

BEMAX
RESOURCES LIMITED

SNAPPER MINERAL SANDS MINE

WASTE MANAGEMENT PLAN

FEBRUARY 2008
Document No. WAMP-R01-B

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1 INTRODUCTION

Bemax Resources Ltd (Bemax) is the proponent of the Snapper Mineral Sands Project (the Project). The Project is located approximately 50 km west of the township of Pooncarie in western New South Wales (NSW) and approximately 10 km to the south-west of the Ginkgo Mine. The Project includes the Snapper Mine Lease, and short extensions to the mineral concentrate transport route and electricity transmission line (Figure 1).

1.1 OBJECTIVES AND PURPOSE

This Waste Management Plan (WAMP) has been prepared as a requirement of Development Consent Condition 6 of Schedule 3 for the Snapper Mineral Sands Mine (Table 1). The WAMP details procedures for the management of waste generated from the operation of the Snapper Mine and the landfilling of production waste returned to the mine from the Broken Hill MSP.

The first objective of the WAMP is to establish a suitable waste management strategy that complies with the Development Consent Conditions, by:

- Identifying streams and quantities of waste to be generated from activities at Snapper;
- Detailing waste management strategies for minimising, reusing/recycling and disposing of waste from Snapper;
- Establishing waste handling and collection protocols including waste tracking procedures; and
- Formulating a waste monitoring program;

The second objective of this WAMP is to establish a management strategy for process waste materials from the MSP to be landfilled at the Snapper Mine which fulfils the relevant Development Consent Conditions, via:

- Identifying and classifying waste materials;
- Formulating a waste management program describing procedures and protocols for the handling of and disposal of waste materials;
- Monitoring waste movements;
- Implementing an ongoing environmental monitoring program; and
- Detailing performance reporting and review requirements.

1.2 STRUCTURE OF THE PLAN

The WAMP is structured as follows:

- Section 1: Introduction - Outlines the objectives and structure of the plan. Details the applicable waste legislation and definitions for classifying waste.
- Section 2: General Waste Management Program – Identifies the types of waste expected to be generated during the operation of the MSP and details a waste management strategy for managing this waste. Includes waste handling and collection requirements.
- Section 3: Process Waste Management Programs – Identifies the streams of process waste expected to be generated from the separation process of the MSP and

details the strategy for managing this waste. Includes the requirements for the tracking of waste.

Section 4: Reporting - Outline the reporting processes in relation to waste management.

Section 5: Training – Outlines the training requirements for Snapper personnel in relation to waste management.

Section 6: References

Table 1 presents the Development Consent Conditions relevant to the WAMP and indicates which section of the plan addresses each condition.

**Table 1.
Development Consent Conditions Relevant to the WAMP**

Development Consent Condition		Where Addressed
Schedule 3	Waste Management	
6	The Proponent shall prepare and implement a Waste Management Plan for the project to the satisfaction of the Director-General. This plan must:	
	(a) be prepared in consultation with the DECC by suitably qualified expert/s whose appointment/s have been approved by the Director-General,	
	(b) be submitted to the Director-General for approval prior to carrying out any development on the site;	
	(c) include:	
	<ul style="list-style-type: none"> • Landfill Management Measures; and • Waste Minimisation Measures. 	All Sections All Sections
7	The Landfill Management Measures must:	
	(a) generally meet the environmental goals listed in <i>Environmental Guidelines: Solid Waste Landfills</i> (DEC, 1996 or its latest version) and;	Section 3.2
	(b) include:	
	<ul style="list-style-type: none"> • design and operation details of waste disposal areas; • a management program for backloaded MSP process waste; • a system to monitor the movement of backloaded MSP waste; and • disposal techniques and handling practices consistent with the <i>Code of Practice and Safety Guide for Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing</i> (ARPANSA, 2005 or its latest version). 	Section 3.4 Section 3.2 Section 3.2 Section 3
8	The Waste Minimisation Measures must:	
	(a) identify the various waste streams of the project;	Section 2.2
	(b) describe what measures would be implemented to reuse, recycle or minimise the waste generated by the project; and	Section 2.3
	(c) include a program to monitor the effectiveness of these measures.	Section 2.5 & 4
	<i>Note: The waste minimisation measures are not relevant to backloaded MSP process waste, overburden or sand residues.</i>	

1.3 WASTE REGULATIONS

1.3.1 Waste Minimisation and Management Act and Protection of the Environment Operations Act

The *Waste Minimisation and Management Act (1995)* provides the statewide framework for waste minimisation. This act introduced the scheme for licensing waste facilities, where wastes that pose a threat to the environment is required to be licensed to ensure the waste is handled, stored, treated and disposed of appropriately. In 1999, the waste licensing provisions of the act were transferred to the *Protection of the Environment Operations Act, (1997) (Operations Act)*. Schedule 1 of the *Operations Act* defines who is required to hold a licence and provides definitions for waste classification. Further to this, under the *Operations Act* is the *Protection of the Environment Operations (waste) Regulation, 2005 (Waste Regulation)*, which contains environmental obligations for non-licensed waste.

1.3.2 Waste Classification

The *Environmental Guidelines: Assessment, Classification & Management of Liquid and Non-liquid Wastes* (DECC, 1999) (the Guidelines), provides the guidelines for assessing and classifying waste as specified in Schedule 1 of the *Operations Act*.

Under the Guidelines, a non-liquid waste material can be classified as inert, solid, industrial or hazardous and a liquid waste can be classified as hazardous, Group A, Group B, Group C or non-controlled aqueous liquid. Table 2 provides examples of waste materials that have already been classified by the DECC (formerly Environment Protection Authority) in accordance with the guidelines. These waste do not have to be re-assessed under the guidelines.

Table 2.
Waste Classification of Liquid and Non-Liquid Waste

Waste Classification	Waste Classification	Waste Types
Non liquid	Inert	<ul style="list-style-type: none"> - Virgin excavated natural material - Building and demolition waste - Asphalt Waste - Office and packaging waste - Used tyres
	Solid	<ul style="list-style-type: none"> - Municipal Waste (e.g. household domestic waste) - Drained crushed oil filters, absorbents - Food Waste - Vegetative Waste - Non-chemical waste from manufacturing and services (metal, timber, plastic, paper)
	Industrial	<ul style="list-style-type: none"> - Stabilised asbestos waste - Asbestos fibre and dust - Non-liquid Radioactive waste that emits ionising radiation spontaneously and has an activity ratio >1

Waste Classification	Waste Classification	Waste Types
	Hazardous	<ul style="list-style-type: none"> - 'Waste that meets the Transport of Dangerous Goods' code (e.g explosives, flammable solids) - Pharmaceuticals and poisons - Radioactive waste that emits ionising radiation spontaneously, has a specific activity ratio >100 and consists of radioactive element listed in <i>Schedule 1 of Radiation Control Regulation (2003)</i>.
Liquid	Group A	<ul style="list-style-type: none"> - Non-aqueous liquid waste, liquid other than water constitutes 20% or more of the volume (eg oil, solvents) - Controlled aqueous liquid waste
	Group B	<ul style="list-style-type: none"> - Liquid food waste - Liquid grease trap waste
	Group C	<ul style="list-style-type: none"> - Liquid waste from human waste storage facilities or waste treatment devices (e.g. septage).
	Hazardous	<ul style="list-style-type: none"> - Waste that meets the '<i>Transport of Dangerous Goods</i>' code (e.g. explosives, toxic and corrosive substances) - Pharmaceuticals and poisons - Radioactive waste that emits ionising radiation spontaneously and has an activity ratio >1.

Source: *Environmental Guidelines: Assessment, Classification & Management of Liquid and Non-liquid Wastes* (DECC, 1999)

2 WASTE MINIMISATION MEASURES

In accordance with Consent Condition 8 of Schedule 3, the waste minimisation measures outlined in this section are not relevant to backloaded MSP process waste, overburden or sand residues. Management measures for backloaded MSP process waste to be landfilled at Snapper are covered in Section 4.

2.1 GENERAL WASTE MANAGEMENT PROGRAM

The objective of the Waste Management Program is to minimise the production and impact of general waste (all waste other than process waste) produced at Snapper through the implementation of the waste minimisation hierarchy:

Avoid/Reduce ⇒ Reuse/Recycle ⇒ Treat ⇒ Dispose

Where waste avoidance is a priority, followed by reuse and recycling/ reprocessing, with disposal as the last resort (DECC, 1999).

Waste management at the MSP will focus on the following:

- Minimising / avoiding waste generation in the first instance;
- Encouraging suppliers to remove empty containers or used products when supplying replacements as part of purchasing agreements;
- Preferential use of suppliers who deliver in bulk and accept the return of packaging for reuse;
- The correct storage and disposal of recyclable and non-recyclable wastes;
- Minimising the volume of the hazardous wastes by investigating the use of alternative products.

2.2 GENERAL WASTE GENERATION

A summary of the various waste streams expected to be generated from the offices, workshop, processing plant (WHIMS plant) and ancillary activities at Snapper is provided in Table 3. Ancillary activities refers to those activities associated with the MSP including transportation of mineral concentrate, delivery of materials and operation of mobile equipment.

**Table 3.
Potential MSP Waste Streams**

Waste Category	Waste Type	Waste Generation Source			
		Offices	W'shop/ Store	WHIMS Process	Ancillary Activities
Non-Liquid Waste	Putrescible and inert miscellaneous material.	✓	✓	✓	✓
	Biodegradable	✓	✓	✓	✓
	Sewerage Sludge	✓	✓	✓	✓

Waste Category	Waste Type	Waste Generation Source			
		Offices	W'shop/ Store	WHIMS Process	Ancillary Activities
	Cans, containers	✓	✓	✓	✓
	Packaging-paper/cardboard/ plastic	✓	✓	✓	✓
	Wood Pallets		✓		
	Wood Misc.		✓		
	Batteries		✓		✓
	Scrap Steel		✓	✓	
	Drums		✓	✓	
	Tyres		✓	✓	✓
	Hydrocarbon containers oil filters, absorbents etc		✓	✓	✓
	Oil contaminated soils/silts		✓	✓	✓
	Metal shavings		✓		
Liquid Waste	Human effluent	✓	✓	✓	
	Solvents	✓	✓	✓	
	Paints/ Preservatives and by products		✓		
	Waste oil		✓	✓	✓
	Waste Grease		✓	✓	✓
	Oil/fuel contaminated water		✓	✓	✓
	Paint/metal/solvent contaminated water		✓	✓	

2.3 GENERAL WASTE MANAGEMENT STRATEGY

A waste management strategy will be implemented to facilitate the effective management of general waste generated from Snapper activities. An outline of the proposed strategy is provided in Table 4. The Environmental Officer will be responsible for monitoring and maintaining the waste management strategy.

Table 4.
Proposed General Waste Management Strategy

Waste Type	Minimise	Re-use/Recycle	Treatment / Destruction	Proposed Disposal Site
Non-Liquid Waste				
Putrescible and biodegradable material	-	Compost	Composting	Use in mine rehabilitation
Inert miscellaneous material.	-	-	Place in colour coded skip	Pooncarie Landfill
Sewerage Sludge	-	-	-	On site waste water treatment system
Cans, containers	Bulk Purchase	Collect for Recycling	Crush & Place in colour coded skip	Recycling Contractor

Waste Type	Minimise	Re-use/Recycle	Treatment / Destruction	Proposed Disposal Site
Non-Liquid Waste				
Packaging-paper/cardboard/plastic	Bulk Purchase	Collect for Recycling	Crush & Place in colour coded skip	Recycling Contractor
Wood Pallets	Avoid Damage	Return for reuse	Place in colour coded skip if damaged	Pooncarie Landfill
Wood Misc.	-	Store/stockpile for future use	Place in laydown area	Recycling Contractor
Batteries	-	Collect for return to supplier	Place in laydown area	Recycling Contractor
Scrap Steel	-	Collect for Recycling	Place in colour coded skip	Recycling Contractor
Drums	Identify Bulk supply/storage	Return to supplier	Ensure empty and crush	Pooncarie Landfill or Recycle
Hydrocarbon containers oil filters, absorbents etc	Avoid spills & placement of hydrocarbon spill kits	Reuse absorbents	Place in Hazardous Waste skip	Transport off site by licenced hazardous waste contractor
Oil contaminated soils/ silts	Avoid spills & placement of spill kits	-	Treat on site	Dispose with backfill after lab analysis
Tyres	-	Collect for return to supplier	Place in laydown area	Recycling Contractor
Paint scrapings/ by products	-	-	Place in Hazardous Waste skip	Transport off site by licenced hazardous waste contractor
Metal shavings	-	-	Place in colour coded skip	Recycling Contractor
Liquid Waste				
Human effluent	-	-	-	On site waste water treatment system
Waste oil	Avoid spillages	Collect for Recycling	Store in on-site oil tanks	Recycling Contractor
Paints/ Preservatives	Placement of spill kits	-	Place in Hazardous Waste skip	Transport off site by licenced hazardous waste contractor
Solvents	Utilise "tool wash" solvent recycle baths. Placement of spill kits	Recycle back to the supplier.	Collect in supplied drums and store to AS 1940-2004	Transport and disposal by licenced contractor
Waste Grease	-	Collect for Recycling	Store in on-site grease waste container	Recycling Contractor
Oil/fuel contaminated water	Avoid spillages utilise spill cleanup kits	Extract pollutant and discharge clean water	Pump out contaminated water to waste storage tank	Transport off site by licenced hazardous Waste Contractor
Paint/metal/solvent contaminated water	Avoid spillages utilise spill cleanup kits	Extract pollutant and discharge clean water	Pump out contaminated water to waste storage tank	Transport off site by licenced hazardous Waste Contractor

2.4 HANDLING AND COLLECTION

2.4.1 Waste Collection and Storage

All waste will be disposed of in accordance with the *Environmental Guidelines: Assessment, Classification & Management of Liquid and Non-liquid Wastes* (DECC, 1999) (the Guidelines) or as specified in Schedule 1 of the *Protection of the Environment Operations Act 1997*.

At the point of generation, waste will be directly transferred to local based waste receptacles for transportation to disposal, reuse or recycling facilities. A colour coding system will be utilised where by waste receptacles will be colour coded to separate the different waste streams for recycling and disposal, (eg green waste skips for municipal waste, red wheelie bins for recyclable waste). Receptacles will be clearly labelled to ensure employees are aware of the waste separation requirements.

Where waste is required to be disposed, material will be transported by licensed waste transporters to an approved landfill. Non-hazardous material will be collected for disposal at the Pooncarie landfill in accordance with a waste agreement. Hazardous material will be collected by licenced hazardous waste contractors for disposal and/or recycling.

A recycling program will be established for recyclable materials in consultation with the WSC. Materials to be recycled will be separated at Snapper and disposed of to the colour coded waste receptacles for collection by recycling contractors.

The site requirements for waste management will be displayed at prominent positions across the mine in the form of charts outlining the correct disposal methods for the different waste streams.

2.4.2 Storage of Dangerous Goods

All dangerous goods on site (including hydrocarbons and chemicals) will be stored in accordance with the Dangerous Goods Regulations 1992, relevant Australian Standards including AS 1940-2004 (The storage and Handling of Flammable and Combustible Liquids) and AS 1692 (Tank Storage of Fuels) and licensing requirements.

A summary of the minimum requirements for storage facilities at Snapper is as follows:

- Storage facilities will be bunded with an impervious material to contain at least 110% of the largest container;
- All valves in the bunding (for the release of rainwater) will be equipped with a locking mechanism;
- Signs will be displayed for each substance stored within the facility illustrating the substance name, dangerous goods class, packaging group and emergency response details;
- All containers will display product information including the product name, UN number, dangerous goods class and packaging group;
- Storage facilities will have effective measures to exclude rain and surface stormwater run-off from the storage area will be established; and

- Storage facilities will have easy access for emergency response and spill clean-up teams.

2.4.3 Waste Tracking Program

Any hazardous, industrial or group A waste to be dispatched from Snapper will undertaken in accordance with DECC waste tracking requirements.

Prior to dispatching any hazardous, industrial or group A waste from Snapper, a consignment authorisation number will be issued from the consignee. The consignee will be licensed to issue a consignment authorisation number and will be able to lawfully accept the class of waste being dispatched.

Prior to transporting the waste an approved waste data form will be completed, which will document all waste details required for the waste material tracking system. A copy of the form will be provided to the persons transporting the waste. The waste data form will be retained for a period of not less than 4 years. The persons transporting the waste will be licensed to transport the waste (where required).

2.5 GENERAL WASTE MONITORING

Section 2.6 outlines the waste auditing program which will be implemented to ensure all waste generated at Snapper is collected and handled appropriately as outlined in the Waste Management Plan.

The Snapper operations will result in the generation of several types of wastes as outlined in Table 4. Movement of general waste from the Snapper Mine will be monitored. A waste monitoring program will be implemented to monitor and record:

- The types of waste being transported from the Snapper Mine;
- The volume of waste; and
- The destination for each consignment.

Bemax will investigate options for utilising waste material for re-use on site or if not suitable, to utilise local services to re-use / recycle recyclable waste materials produced on site. The waste monitoring program records will be reviewed annually with the view to improve re-use and recycling. A summary of activities undertaken during the 12-month period will be reported in the Annual Environmental Monitoring Report (Section 4.1).

2.6 WASTE AUDITING PROGRAM

A waste auditing program will be implemented to ensure all waste generated at the Snapper Mine is collected and handled appropriately as outlined in the Waste Management Plan. Specifically the waste auditing program will ensure:

- All waste generated at the Snapper Mine is correctly classified in accordance with the Guidelines;
- Monitor waste generation and disposal using a waste inventory system;

- Waste dispatched from Snapper has the required waste tracking data forms completed prior to transportation including a consignment authorisation number (if required);
- Employees actively participate in the reduction and recycling of waste materials;
- Waste is separated at the point of generation and correctly stored in the appropriate waste receptacles; and
- Waste is only dispatched to landfills that are licensed to receive that class of waste.

3 LANDFILL MANAGEMENT MEASURES

Heavy mineral concentrate produced at the Snapper Mine will be transported to the MSP in Broken Hill where it will then be separated to produce ilmenite, altered ilmenite, rutile and zircon (Figure 2). Wastes to be generated at the MSP are associated with the:

- Leucoxene circuit
- Feed preparation circuit
- Baghouse/venturi scrubber
- Ilmenite circuit
- Rutile circuit
- Zircon circuit; and
- Combustion of coal

Process wastes generated from the separation process at the MSP will include:

- silica and quartz from the feed preparation circuit;
- monazite and silicate minerals from the ilmenite and leucoxene circuits;
- silicate minerals from the zircon and other dry circuits; and
- ash waste by-product and sulphur-based effluent stream

Figure 2 shows the various waste streams from the MSP.

A proportion of reject material from the zircon dry circuit will be monazite, which is a naturally occurring radioactive mineral. Monazite ($Ce, La, Nd, Th-PO_4$) contains cerium, lanthanum, and neodymium and is a source of the radioactive element thorium. The percentage of monazite in the Snapper deposit mineral assemblage is expected to be relatively low at approximately 0.0045%.

On separation from the product zircon minerals, the monazite reject stream would be directed to a process sump where it would be wetted and blended with other waste streams. The waste material produced at the MSP would be temporarily stored in a concrete storage bay prior to backloading to the Snapper Mine. The storage bay would be fitted with overhead sprinklers to minimise generation of wind blown material.

3.1 WASTE CLASSIFICATION

Waste materials will be assessed in accordance with the technical assessment procedure outlined in Technical Appendix 1 of the *Environmental Guidelines: Assessment, Classification & Management of Liquid and Non-liquid Wastes* (DECC, 2004) or as specified in Schedule 1 of the *Protection of the Environment Operations Act 1997*. Under the Guidelines, a non-liquid waste material can be classified as *inert, solid, industrial* or *hazardous* (Table 2).

3.1.1 Backloaded MSP Waste Blend

The total activity of the combined waste materials generated at the MSP would be approximately 190 Bq/g. Therefore under the DECC *Environmental Guidelines: Assessment, Classification and Management of Liquid and Non-liquid Wastes* (DECC, 2004), the combined waste materials

produced would be classified as *hazardous* wastes (ie. total activity would be more than 100Bq/g). These materials are classified as hazardous on the basis they contain radioactive material from the separation circuit and except for this radioactive component would be classified as inert waste as specified in Schedule 1 of the Protection of the Environment Operations Act (POEO).

Under the NSW Radiation Control Act 1990 (RCA) and the Radiation Control Regulation 2003 (RCR), 100 Bq/g is set as the cutoff concentration above which a bulk material is defined as 'radioactive', and to which the Act and Regulation apply.

Under Schedule 1 of the Protection of the Environment Operations Act (POEO) and the Guideline of Assessment and Classification of Wastes, a waste material which is radioactive under RCA is ipso facto a hazardous waste.

The Radiation Control Regulation requires that any substance which is classified as 'radioactive' under the Act must in its transport, comply with the Code of Practice for the Safe Transport of Radioactive Material, 2001, issued by ARPANSA.

The DEC's classification of waste containing radioactive substances is currently under review. As a result, the classification of radioactive waste will be carried out as required in a manner determined by the DECC. Based on the current Guidelines (DECC, 2004), blended MSP waste material to be transported to Ginkgo Mine will be assessed regularly and classified on the basis of both its radioactive and other characteristics as defined below:

- The waste will be classified according to its characteristics in accordance with normal non-liquid waste assessment and classification in Section 3 of the Guidelines.
- The waste will have a specific activity greater than 100 Bequerels per gram.
- The waste will consist of, or contain equal to or less than the prescribed activity of any radioactive element listed in Schedule 1 of the *Radiation Control Regulation 2003*.
- The *specific activity ratio* and/or *total activity ratio* will be greater than one.

Further, analysis of metals in the waste material will be undertaken at regular intervals to confirm the classification of the waste (Section 3.7.5).

The total activity of a material means the activity of the whole of the material in which the radionuclides are essentially uniformly distributed (determined using 1-kilogram representative samples of the whole material).

The *total activity ratio* is calculated using the expression:

$$\text{Total activity ratio} = (A1 \times 10^{-3}) + (A2 \times 10^{-4}) + (A3 \times 10^{-5}) + (A4 \times 10^{-6})$$

Where A1 to A4 are the total activity of Group 1 to Group 4 radionuclides, as set out in Column 1 of in Schedule 1 of the *Radiation Control Regulation 2003*.

Specific activity is defined in the *Code of Practice for the Safe Transport of Radioactive Materials 2001* as the activity per unit mass of that nuclide. The specific activity of a material means the activity per unit mass or volume of the material in which the radionuclides are essentially uniformly distributed.

The *specific activity ratio* is calculated using the expression:

$$\text{Specific activity ratio} = SA1 + (SA2 \times 10^{-1}) + (SA3 \times 10^{-2}) + (SA4 \times 10^{-3})$$

Where SA1 to SA4 are the specific activity of Group 1 to Group 4 radionuclides, as set out in Column 1 of in Schedule 1 of the *Radiation Control Regulation 2003*.

3.1.2 Snapper Mine Waste Material

The industrial or hazardous backloaded waste blend as described in Section 3.3.1 will be transported to the Snapper Mine for disposal. Back-loaded, diluted waste from the MSP will be deposited in a designated stockpile. This waste will be placed in a shore based hopper, mixed with waste water from the salt washing facility, then transported to the floating Wet Plant via a slurry pipe. This slurry would join the sand residue stream and be deposited on the sand residue beach. The slurry would be disposed of above the groundwater table and would be covered under a minimum of 10 m (up to 35 m) of sand and clay overburden.

3.2 WASTE MANAGEMENT PROGRAM

The following sections describe the waste management strategies for the Snapper Mine (Section 3.1) in order to meet the following environmental goals as listed in the *Environmental Guidelines: Solid Waste Landfills* (DECC, 1996):

- Prevention, detection and remediation (if necessary) of water polluted by leachate.
- Prevention, detection and remediation (if necessary) of landfill gas emissions.
- Recording and assurance of quality of wastes received.
- Remediation of landfill after closure.
- Prevention of unauthorised entry.
- Prevention of degradation of local amenity.
- Prevention of noise pollution.
- Provision of adequate fire-fighting capacity.
- Provision of adequate staffing and training.

3.2.1 Benchmark Techniques

The benchmark techniques listed in the *Environmental Guidelines: Solid Waste Landfills* (DECC, 1996) provides guidance in order to meet the environmental goals set out for performance-based environmental management and regulation of the Snapper landfilling. Table 5 lists the benchmark techniques adopted. An overview of the handling of monazite containing material, landfill design and operation is provided in the following section.

3.2.2 Monazite Handling

Over the last 20 years the mineral sands industry has established standard practices which minimise employee radiation doses and potential environmental impacts associated with radioactive material. This has included characterisation of radiation sources such as the mineral monazite and the application of relevant management practices. In some mineral sands projects,

monazite is separated as a product stream. The Snapper deposit contains a very low level of monazite. These levels are insufficient to warrant commercial recovery as part of the proposed project. The monazite does though, tend to concentrate in some MSP separation streams along with other minerals that have similar specific gravities, magnetic and conductivity properties.

The material referred to as monazite in the MSP EIS (BeMaX, 2001b) is a zircon magnetic reject stream which is classified as reject material because it contains no commercially recoverable minerals.

Typically Australian mineral sands projects encounter monazite contents of less than 15% in this reject stream and this would be an anticipated maximum for the Ginkgo heavy mineral concentrate. Without mixing with other waste or rejects, the total activity of this stream is likely to be less than 450 Bq/g. Under the *Radiation Control Regulation 2003* and prior to blending, this material may therefore be defined as a radioactive substance (ie. prescribed activity > 100 Bq/g).

Standard practice in the mineral sands industry that has proven to be very successful in minimising employee radiation dosages and associated potential environmental impacts includes:

- separate dust collection for this section of the circuit;
- provision of an industrial vacuum system to minimise potential dust sources and ensure maintenance workers are not exposed to high dust exposures that have elevated radiation levels;
- provision of a separate enclosure within the MSP for those equipment items that handle the streams containing any elevated monazite contents; and
- “pugging” of any dust collected to eliminate the dust hazard at its source.

Practices proposed for the MSP would include the application of the above. On separation from the product zircon minerals, the monazite reject stream would be directed to a process sump where it would be wetted and blended with other waste streams. The blended wet reject would then be stored as a damp (“pugged” or slurried) waste material with a total activity level of approximately 190 Bq/g. This material would be classified as *hazardous* waste (in accordance with the DECC classification guidelines) and stored in a concrete storage bay fitted with overhead sprinklers or further controlled in a manner acceptable to the DECC.

3.2.3 Landfill Design and Operation

In accordance with conventional practice, monazite containing waste material separated from heavy minerals at the MSP, after blending with the materials discussed above, will be returned to its point of origin at the Snapper Mine. Back loaded waste material from the MSP will be deposited in a designated stockpile. This waste will be placed in a shore based hopper, mixed with waste water from the salt washing facility, then transported to the Wet Plant via a slurry pipe. This slurry would join the sand residue stream and be deposited on the sand residue beach, thereafter to be covered with up to 35 metres of overburden.

The total tonnage of MSP waste blend disposed of at the Snapper Mine will be up to 300,000 tpa.

Similar to the Ginkgo Mine, management measures described in this Plan would provide for wastes to be landfilled in a manner to ensure:

- (i) the average concentration of radioactive material in landfill at the premises will not exceed the average concentration of radioactive material in the original orebody; and
- (ii) the radiation level of any material deposited to land is no greater than 0.7 microGray per hour measured 1 metre vertically above the surface of the material being deposited; and
- (iii) there will be no detectable change from the original natural background radiation level measured at the ground surface.

The environmental monitoring program for radiation levels is detailed in Section 3.7.

Transport of waste from the MSP to Snapper will be carried in accordance with the Transport Management Plan (See Section 3.8.2). The Radiation Control Regulation requires that any substance which is classified as 'radioactive' under the Act must in its transport, comply with the Code of Practice for the Safe Transport of Radioactive Material, 2001, issued by ARPANSA.

Regular monitoring of groundwater bores will be conducted as described in Section 3.7.3.

Rehabilitation concepts for the replaced sand residues and waste materials and overburden cover behind the dredge pond at the Snapper Mine are shown on Figure 3 and will include:

- application of a layer of a up to approximately 3 m of non-slurried material to provide additional growing medium and retain soil moisture above the dried sand residues;
- re-spreading of stockpiled soils on final surfaces; and
- revegetation utilising suitable endemic species.

**Table 5
Industrial Waste Landfill Benchmark Techniques – Snapper Mine**

Benchmark Technique		Adopted Techniques/ Where Addressed
1A	Leachate barrier system	N/A – Shake solubility test results show that the potential for leaching of metals and other toxicants is low because the source material (mineral deposit) is an alluvial deposit which is the result of natural weathering processes, resulting in low levels of chemical activity and availability.
2A	Leachate collection system	As above.
3	Surface water controls	Detailed in Water Management Plan.
4A	Groundwater monitoring network	Detailed in Borefield Impact Management Plan .
5	Groundwater monitoring program	Detailed in Borefield Impact Management Plan .
6	Groundwater assessment program	Detailed in Borefield Impact Management Plan
7	Surface water monitoring program	Detailed in Water Management Plan.
8A	Leachate monitoring program	Detailed in Water Management Plan
9	Water contamination remediation plan	Detailed in Water Management Plan.
10A	Landfill gas containment system	N/A – Negligible landfill gas will be emitted from proposed material to be landfilled.
11	Extraction and disposal of landfill gas	N/A – Negligible landfill gas will be emitted from proposed material to be landfilled.
12	Fire prevention	Detailed in Bushfire Management Plan
13	Controlled burning	Detailed in Bushfire Management Plan
14A	Site closure	Detailed in Integrated Mining and Rehabilitation Plan
15	Subsurface gas monitoring devices	N/A – Negligible landfill gas will be emitted from proposed material to be landfilled.
16	Subsurface gas monitoring program	N/A – Negligible landfill gas will be emitted from proposed material to be landfilled.
17	Surface gas emission monitoring	N/A – Negligible landfill gas will be emitted from proposed material to be landfilled.
18	Gas accumulation monitoring	N/A – Negligible landfill gas will be emitted from proposed material to be landfilled.
19	Remediation of uncontrolled landfill gas emissions	N/A – Negligible landfill gas will be emitted from proposed material to be landfilled.
20	Assurance of quality	The Landfill will be operated in accordance with relevant standards, codes and guidelines. Detailed in Environmental Management Strategy.
21A	Screening of wastes received	Detailed in Sections 3.1.1 & 3.3
22A	Measurement of quantities of wastes received	Detailed in Sections 3.1.1 & 3.3
23A	Recording of quantities, types and sources of wastes received	Detailed in Sections 3.1.1 & 3.3

Table 5 (Continued)
Industrial Waste Landfill Benchmark Techniques – Snapper Mine

Benchmark Technique		Adopted Techniques/ Where Addressed
24A	Compaction of waste	N/A – There is no specific requirement for compaction within the mine path as this would be achieved through the replacement of overburden and mine rehabilitation activities.
25	Recycling	N/A – Wastes landfilled are being returned to point of origin.
26	Financial assurance	Detailed in Mining Operations Plan
27	Filling plan/contours	Detailed in Section 3.2.3 and Figure 3
28A	Site capping and revegetation	Detailed in Section 3.2.3 and Figure 3
29	Landfill closure and post-closure monitoring and maintenance	Detailed in Integrated Mining and Rehabilitation Plan
30A	Security of site	Detailed in Mining Operations Plan.
31	Litter control	N/A
32	Cleaning of vehicles	N/A
33	Covering of wastes	Detailed in Section 3.2.3 and Figure 3.
34	Dust controls	Detailed in Environmental Monitoring Program
35	Pest, vermin and noxious weed controls	Detailed in Flora and Fauna Management Plan.
36	Odour controls	N/A – No odourous materials are proposed to be landfilled.
37	Noise control	Addressed in Environmental Monitoring Program
38	Fire-fighting capacity	Addressed in Bushfire Management Plan.
39	Staffing and training requirements	Addressed in Section 5 and Mining Operations Plan.

3.3 WASTE MOVEMENT MONITORING

Bemax will monitor waste movements from the MSP to the Snapper Mine in accordance with DECC waste tracking requirements.

BeMaX will implement a waste material tracking system which will monitor:

- the types of waste by providing a statement identifying the waste class in accordance with Schedule 1 of the *Protection of the Environment Operations Act 1997* (Section 3.1);
- the volume of waste to which each consignment applies;
- the number of loads per consignment;
- the destination for each consignment;
- the total period required for transportation of the consignment; and
- the date of dispatch and receiving dates of at least the first load in the consignment.

3.4 WASTE DISPATCHED FROM MSP

Any waste dispatched from the MSP will require a consignment authorisation number to be issued from the Snapper Mine prior to transport. An approved waste data form will be completed which will document all waste details required for the waste material tracking system. A copy of the form will be provided to the licensed person transporting the waste.

3.5 WASTE RECEIVED AT THE SNAPPER MINE

Prior to receiving any waste at the Snapper Mine from the MSP, a consignment authorisation number will be issued upon written application containing the following information:

- a statement describing the waste and identifying the waste class in accordance with Schedule 1 of the *Protection of the Environment Operations Act 1997* (Section 3.1);
- an estimate of the amount of waste to which the application applies;
- whether the consignment will consist of a single load or multiple loads;
- an estimate of the total period required for transportation of the consignment;
- the date of dispatch of at least the first load in the consignment; and
- copies of all information used by the consignor to classify the waste.

Only waste that has been issued a valid consignment authorisation number will be accepted at the Snapper Mine from the licensed transporter. The licensed transporter will provide a copy of the waste data form for records at the Snapper Mine. A copy of the waste receipt record for each waste collection at the Snapper Mine will be provided to the MSP within 21 days of the date the waste is collected.

3.6 RADIATION IMPACT ASSESSMENT CRITERIA

3.6.1 Occupational Health Assessment Criteria

In accordance with Schedule 1 of the Code of Practice and Safety Guide Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing (2005), Bemax has adopted the dose constraints of 20 mSv/y for designated workers and 1 mSv/y for members of the public. A designated worker is a member of the workforce who is assessed as having the potential to receive an annual radiation dose in excess of 5 mSv. ARPANSA's recommended dose limits as per Schedule of the Code:

Dose limit		Application
Occupational	Public	
20 mSv/y averaged over 5 consecutive years*	1 mSv/y [#]	Effective dose
		Equivalent dose in:
150 mSv/y	15 mSv/y	the lens of the eye
500 mSv/y	50 mSv/y	the skin
500 mSv/y	-----	the hands & feet

* Should not exceed 50 mSv/y in any single year

A higher value could be allowed in a year, provided that the average over 5 years does not exceed 1 mSv/y

3.6.2 Environmental Assessment Criteria

Similar to the Ginkgo Mine, management measures described in this Plan would provide for wastes to be landfilled in a manner to ensure:

- i. the average concentration of radioactive material in landfill at the premises will not exceed the average concentration of radioactive material in the original orebody; and
- ii. the radiation level of any material deposited to land is no greater than 0.7 microGray per hour measured 1 metre vertically above the surface of the material being deposited; and
- iii. there will be no detectable change from the original natural background radiation level measured at the ground surface.

3.7 MONITORING PROGRAM

3.7.1 Background Monitoring

Prior to operations, background radiation levels will also be measured using a gamma dose rate meter (eg. Geiger counter, scintillometer or spectrometer) to record background levels in the environment.

The radiation levels will also be measured using a gamma dose rate meter (eg. Geiger counter, scintillometer or spectrometer) at areas of higher radiation potential (eg. mineral stockpiles) for comparison with limits as listed in the *Code of Practice and Safety Guide Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing, 2005*. The surveys will be conducted on a quarterly basis.

Monitoring of background radiation levels will continue to be conducted on a regular basis during operations at the Snapper Mine. Results of monitoring will be reported in the AEMR (Section 4.1). Radiation monitoring activities will continue after mining ceases as determined in consultation with key government agencies and detailed in the Snapper Mine closure plan.

3.7.2 Operational Monitoring

Radiation assessments will be conducted to ensure radioactivity levels remain below occupational health and safety and environmental exposure limits throughout the operations.

Personal Gamma Monitoring

All designated workers are to wear special TLD monitors issued by ARPANSA on all shifts worked throughout the year. The number of monitors to be issued for a three month wearing period to each worker category is shown in the table in Section 3.6.1.

Area Gamma Monitoring

A gamma radiation survey is undertaken every three months in, and around, the WHIMS plant and laboratory. Monitoring will also be undertaken on the sand residue beach and on the mine path after the rehabilitation to confirm compliance with Section 3.6.2 above.

Waste Sampling

In order to correctly classify waste generated, stored and transported from the MSP, a thorough sampling and analysis program will be put in place utilising X-ray Diffraction analysis and Quantitative Gamma Spectrometry. Prior to backloading of waste to the Ginkgo Mine, radiation levels of waste material will be established through the following:

- A composite sample from the waste stockpile will be collected during each shift worked at the MSP. X-ray diffraction monitoring of the Uranium (U) and Thorium (Th) levels in the waste stream will then be carried out on the composite sample. The U and Th levels would then be used to calculate the activity levels of the waste stream per shift and, therefore, the activity levels of each load of waste backloaded to the Snapper Mine.

- Monitoring undertaken in accordance with Broken Hill Mineral Separation Plant Development Consent condition 4.8 which requires quarterly radiation monitoring by quantitative gamma spectrometry of waste to be disposed outside the MSP.
- Monitoring undertaken in accordance with the Snapper Mineral Sands Mine Environmental Assessment which proposed quarterly monitoring by quantitative gamma spectrometry of stockpiles of backloaded waste at Snapper.

Radiation monitoring of composite samples from the Ginkgo mineral deposit (in front of dredge at pond level) and replaced sand residues with MSP waste blend materials (behind the dredge at pond level) will be conducted quarterly and analysed by quantitative gamma spectrometry to confirm compliance with Section 3.6.2 above.

3.7.3 Groundwater Monitoring

Monitoring of total dissolved solids and water levels in the groundwater bores will be conducted at the monitoring locations at the Snapper Mine (in accordance with the Borefield Impact Management Plan).

3.7.4 Dust Monitoring

Dust monitoring will be conducted in accordance with that described in the Snapper Environmental Assessment and assessed against the criteria set of in Consent Condition 13 of Schedule 3.

3.7.5 Metals Monitoring

Blended waste to be landfilled at the Snapper Mine will be analysed for metals quarterly or when a change to the geochemical nature of the waste material is expected from a change in ore feed to the MSP, whichever occurs first. This monitoring will be undertaken to confirm the classification of the waste and the frequency will be as per the above until information is available to demonstrate to the DECC that the frequency can be reduced (eg when it can be demonstrated that waste classification can reasonably be predicted from the mineralogy/geochemistry of ore feed type).

3.8 ENVIRONMENTAL MANAGEMENT PLANS

3.8.1 Radiation Management Plan

In accordance with the *Code of Practice and Safety Guide for Radioactive Protection and Radioactive Waste Management in Mining and Mineral Processing (2005)* a Radiation Management Plan (RMP) has been developed and implemented for the all Bemax operations. The RMP has been implemented to ensure that Monazite from mine sites and the separation plants is handled and disposed of appropriately and in accordance with legislative requirements.

3.8.2 Transport Management Plan

A Transport Management Plan (TMP) will be developed and will be implemented for the transporting of radioactive waste from the MSP to the Snapper Mine to ensure that waste materials are handled and transported appropriately and in accordance with legislative requirements and Development Consent Conditions.

The TMP will be applied to transporting of process waste from the MSP to the Snapper Mine along the mineral concentrate transport route. The primary objective of the TMP is to outline arrangements for the safe transport of hazardous materials along the entire length of the Mineral Concentrate Transport route and demonstrate that the transport of material is in accordance with the Code of Practice for Safe Transport of Radioactive Materials 2001, and the relevant NSW and Commonwealth regulations.

4 PERFORMANCE REPORTING AND REVIEW

4.1 ANNUAL REPORTING

An Annual Environmental Management Report (AEMR) will be prepared for the Snapper Mine. The AEMR will provide a summary of activities undertaken during the 12-month period. The AEMR will include hydrogeological reports, surface water monitoring results, dust monitoring results, a summary of incidents and any other specific information requested by the DECC for the 12 month period.

A waste management summary report will be provided in the AEMR, which will include:

- Quantity and composition of process waste dispatched to Snapper Mine over the 12-month period;
- Results of the waste auditing program; and
- Any variations to approvals obtained for the waste management strategy.

The AEMR will be distributed to DOP, WSC, DPI, DECC, DWE and local landholders in close proximity to the operations. The report will also be made available for public information at WSC.

4.2 INCIDENT REPORTING

Any incidents that represent a threat to the environment and which may lead to a breach of licence conditions will be notified to the DECC within 24 hours of the incident first being identified.

4.3 WASTE MANAGEMENT PROGRAM REVIEW

The waste management program will be reviewed annually and updated when necessary. Prior to cessation of the mining operation and processing of minerals at the MSP, the waste management program will be reviewed, updated and prepared as a final waste management program including details for decommissioning and final rehabilitation phases.

5 TRAINING

All personnel will undergo waste management awareness training. Waste Management will be a component of the site induction program and also topic specific training packages will be developed. The following areas will be covered in such training programs:

- Importance of reducing and recycling waste;
- Minimum requirements for avoiding/ minimising, recycling/ reusing and disposing of waste from the MSP;
- Environmental risks and effects of products from the time that they are made and purchased to the time that they are disposed, i.e. **cradle to grave** management.

Specific radiation safety training for personnel including employees, contractors and transporters will be provided by authorised personnel and will include:

- radiation inductions for all new personnel;

- annual re-inductions, principally targetting personnel moving bulk material; and
- on-demand training.

All truck drivers carrying waste, before their first trip, will be required to attend a Driver's Radiation Safety and Accident Response Briefing, and will be given a manual containing all key standing instructions. This document will be signed for and kept on file.

6 REFERENCES

Bemax Resources Ltd (Bemax) (2007) *Snapper Mineral Sands Project – Environmental Assessment*. Report prepared by Resource Strategies Pty Ltd.

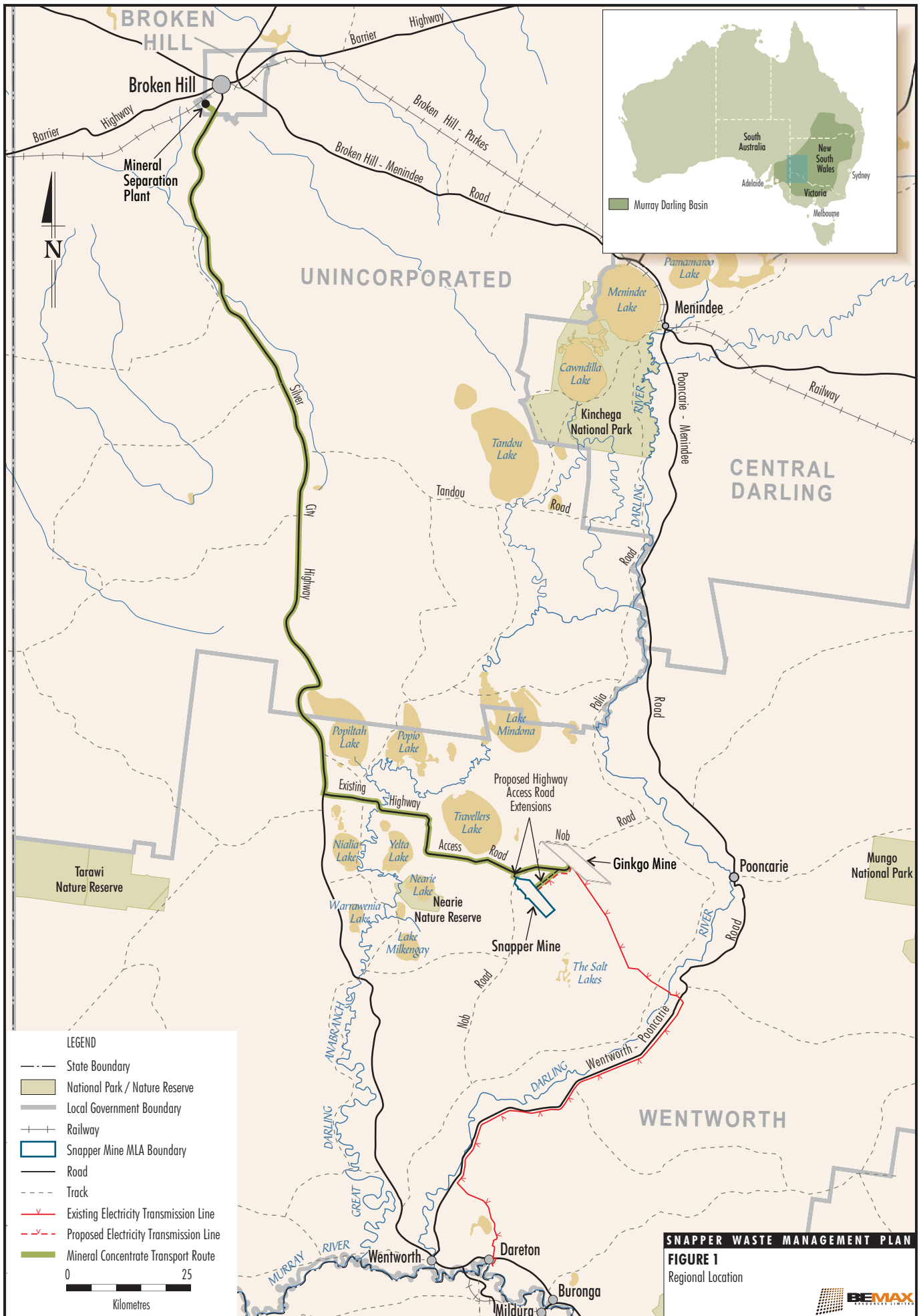
Commonwealth of Australia (COA) (2005) *Code of Practice and Safety Guide for Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing*. ARPANSA.

Environmental Protection Authority (DECC) (1996) *Environmental Guidelines: Solid Waste Landfills*. New South Wales.

Environmental Protection Authority (DECC) (2004) *Environmental Guidelines: Assessment, Classification & Management of Liquid and Non-liquid Wastes*. New South Wales.

FIGURES



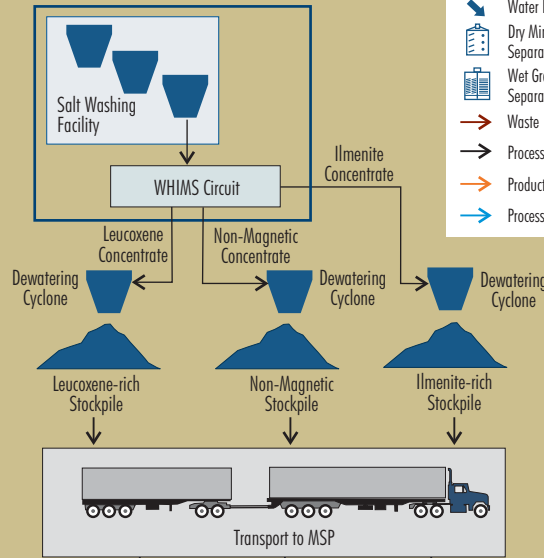
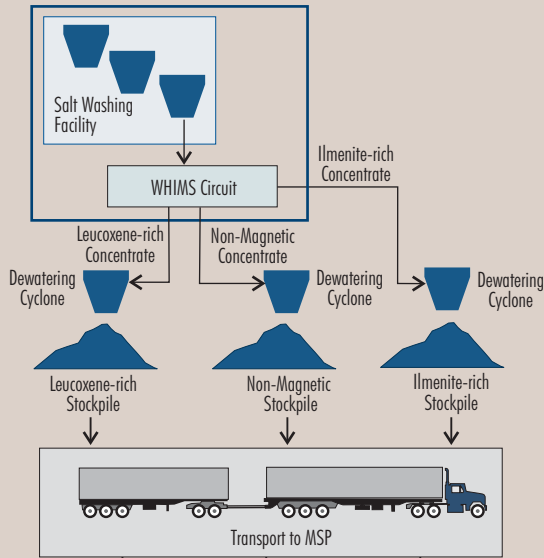


SNAPPER MINE

GINKGO MINE

LEGEND

- Tank / Surge Bin
- Water Input
- Dry Mineral Separation Circuit
- Wet Gravity Separation Circuit
- Waste
- Processing Flow
- Product
- Process Water Output

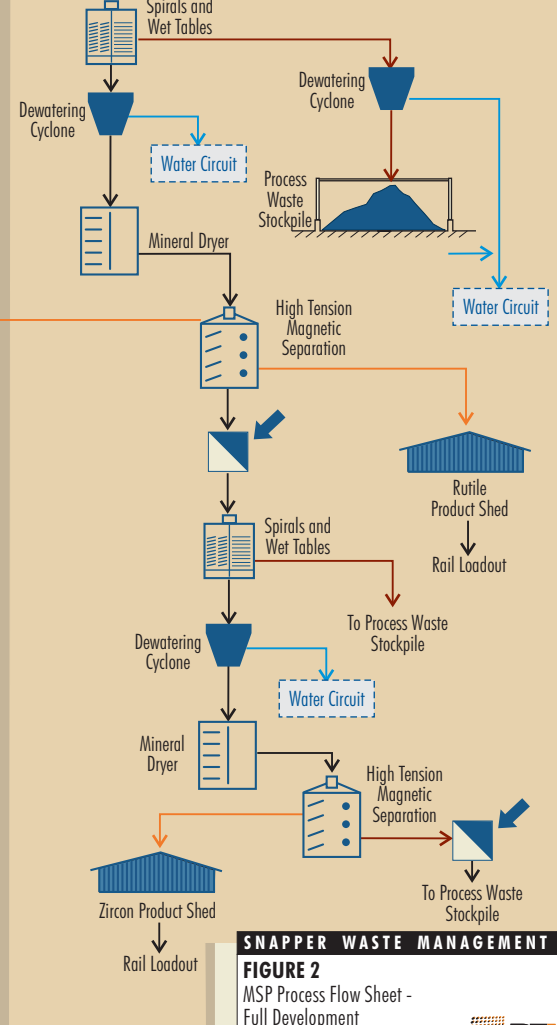
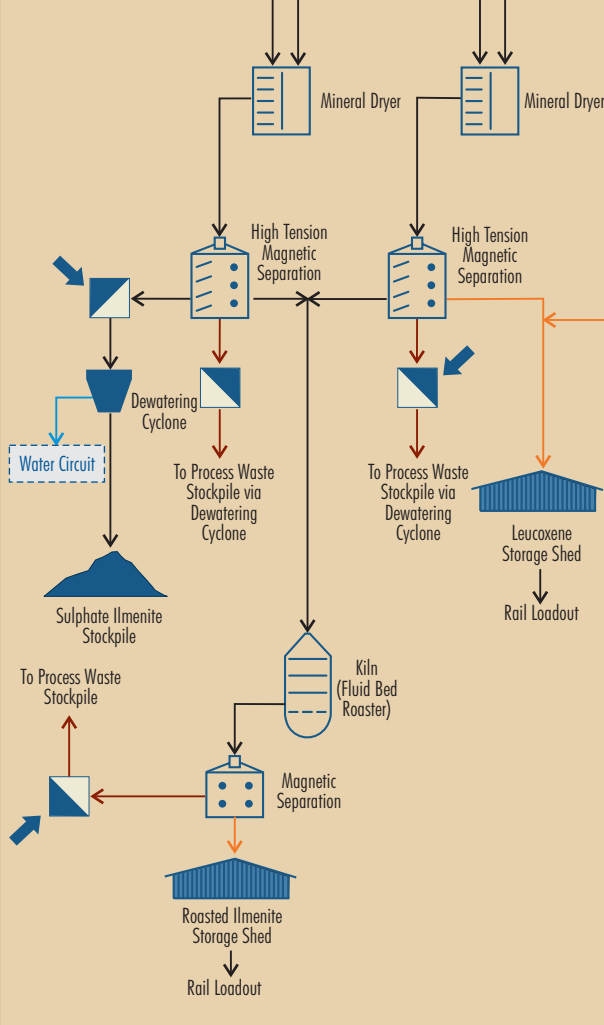


MINERAL SEPARATION PLANT



MAGNETIC MINERALS

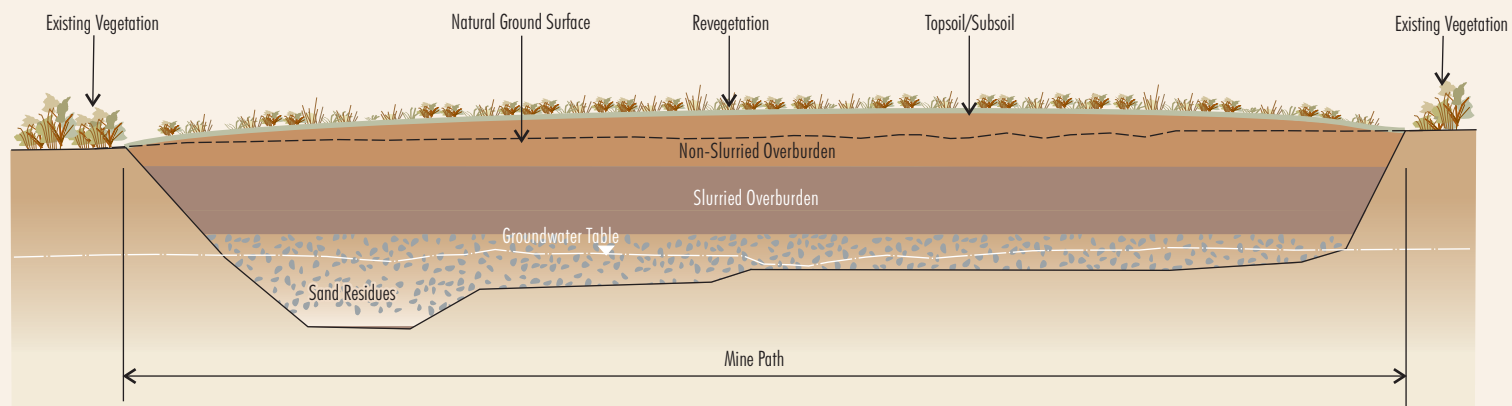
NON-MAGNETIC MINERALS



SNAPPER WASTE MANAGEMENT PLAN

FIGURE 2
MSP Process Flow Sheet - Full Development





CONCEPTUAL MINE PATH REHABILITATION CROSS SECTION



REHABILITATED MINE PATH CONCEPTUAL PROFILE

Not to Scale

SNAPPER WASTE MANAGEMENT PLAN

FIGURE 3
 Conceptual Cross Section
 Rehabilitated Mine Path