pooncarie, Bunnerungee, Para and Arumpo 1:100,000 map sheets);
- Australian Museum (using a search area of approximately 400 km^2 surrounding the study area);
- Birds Australia (using a search area of approximately 400 km^2 surrounding the study area);
- other fauna studies in the region (eg. Mount King Ecological Surveys, 2001); and
- distribution and habitat descriptions in texts such as the threatened species home page (DEC, 2006).

Threatened fauna species have been recorded within an approximate 30 km radius of the study area and have the potential to utilise habitat within the study area:

Likely Extent and Nature of Potential Impacts

Potential impacts on fauna include:

- fauna habitat clearance and modification;
- potential for weed and animal pest introduction without control measures in place; and
- potential for impacts on threatened fauna species.

Proposed Level and Scope of Assessment

Fauna specialists from Western Research Institute (a consulting arm of Charles Sturt University) have been engaged by BEMAX and have recently begun a fauna survey and assessment in accordance with the DEC *Draft Guidelines for Threatened Species Assessment* (DEC, 2005b). Upon completion, the fauna assessment would include the list below.

- Terrestrial vertebrate fauna survey of the study area.
- A literature search would be conducted to further characterise the faunal characteristics of the study area.
- Targeted surveys for threatened fauna species known or considered possible occurrences within the Study area and surrounds (including those listed in the Schedules of the NSW *Threatened Species Conservation Act*, *1995* and Commonwealth *Environment Protection and Biodiversity Conservation Act*, *1999*).
- Fauna habitat assessment.
- Comprehensive listing of fauna species recorded within the study area.
- Threatened species assessment conducted in accordance with the DEC *Draft Guidelines for Threatened Species Assessment* (DEC, 2005b). It would assess of the magnitude, extent and significance of impacts as related to the conservation importance of habitat, individuals and populations.
- Measures to manage/mitigate/avoid potential impacts.

4.2.6 Rehabilitation Materials Management

Rehabilitation materials include surface and near-surface soils, overburden, sand residues and back-loaded MSP waste materials. A description of the surface and near-surface soils, overburden and sand residues is provided because of their relevance to the rehabilitation of the Snapper Mine. Back-loaded MSP waste materials are described in Section 4.2.3.

Existing Environment

Existing descriptions of the surface and near-surface soils of the Snapper Mine area are limited to the Soil Conservation Service of NSW (1985) broad land systems classification of the Ana Branch region at a scale of 1:250,000 (Land Systems Series Sheet 54-7).

The Snapper Mine area falls within the Trelega, Overnewton, Hatfield and Arumpo land systems (Soil Conservation Service of NSW, 1985) (Figure 6). The features of these land systems are described below:

> *Trelega: level to slightly undulating sandplains and swales of loamy solonised brown soils. Aligned low dunes and low rises of deep brownish sands and calcareous red earths; relief to 3 m. Moderate to dense belah, scattered wilga, mallee and rosewood; dense to scattered pearl and black bluebushes; abundant porcupine grass on dunes; short grasses and forbs.*
>
> *Overnewton: extensive slightly undulating sandplain with isolated sandy hummocks and depressions; relief to 5 m. Sandplains of calcareous loams and sandy loams with moderately dense clumps of belah, rosewood, scattered bluebush and inedible shrubs. Areas of deep brownish sands with white cypress pine or nelia. Abundant short grasses and forbs throughout.*
>
> *Hatfield: extensive, slightly undulating sandplains with isolated small depressions, relief to 10 m. Sandplains of solonised brown soils and sandy red and brown texture-contrast soils with scattered clumps of rosewood and belah, moderate to dense stands of black or pearl bluebush, abundant short grasses and forbs. Areas of deeper sandy soils with scattered white cypress pine and abundant short grasses and forbs. Depressions of grey clays with canegrass, rimmed by scalded red texture-contrast soils.*
>
> *Arumpo: parallel dunes of deep loamy sand to sandy red soils with dense mallee and areas of porcupine grass; relief to 10 m. Narrow swales of calcareous loamy red earths with belah and rosewood, areas of inedible shrub, abundant short grasses and forbs.*

The Ginkgo and Snapper Mine deposits both occur within the Loxton-Parilla Sands host unit. Various sub-units of the Loxton-Parilla Sands are recognised. The Snapper Mine deposit consists of fine to medium grained quartz sands which are generally unconsolidated, well sorted and contain little clay.

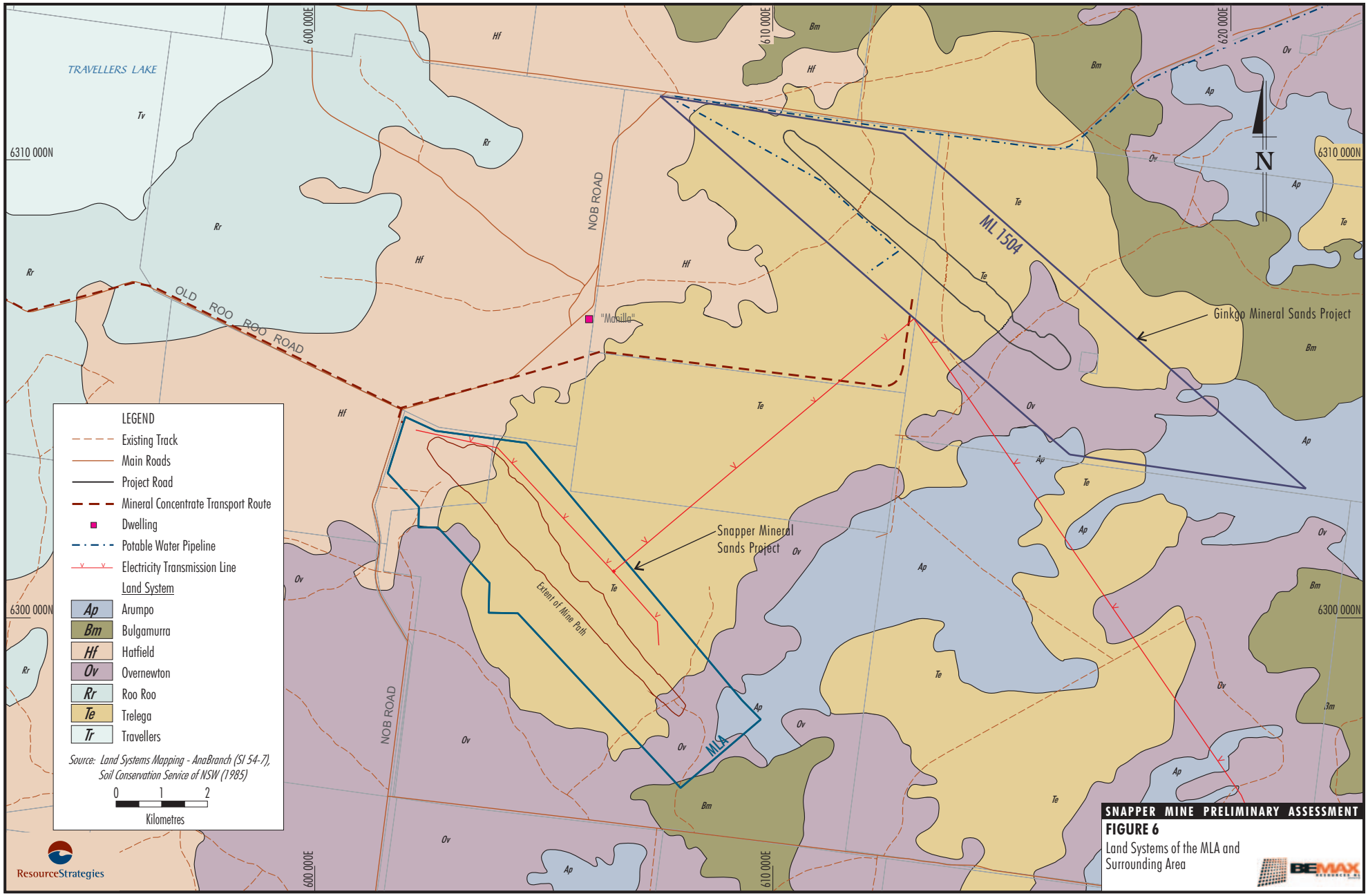
The deposit is overlain on average by 30 to 35 m of overburden, increasing at the northern end where the orebody dips to the north-west. This overburden includes the upper section of the Loxton-Parilla Sands unit (i.e. Loxton-Parilla Sands that do not contain heavy minerals). The Karoonda surface, which is the result of prolonged weathering with little erosion, is generally situated above the Loxton-Parilla Sands unit. The Karoonda surface is overlain by the Blanchetown Clay, which occurs over the entire Snapper Mine deposit and is believed to have been deposited in a lacustrine environment during the Quaternary period. This, in turn, is overlain by between 10 centimetres (cm) and 5 m of unconsolidated sand, representing the Woorinen Formation and aeolian sand dunes developed in the Recent period. The *in situ* profile described above is shown conceptually in Figure 7.

Likely Extent and Nature of Potential Impacts

The physico-chemical nature of overburden material would be altered during the course of the proposed overburden slurrying system. The predominant resultant change would be an increase in salinity of the material due to slurrying with saline groundwater. Similarly, sand residues would also be saline. Potential impacts associated with this change in salinity include potential impacts on vegetation, soil structure and water resources.

Potential impacts of the Snapper Mine on surface and near-surface soils relate primarily to:

- stripping of in situ soil resources within mining disturbance areas;
- alteration of soil structure beneath infrastructure areas (e.g. administration buildings, workshop buildings), stockpile areas (e.g. mineral concentrate and waste material stockpiles) and roads;



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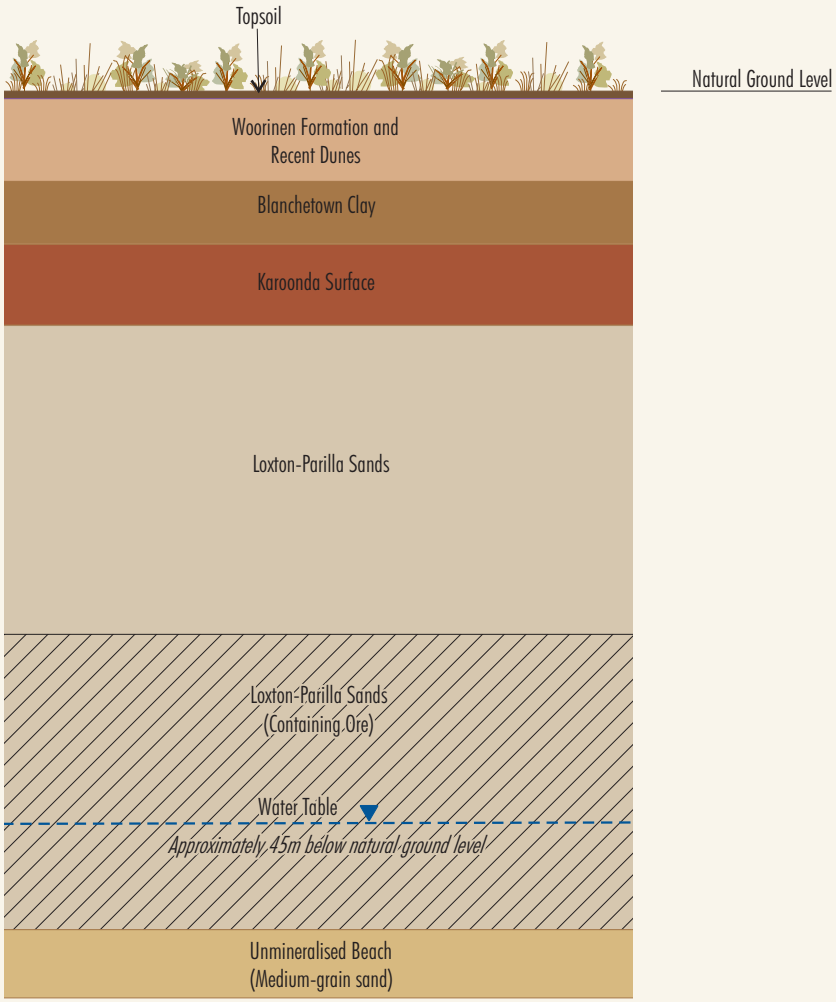
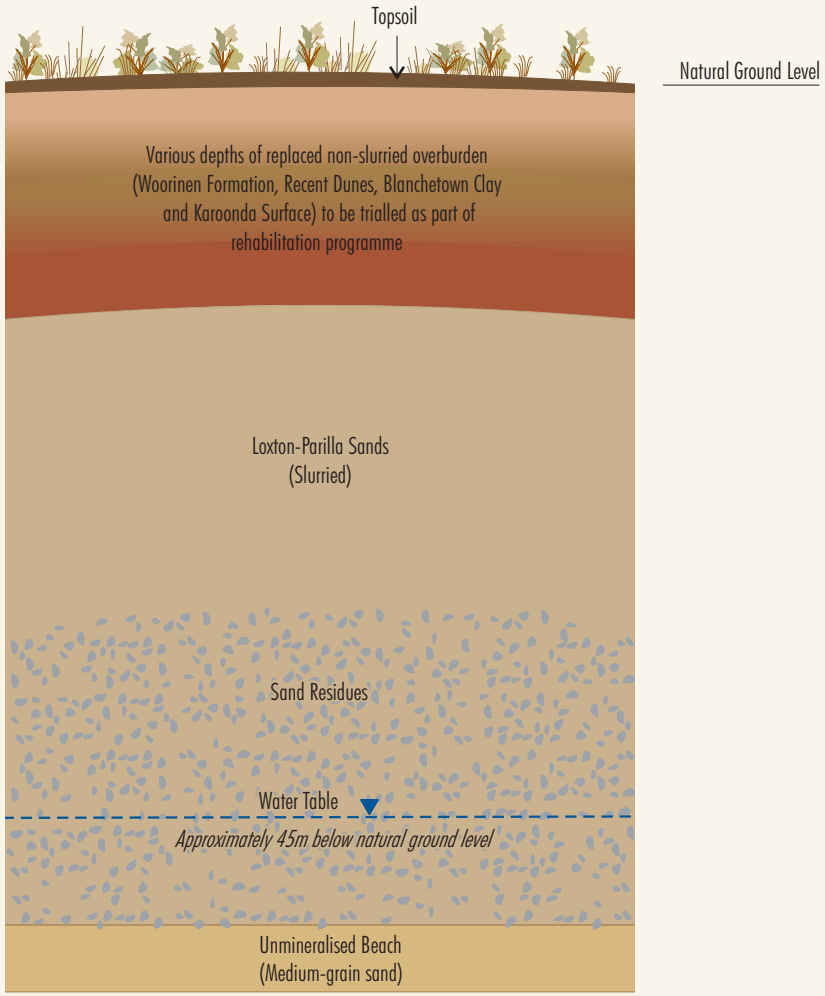
IN SITU MINE PATH CONCEPTUAL PROFILE



REHABILITATED MINE PATH CONCEPTUAL PROFILE



Not to Scale

SNAPPER MINE PRELIMINARY ASSESSMENT

FIGURE 7

Conceptual Cross Section - In Situ and Rehabilitated Mine Path

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- soil contamination as a result of spillage of fuels, lubricants and other chemicals;
- increased erosion and sediment movement due to increased exposure of soils during construction of mine infrastructure; and
- alteration of physical and chemical soil properties (e.g. structure, fertility, microbial activity) during soil stripping and stockpiling operations.

When ore is brought to the surface at mines, often too is the mineral pyrite. Pyrite may react with oxygen and water to form acid, resulting in acid mine drainage (AMD). Minor amounts of pyrite may potentially be contained within the Snapper Mine deposit.

Mineral sands deposits commonly contain a small quantity of the mineral monazite. Monazite liberated at the MSP would be a radioactive substance (in accordance with the *Radioactive Control Regulation 2003*), which is anticipated to be in various reject streams from the MSP, including the leucoxene, zircon and rutile circuits. Section 4.2.4 provides a discussion on the likely extent and nature of potential impacts and the proposed level and scope of assessment relevant to back-loaded MSP waste materials.

Proposed Level and Scope of Assessment

Soil samples from the MLA would be collected and then classified and mapped. The EA would include measures to manage/mitigate/avoid potential impacts on soil resources.

The Environmental Assessment would also include a rehabilitation materials characterisation including assessment of overburden and sand residue characteristics relevant to rehabilitation. The proposed scope of the assessment is provided below.

- A review of available geochemical data from the exploration conducted to date.
- Additional geochemical testwork on representative samples recovered from existing exploration holes (where necessary).
- Physical and geochemical characterisation of waste materials to be handled during the life of the mine (i.e. overburden and sand residues).
- Assessment of geochemical characteristics of the overburden and sand residues. This would include an assessment of the potential for AMD as a result of mining or primary concentration, as well as an assessment of the salinity of replaced overburden and sand residues containing entrained groundwater.
- Development of measures to manage/mitigate/avoid potential impacts.

4.2.7 Noise

Existing Environment

An assessment of the existing noise environment was conducted for the Ginkgo Mine as a component of the Ginkgo Mine EIS (Holmes Air Sciences, 2001a). The assessment found the existing background noise was negligible, with the most significant noise sources likely to be from wildlife.

Noise generated from the Ginkgo Mine and associated traffic would contribute to the existing acoustic environment at the Snapper Mine. The mining method at the Ginkgo Mine utilises an electrically powered dredge, floating plant (primary concentration unit), and overburden slurrying system, therefore noise generated from the mining operation is minimised. Transport noise associated with the Ginkgo Mine was assessed in the Ginkgo Mine EIS and the *Ginkgo Mineral Sands Project Ancillary Infrastructure Modification Statement of Environmental Effects* (BEMAX, 2003b), which found that at the location of the closest dwelling to the HAR the predicted noise levels would comply with the Environmental Criteria for Road Traffic Noise $L_{Aeq(1hour)}$ for a local road in a rural area.

Likely Extent and Nature of Potential Impacts

Noise during the Snapper Mine construction period (approximately 15 months) would be generated by conventional mobile equipment associated with vegetation clearing, excavation of the active mining area, construction of the initial water and sand residue dams, intermediate water dam and initial overburden emplacements and extension of the mineral concentrate transport route and ETL.

Noise from mining the at Snapper Mine would be generated by conventional mobile equipment, such as dozers and scrapers, associated with the dry and dredge mining methods.

Similar to Ginkgo Mine operations, dredge mining at the Snapper Mine would utilise an electrically powered dredge, primary concentration unit, and overburden slurrying system, effectively minimising noise levels from the dredge mining operation.

The Manilla homestead is located between the Snapper and Ginkgo Mines, and would be the closest receptor to the Snapper Mine (i.e. approximately 3 km from the Snapper Mine path). The cumulative effect of the two operations may increase the noise levels experienced at the Manilla dwelling, particularly during the construction phase at the Snapper Mine.

Proposed Level and Scope of Assessment

The NSW EPA *Industrial Noise Policy* (2000) requires project proponents to characterise background noise levels for the project area and surrounds and assess the likely impact of the predicted or measured noise levels from the proposed development. Where noise from project vehicle movements on a public road occurs, the *Environmental Criteria for Road Traffic Noise* (EPA, 1999) applies. Therefore, a noise assessment would be undertaken to review the potential noise issues associated with the Snapper Mine in accordance with the *Industrial Noise Policy* (EPA, 2000) and *Environmental Criteria for Road Traffic Noise* (EPA, 1999). The scope of the assessment would include:

- characterisation of background noise levels;
- assessment of the noise impacts associated with the construction and operation phases;
- consideration of simultaneous operation of the two methods of mining (i.e. dry mining and dredge mining);
- consideration of the cumulative effects of the Snapper Mine and neighbouring land uses (including consideration of the Ginkgo Mine);
- consideration of road traffic noise effects of HMC and back-loaded waste haulage;
- development of a predictive noise model;
- presentation of the results of the modelling as contour plots on a map showing local land use and location of sensitive receptors;

- comparison of the predicted noise levels against relevant criteria; and
- development of measures to manage/mitigate/avoid potential impacts.

4.2.8 Air Quality

Existing Environment

The Snapper Mine lies in a persistently dry, arid climatic zone with mostly uniform rainfall distribution throughout the year. The Bureau of Meteorology collects meteorological data at several stations in the area, and the closest site that has continuous recorded wind speed and direction data is located approximately 100 km south-east of the mine site at Lake Mungo. Wind roses from Lake Mungo indicate a predominance of winds from the south and south-west during summer. Winds from the north and north-east are slightly more common during autumn and spring and are common during winter.

An assessment of the existing air quality was conducted for the Ginkgo Mine as a component of the Ginkgo Mine EIS (Holmes Air Sciences, 2001b). The assessment considered emissions likely to be generated by the Ginkgo Mine include particles that are derived primarily from the mechanical disturbance of soils and overburden, the transport of mineral concentrates and particles from diesel exhausts in activities where diesel powered equipment is used. The operation of site dozers, wind erosion from cleared areas ahead of the active mine area and dredge pond, and mineral concentrate haulage (i.e. traffic generated road dust) would be the most significant sources of dust at the mine site. Modelling undertaken by Holmes Air Sciences (2001b) predicted that dust deposition and concentrations of particulate matter at the nearest residence generated by the Ginkgo Mine would remain within NSW DEC amenity criteria.

Likely Extent and Nature of Potential Impacts

Air quality impacts during the Snapper Mine construction period (approximately 15 months) would be generated by conventional mobile equipment associated with vegetation clearing, excavation of the active mining area, construction of the initial water and sand residue dams, intermediate water dam and initial overburden emplacements and extension of the mineral concentrate transport route and ETL.

Operations at the Snapper Mine would utilise a dry mining method, and the additional conventional mobile equipment may increase dust deposition and concentrations of particulate matter beyond current levels.

The Manilla homestead is located between the Snapper and Ginkgo Mines, and would be the closest receptor to the Snapper Mine. The cumulative effect of the two operations may increase the levels of dust deposition and concentrations of particulate matter currently experienced at the Manilla dwelling, particularly during the construction phase at the Snapper Mine.

The major source of emissions of greenhouse gases associated with the Snapper Mine would be the combustion of diesel fuel (used in diesel-powered equipment). In addition, emissions would occur indirectly from the use of electricity to power mining equipment.

Proposed Level and Scope of Assessment

The *Approved Methods for the Modelling and Assessment of Air Pollutants in New South* Wales (DEC, 2005c) lists the statutory methods for modelling and assessing emissions of air pollutants from stationary sources in NSW. That document is referred to in Part 4: Emission of Air Impurities from Activities and Plant in the *Protection of the Environment Operations (Clean Air) Regulation, 2002* (POEO [Clean Air] Regulation). Industry has an obligation to ensure compliance with the requirements specified in the POEO (Clean Air) Regulation. Therefore, an air quality assessment would be undertaken to review the potential air quality impacts associated with the Snapper Mine. The scope of the assessment would include:

- characterisation of background air quality, including dust deposition and suspended particulates (TSP and PM_{10});
- assessment of the air quality impacts associated with the construction and operation phases;
- consideration of the simultaneous operation of the two methods of mining (i.e. dry mining and dredge mining);
- consideration of the cumulative effects of the Snapper Mine and neighbouring land uses (including consideration of the Ginkgo Mine);
- development of a predictive air quality model;
- presentation of the results of the modelling as contour plots on a map showing local land use and location of sensitive receptors;
- comparison of the predicted dust deposition and suspended particulates levels against relevant criteria; and
- development of measures to manage/mitigate/avoid potential impacts.

The scope of the air quality assessment would also include an assessment of greenhouse gas emissions, as well as the development of measures to manage/mitigate/avoid potential impacts.

4.2.9 Non-Aboriginal Cultural Heritage

Existing Environment

Non-Aboriginal cultural heritage sites in the region of the Snapper Mine primarily relate to the arrival of European graziers and associated industries during the 1800s. Such sites include (Cupper, 2006):

- pastoral sites (e.g. old homesteads, works sheds, shearing sheds, survey markers, etc.);
- transport sites (e.g. small bridges, shipping-related wrecks and historic mileage markers and navigation markers along the Murray and Darling Rivers, etc.); and
- historical features constructed to divert or alter the flow of water including blockbanks and weirs.

The State Heritage Inventory contains items listed by the Heritage Council under the *Heritage Act, 1977*. This includes items listed by local governments and state government agencies. All heritage items listed under Schedule 1 of the Wentworth LEP are contained in the State Heritage Inventory. The NSW State Heritage Inventory site database has 36 listed heritage items within the Wentworth Shire local government area (NSW Heritage Office, 2006). Of these, the closest listing is the Windamingle Homestead, which is approximately 33 km from the proposed development. The State Heritage Inventory also includes some Aboriginal heritage sites (see Section 4.2.2.1 for discussion on Aboriginal heritage sites).

The Australian Heritage Database contains places listed in the World Heritage List, the National Heritage List, the Commonwealth Heritage List and the Register of the National Estate. The Australian Heritage Database site has 24 places listed within Wentworth Shire (Australian Heritage Council, 2006). Twenty-two of these are listed on the Register of National Estate. The Willandra Lakes Region is listed on the Register of National Estate, the World Heritage List and the National Heritage List. The Snapper deposit is located within the Lower Darling and Paroo Rivers Wetlands; approximately 1,500,000 ha listed on the Australian Heritage Database comprising the Darling River System and lakes. Of the remaining places listed on the Australian Heritage Database the closest listing is the Nearie Lake Nature Reserve, which is approximately 17 km from the proposed development, at its closest point. The Australian Heritage Database also includes some Aboriginal heritage sites (see Section 4.2.2.1 for discussion on Aboriginal heritage sites).

The Carstairs Homestead (associated with the “Carstairs” pastoral lease [refer to Section 1.3.1]) is listed as a heritage item under Appendix 5 of the Wentworth Shire Heritage Study (Hassell Planning Consultants Pty Ltd, 1989). The Carstairs Homestead is located adjacent to the Darling River and is approximately 30 km from the proposed development (Figure 3).

Likely Extent and Nature of Potential Impacts

Potential impacts on non-Aboriginal cultural heritage include disturbance to places and items (such as those mentioned above) within the Snapper Mine area.

Proposed Level and Scope of Assessment

A non-Aboriginal heritage survey and assessment would be undertaken for the EA. The proposed scope of the survey and assessment is described below.

- A review of relevant National and State databases and past studies.
- A field survey of the proposed disturbance areas (including the MLA area, ETL route and the mineral concentrate transport route) and surrounds.
- An assessment of heritage items of significance identified during the field survey in accordance with the relevant guidelines, such as the NSW Heritage Manual.
- Preparation of a non-Aboriginal heritage assessment report for the EA. The report would include development of measures to manage/mitigate/avoid potential impacts.

4.2.10 Road Transport

Existing Environment

The main arterial road in the Project area is State Highway No. 22 (Silver City Highway), which provides a sealed north-south route connecting Mildura to the south with Broken Hill in the north (Figure 1). The Silver City Highway forms part of the NSW Roads and Traffic (RTA) approved Road Train Route. In addition, State Road No. 68 provides a north-south arterial route to the east of the MLA area, connecting the township of Wentworth with Menindee in the north (Figure 1). This road is sealed between Wentworth and Pooncarie. Local roads of significance to the Project include Old Roo Roo Road and Nob Road, which provide east-west routes connecting the Silver City Highway with State Road No. 68 (Figure 1).

The haulage of mineral concentrate from the Ginkgo Mine site to the MSP is currently undertaken by a haulage contractor operating a fleet of 55 t payload double road trains (triple road trains may be used later following further economic assessment and after relevant approvals have been obtained). The same haulage fleet and mineral concentrate transport route would also be used to truck mineral concentrate from the Snapper Mine site to the MSP.

The HAR linking both the Ginkgo and Snapper Mine sites with the Silver City Highway comprises an all weather road with a gravel pavement some 10 m wide. The HAR would be extended by approximately 1 km in order to service the Snapper Mine site. Roadworks required to upgrade the mineral concentrate transport route to applicable road safety standards were undertaken as part of the Ginkgo Project. These roadworks included:

- upgrading of an existing section of Old Roo Roo Road, new sections of road on an improved alignment as well as an upgraded crossing of the Great Darling Anabranch;
- intersection upgrades where the HAR meets the Silver City Highway in consultation with the RTA providing right-turn and left-turn improvements based on the RTA Road Design Guide; and
- a Road Safety Audit undertaken along the entire mineral concentrate transport route.

Likely Extent and Nature of Potential Impacts

As stated above, the HAR linking both the Ginkgo and Snapper Mine sites with the Silver City Highway comprises an all weather road with a gravel pavement some 10 m wide, which would be extended by approximately 1 km in order to service the Snapper Mine site.

The construction phase of the mine would generate light traffic associated with the construction workforce and visitors as well as heavy vehicles delivering equipment and consumables. During the operational phase, Snapper Mine traffic would include the workforce, visitors, heavy vehicles delivering consumables and road trains hauling mineral concentrate to the Ginkgo Mine and/or MSP.

During operations at the Snapper Mine, transport of mineral concentrate to the MSP would increase (beyond the existing number of trips from the Ginkgo Mine), given the increase from the approved concentrate haulage of 576,000 tpa for the Ginkgo Mine alone to the combined concentrate haulage of approximately 715,000 tpa from the Snapper and Ginkgo Mines.

Proposed Level and Scope of Assessment

An assessment of the potential impacts of the Snapper Mine on the road infrastructure of the region would be undertaken for the Snapper Mine EA. The scope of the assessment would include:

- characterisation of the existing road transport environment;
- collation of existing traffic count data from Wentworth Shire Council and the RTA;
- consultation with relevant authorities;
- assessment of potential road transport impacts; and
- development of measures to manage/mitigate/avoid potential impacts.

4.2.11 Socio-Economics

Existing Environment

The Snapper Mine is located in Wentworth Shire within the Murray Darling Statistical Division of NSW. The shire covers some 26,000 km^2 and is bordered by the South Australian border to the west, the Murray River to the south, Balranald Shire to the east and Central Darling and the NSW Unincorporated Area to the north (Figure 1).

Wentworth is the largest town in the Shire and has a population of some 1435 people (ABS, 2001). Other smaller towns in the shire located near the Snapper Mine include Dareton (population 620), and Pooncarie (population 202). Pooncarie is located some 40 km east of the mine site and is the nearest town. Wentworth and Dareton would be of significance to the Snapper Mine because of their capacity to provide employees, accommodation facilities and services to the mine.

While not located within the Wentworth Shire, the city of Broken Hill (population approximately 20,000) is expected to supply much of the Snapper Mine labour force due to its long mining history. The city is located some 160 km north of the mine site in the Far Western region of NSW. Also located outside of Wentworth Shire but of significance to the Snapper Mine is the city of Mildura (Victoria) which is a major regional retail centre located some 30 km south of Wentworth and some 75 km south of the mine site.

The Ginkgo Mine currently has an operational workforce of approximately 55 BEMAX employees and approximately 45 contractors. Approximately 70% of the BEMAX employees and 70% of the contractors are from the Broken Hill, Wentworth Shire and the Murray Darling and Far West Regions.

Likely Extent and Nature of Potential Impacts

The Snapper Mine would share a significant labour workforce component with the Ginkgo Mine, including general management, mine planning, geological supervision, environment, safety, catering and major maintenance personnel.

The construction phase of the Snapper Mine would require a workforce averaging around 90 people with a maximum of approximately 145 employees required during the peak 2-3 months of construction activity. Approximately 25-50% of the construction phase workforce would also be working at the Ginkgo Mine. Both local and non-local workers would be employed during the construction of the Snapper Mine. The majority of the mine site construction workforce would be housed in the accommodation camp, at the Ginkgo Mine. No significant demands on existing social infrastructure would be expected during the construction phase other than short term accommodation requirements (during the first three months of construction whilst the Ginkgo Mine accommodation camp is being expanded). There may also be a slight increase in the demand on medical services in the region as a result of the additional regional population.

An operational workforce of some 100 employees is anticipated. Approximately 50% of the operational phase workforce would also be working at the Ginkgo Mine. It is expected that on average 70% of the operational positions created by the Snapper Mine would be filled from Broken Hill, Wentworth Shire and the Murray Darling and Far West Regions. The limited number of incoming non-local workers and the expected settlement of these workers in the larger regional towns limits the potential local impacts of the Snapper Mine on community infrastructure and services during the operational phase. Potential impacts could include a slight increase in the demands for health care, emergency services and fire brigade services because of the increased population at the mine site

It is likely that the Snapper Mine would be able to draw on the existing pool of unemployed people in both Broken Hill and the Wentworth Shire.

Proposed Level and Scope of Assessment

An assessment of the potential impacts of the Snapper Mine on the social and community infrastructure of the region would be undertaken, drawing from a range of information sources such as the Australian Bureau of Statistics and local councils.

The scope of the assessment would include:

- a cost benefit analysis;
- a regional economic impact analysis; and
- development of measures to manage/mitigate/avoid potential impacts.

4.2.12 Surface Hydrology

Existing Environment

The Snapper Mine is located within the lower Darling River system, which extends from the Menindee Lakes to the junction of the Darling River and the Murray River at Wentworth. Also included in the lower Darling River system are numerous ephemeral wetland systems that are linked to the Darling River and the Great Darling Anabranch.

As a result of the limited and well dispersed annual rainfall, the sandy soils, limited topographical relief and high evaporation rates, no significant drainage lines are located on the Snapper Mine area. Overland flow does occur during prolonged rainfall events and surface waters accumulate in topographic depressions and then evaporate or seep into the groundwater table over time. Given the lack of surface water bodies in the MLA and major ancillary infrastructure areas, no surface water quality data is available.

Likely Extent and Nature of Potential Impacts

The potential impacts of the Snapper Mine on surface water systems would be limited due to the location of the mine site away from any significant, well-defined surface water features. The Darling River and the Great Darling Anabranch are significant regional surface water features which, at their closet points, are located some 27 km south-east and 23 km north-west of the Snapper Mine, respectively.

There may be limited potential contamination risks to surface water resources such as diesel/oil spills from mobile equipment and sediment/salt runoff from infrastructure areas.

Proposed Level and Scope of Assessment

Given the limited potential impacts described above, a detailed surface water assessment is not proposed to be undertaken for the EA. However, the EA would include measures to manage/mitigate/avoid potential contamination risks to surface water resources.

4.2.13 Land Resources

Existing Environment

The Project area is largely characterised by rangelands and the dominant landuse is light intensity grazing. The mine site is located on two pastoral properties ("Carstairs" and "Trelega") (Figure 3).

A preliminary agricultural suitability assessment for the mine site has been conducted in accordance with the five class system (Riddler, 1996), which classifies land according to its productivity for a wide range of agricultural activities. The only class identified within the MLA area is Class 4.

Class 4 agricultural suitability is defined as:

> *Land suitable for grazing but not cultivation. Agriculture is based on native pastures or improved pastures established using minimum tillage techniques. Production may be high seasonally but the overall level of production is low as a result of a number of major constraints, both environmental and edaphic* (Cunningham *et al*., undated).

Climatic and physical limitations preclude the establishment of improved pastures on MLA area soils.

A preliminary rural land capability assessment has been conducted in accordance with the standard NSW eight class system. This system is based on the assessment of biophysical characteristics categorising land in terms of its general limitations such as erosion hazard, climate and slope. Land is classed based on the limitations to a particular type of landuse (Emery, 1985). The only class identified in the MLA area is Class VI.

Class VI Capability is defined as:

> *Land not capable of being cultivated but suitable for grazing with soil conservation practices including limitation of stock, broadcasting of seed and fertiliser, prevention of fire and destruction of vermin. This class may require some structural works* (Cunningham *et al*, undated).

Likely Extent and Nature of Potential Impacts

With respect to land resources, the Snapper Mine has the potential to alter:

- topography and landscape features;
- soils and erosion potential (refer to Section 4.2.6);
- landuse/capability;
- land contamination status; and
- the level of bushfire hazard.

Proposed Level and Scope of Assessment

The EA would include measures to manage/mitigate/avoid potential impacts to land resources as appropriate. Further, the EA would include rehabilitation proposals to limit impacts to land resources (refer to Section 4.2.6). Therefore, an assessment of the abovementioned potential impacts of the Snapper Mine on land resources would be included in the EA rehabilitation proposal and the proposed rehabilitation materials management study (Section 4.2.6).

4.2.14 Visual

Existing Environment

The Snapper deposit is located within an area of low hills, sand ridges, depressed open plains and playa plains. The landscape is characterised by native grasses, low growing Bluebush and Turpentine shrublands (1.5 m high), Mallee Trioda and Mallee Chenopod shrublands, Belah woodlands and Black Box woodland vegetation communities (up to 15 m in height).

Likely Extent and Nature of Potential Impacts

Public viewpoints of these components would be available along Nob Road and Old Roo Roo Road. However, the likely number of viewers would be limited due to the sparse settlement patterns and road works. Further, the initial overburden emplacements, sand residue dam and initial water dam would be rehabilitated early in the mine life.

The Manilla homestead would be the closest residence to the Snapper Mine and is located some 3 km away within a slight topographical depression. Views from Manilla homestead would therefore be limited.

Further, rehabilitation of mine landforms (Section 4.2.6) would inherently minimise visual impacts.

Proposed Level and Scope of Assessment

Given the limited potential impacts described above, a detailed visual assessment is not proposed to be undertaken for the EA. However, the EA would include measures to manage/mitigate/avoid potential impacts as appropriate.

4.3 LEVEL AND SCOPE OF ASSESSMENT

The key potential environmental issues associated with the construction and operation of the Snapper Mine identified by this Preliminary Assessment are summarised in Table 6 along with the key proposed EARs.

Table 6
Key Environmental Issues, Key Potential Impacts and Proposed Environmental Assessment Requirements

Key Environmental Issue	Key Potential Impacts	Proposed Environmental Assessment Requirements
Hydrogeology	• Potential impacts resulting from groundwater abstraction and aquifer recharge on the Darling River, surrounding groundwater users and naturally occurring groundwater features (e.g. The Salt Lakes).	• Modelling of potential impacts on the natural groundwater levels and flows, including potential cumulative impacts that may arise from the combined operation of the Snapper and Ginkgo Mines. • Development of a site water balance. • Measures proposed to minimise impact on natural groundwater features and landholder water supply.
Aboriginal cultural heritage	• Potential impacts resulting from disturbance to places and items that are of significance to Aboriginal people.	• Assessment of potential impacts on Aboriginal cultural heritage.
Management of back-loaded MSP waste materials	• Potential impacts associated with the transport of back-loaded MSP waste materials from the MSP to the Snapper Mine.	• Assessment of the potential impacts associated with transport, handling and disposal of back-loaded MSP waste materials.
Flora	• Potential impacts resulting from vegetation clearance and modification.	• Assessment of potential impacts on critical flora habitats, threatened flora species, populations, ecological communities and native vegetation, including potential cumulative impacts that may arise from the combined operation of the Snapper and Ginkgo Mines. • Measures to ensure that there is no net loss of flora values in the area in the medium to long term, including a comprehensive vegetation offset strategy.
Fauna	• Potential impacts resulting from fauna habitat clearance and modification.	• Assessment of potential impacts on critical fauna habitats, threatened fauna species, populations, ecological communities and native vegetation, including potential cumulative impacts that may arise from the combined operation of the Snapper and Ginkgo Mines. • Measures to ensure that there is no net loss of fauna values in the area in the medium to long term.
Rehabilitation Materials Management	• Potential impacts resulting from an increase in salinity of overburden and sand residue material due to slurrying with saline groundwater.	• A justification for the proposed final land form and use in relation to the strategic land use objectives. • A detailed description of how the site would be progressively rehabilitated and integrated into the offset strategy for the project. • Measures which would be put in place for the long – term management of the site (and any offset areas) following cessation of mining.
Noise	• Potential impacts resulting from the use of mining equipment.	• Assessment of potential noise impacts, including road traffic noise and potential cumulative impacts that may arise from the combined operation of the Snapper and Ginkgo Mines.

Table 6 (Continued)
Key Environmental Issues, Key Potential Impacts
and Proposed Environmental Assessment Requirements

Key Environmental Issue	Key Potential Impacts	Proposed Environmental Assessment Requirements
Air Quality	• Potential impacts resulting from the use of mining equipment. • Potential greenhouse gas emissions resulting from the combustion of diesel fuel and indirect greenhouse gas emissions resulting from the use of electricity.	• Assessment of potential air quality impacts, including potential cumulative impacts that may arise from the combined operation of the Snapper and Ginkgo Mines. • Assessment of potential greenhouse gas emissions.
Road Transport	• Potential impacts resulting from increased road traffic movements associated with haulage of Snapper Mine HMC and back-loaded MSP waste materials.	• Assessment of potential traffic impacts, including transport infrastructure requirements.

Other environmental issues that are considered to result in lower risk levels relative to the above key issues include non-Aboriginal cultural heritage, socio-economics, surface hydrology, land resources and visual aspects.

5 REFERENCES

Allen, H. (1974). The Bagundji of the Darling Basin: cereal gatherers in an uncertain environment. *World Archaeology* 5: 309-322.

Australian Heritage Council (2006). *Australian Heritage Database Search Results*. Website: http://www.deh.gov.au/cgi-bin/ahdb/search.pl. Date retrieved: 15 May 2006.

BEMAX Resources Limited (BEMAX) (2001a). *Ginkgo Mineral Sands Project Environmental Impact Statement*.

BEMAX Resources Limited (BEMAX) (2001b). *Broken Hill Mineral Separation Plant Environmental Impact Statement*.

BEMAX Resources Limited (BEMAX) (2003a). *Snapper Feasibility Study*.

BEMAX Resources Limited (BEMAX) (2003b). *Ginkgo Mineral Sands Project Ancillary Infrastructure Modification Statement of Environmental Effects*.

BEMAX Resources Limited (BEMAX) (2005). *Broken Hill Mineral Separation Plant August 2005 Modification Statement of Environmental Effects*.

Balme, J. (1995). 30,000 years of fishery in western New South Wales. *Archaeology in Oceania* 30: 1-21.

Balme, J. and Hope, J. (1990). Radiocarbon dates from midden sites in the lower Darling River area of western New South Wales. *Archaeology in Oceania* 25: 85-101.

Blows, J.M. (1995). *Eagle and Crow: An Exploration of an Australian Aboriginal Myth*. Garland Publishing, New York.

Bowler, J.M., Jones, R., Allen, H. and Thorne, A.G. (1970). Pleistocene human remains from Australia: a living site and human cremation from Lake Mungo, western New South Wales. *World Archaeology* 2: 39-60.

Bowler, J. M., Johnston, H., Olley, J. M., Prescott, J. R., Roberts, R. G., Shawcross, W. & Spooner, N. A. (2003). New ages for human occupation and climatic change at Lake Mungo, Australia. *Nature* 421: 837-840.

Cupper, M.L. (2003). *Archaeological and Aboriginal Heritage Survey: Ginkgo Mineral Sands Project Ancillary Infrastructure Modification*. Report prepared for BEMAX Resources Limited.

Cupper, M.L. (2006). *Snapper Mineral Sands Project - Proposed Groundwater Bores and Dams Cultural Heritage Assessment*. Report prepared for BEMAX Resources Limited.

Cupper, M.L. and Duncan, J. (in press). *Last glacial megafaunal death assemblage and early human occupation at Lake Menindee, southeastern Australia*. Quaternary Research.

Department of Environment and Conservation (DEC) (1997). *Aboriginal Cultural Heritage Standards and Guidelines Kit*.

Department of Environment and Conservation (DEC) (2004a). *Interim Community Consultation Requirements for Applicants*.

Department of Environment and Conservation (DEC) (2004b). *Environmental Guidelines: Assessment, Classification and Management of Liquid and Non-liquid Wastes.*

Department of Environment and Conservation (DEC) (2005a). *Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation*.

Department of Environment and Conservation (DEC) (2005b). *Draft Guidelines for Threatened Species Assessment*.

Department of Environment and Conservation (DEC) (2005c). *Approved Methods for the Modelling and Assessment of Air Pollutants in New South* Wales.

Department of Environment and Conservation (DEC) (2006). *Threatened Species*. Website: http://www.threatenedspecies.environment.nsw.gov.au/index.aspx . Date retrieved: 31 May 2006.

Department of Infrastructure Planning and Natural Resources (DIPNR) (2005a). *Steps in the Assessment and Approval of Major Projects under Part 3A.*

Department of Infrastructure Planning and Natural Resources (DIPNR) (2005b). *Guideline: What is the Level and Scope of Assessment for Major Projects? Preliminary Assessment.*

Department of Urban Affairs and Planning (DUAP) (1992a). *Hazardous Industry Planning Advisory Paper No. 6 – Guidelines for Hazard Analysis*.

Department of Urban Affairs and Planning (DUAP) (1992b). *Hazardous Industry Planning Advisory Paper No 4 – Risk Criteria for Land Use Safety Planning*.

Department of Urban Affairs and Planning (DUAP) (1999). *Multi-Level Risk Assessment*. Revised Edition.

Environment Protection Authority (EPA) (1999). *Environmental Criteria for Road Traffic Noise*.

Environment Protection Authority (EPA) (2000). *Industrial Noise Policy.*

Eyre, E.J. (1985 [1842]). *Reports and letters to Governor Grey from E.J. Eyre at Moorunde*. Sullivan's Cove, Adelaide.

Golder Associates Pty Ltd (2001). *Hydrogeological Assessment of the Ginkgo Mineral Sands Project*. Report prepared for BEMAX Resources Limited.

Hardy, M.E. (1976). *Lament for the Barkindji: The vanished tribes of the Darling River region*. Rigby, Adelaide.

Hassell Planning Consultants Pty Ltd (1989). *Wentworth Shire Heritage Study*. Prepared for Wentworth Shire Council. Prepared in association with Colin Pardoe.

Holmes Air Sciences (2001a) *Noise Assessment Ginkgo Mineral Sands Project, NSW.*

Holmes Air Sciences (2001b) *Air Quality Assessment Ginkgo Mineral Sands Project, NSW.*

Hope, J. (ed.). (1981). *Darling Surveys 1*. Department of Prehistory, Research School of Pacific Studies, Australian National University.

Krefft, G. (1865). On the manners and customs of the Aborigines of the Lower Murray and Darling. *Transactions of the Philosophical Society of New South Wales* 1862-1865: 357-374.

Mitchell, T.L. (1839). *Three expeditions into the interior of Eastern Australia*. T. and W. Boone, London.

Mount King Ecological Surveys (2001). *Ginkgo Mineral Sands Project Fauna Assessment*.

NSW Heritage Office (2006). *Statutory Listed Items*.
Website: http://www.heritage.nsw.gov.au/07_subnav_01_1.cfm.
Date retrieved: 15 May 2006.

Soil Conservation Service of NSW (1985). *Land Systems Series Sheet 54-7*.

Sturt, C.N. (1833). *Two Expeditions into the interior of Southern Australia during the years 1828, 1829, 1830 and 1831*. Smith Elder, London.

Sturt, C.N. (1984 [1844-6]). *Journal of the Central Australian Expedition*. (Edited J. Waterhouse). Caliban Books, Dover, NH.

Tindale, N.B. (1974). *Aboriginal Tribes of Australia: their terrain, environmental controls, distribution, limits and proper names*. University of California, Berkeley, CA.

Thorne, A., Grün, R., Mortimer, G., Simpson, J.J., McCulloch, M., Taylor, L. and Curnoe, D. (1999). Australia's oldest human remains: age of the Lake Mungo Skeleton. *Journal of Human Evolution* 36: 591-692.