Eneabba Mineral Sands Mine
IPL North Proposal

Part IV – Referral Document
Supporting Document

2012

ILUKA

EXECUTIVE SUMMARY

Iluka Resources Limited (Iluka) is a major producer of zircon globally and one of the largest producers of the high-grade titanium dioxide products of rutile and synthetic rutile, with operations in Australia and USA. The Eneabba Mineral Sands Mine has been operating for over 30 years under various approval arrangements and by a range of operators. Iluka is seeking environmental approval for the proposed development and mining of the IPL North deposit (the Proposal) at its Eneabba Mineral Sands Mine at Eneabba, WA.

Eneabba is located approximately 280km north of Perth and 150km south of Geraldton. Iluka holds tenements in the Eneabba region under the mineral sands agreement tenement (AM70/267), various Mining Lease tenures and under Exploration Leases.

The Proposal is located south and east of the town of Eneabba, north of the Mine Access Road, south of Three Springs Road and is traversed by Mineral Sands Road, railway line and a gas pipeline. The Proposal falls within the existing mineral sands agreement tenement (AM70/267) and Mining Lease (M70/879). Part of the Proposal is located on Lot 10 which is owned by Iluka with the remainder located on Crown Reserve and Vacant Crown Land.

The Proposal involves open cut mining over approximately six years to extract over 2.1Mt of heavy mineral concentrate (HMC) (mostly zircon and titanium minerals) from the IPL North mineral deposit. Mining is proposed to commence at the most southern end of the deposit and progress to the north at an average advance rate of approximately 3m/day. It is expected that mining will occur 24 hours/day for the majority of the Proposal.

All overburden will be returned to the mined-out void with the majority directly returned as mining progresses, i.e. not stockpiled. The sand tails fraction of the mining by-products will be placed in the mined-out void. The clay/slime fraction will be co-disposed with the remaining sand tails in tailings storage facilities within existing operational areas. Rehabilitation will occur on the reinstated land surface behind the advanced open cut.

To minimise clearing, and optimise rehabilitation outcomes, the Proposal has modified the mining method from that typically used at the Iluka Eneabba operations. To minimise overburden rehandle and maximum topsoil replacement, the mine sequence was scheduled using sand tails backfill. Sand tails deposition drains rapidly to allow almost immediate overburden replacement, thereby significantly reducing the amount of open area required for stockpiling. The sand fraction will be split out from the WCP tailing to enable sand tails deposition into the IPL North mine pit. The higher clay/slime fraction will be co-disposed with the remaining sand tails in a tailings storage facility within existing operational areas.

To ensure a soil profile is returned that will support the re-establishment of Kwongan vegetation, the clay overburden will be backfilled to a design surface, followed by sandy dune soils (where applicable), subsoil and topsoil. Mine planning indicates the backfill strategy will support a significant component of direct topsoil replacement. Using the above mining schedule, approximately 20-30ha of the mine pit area is open (disturbed) at any given time during operation and an additional 57ha is required for off-path stockpiling.

The Proposal covers an area of approximately 545ha and includes areas of native vegetation as well as previously and/or currently disturbed areas such as the railway line, gas pipeline, existing roads, motocross, etc. The proposed locations for the topsoil stockpiles are on existing disturbed land. The potential disturbance areas are still under investigation and subject to further design.

The Proposal does not involve any increase to the mine throughput, and hence there will be no increase to unit (i.e. daily) water consumption, unit electricity consumption, unit waste and wastewater production. The Proposal will have a processing rate of approximately 600tph (which is 50% of the Newman Wet Concentrator Plant capacity), will produce around 350kta of HMC and use approximately 8GL per year (GL/yr) of water for processing.

The purpose of this Supporting Document is to support the referral of the Proposal to the Environmental Protection Authority (EPA) in order to determine the appropriate level of assessment under Section 38(1) of the *Environmental Protection Act 1986* (EP Act).

This document has been prepared to meet the requirements of Part IV of the EP Act and together with the EPA Referral Form provides the background and key environmental information relating to the Proposal. This document includes additional information on the Proposal, justification of the Proposal and identifies key environmental factors that Iluka considers relevant to the EPA in making a decision on whether or not to assess the Proposal.

Additional non-key environmental factors identified for the Proposal not expected to be significantly impacted by the Proposal are considered to be adequately covered in the EPA Referral Form and under other existing relevant environmental approvals.

The Proposal has been developed to avoid, minimise and mitigate environmental impacts, with the key environmental factors identified for the Proposal being;

- Native vegetation and flora
- Fauna
- Noise
- Air quality (dust)
- Groundwater (incl. Eneabba town water supply)
- Rehabilitation and closure

Targeted investigations and surveys will be undertaken to assess the significance of the potential impact of the Proposal. Iluka is committed to operating in a sustainable manner, and considers developing and maintaining sustainable business practices to be of importance.

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1. INTRODUCTION

Iluka Resources Limited (Iluka) is seeking environmental approval for the proposed development and mining of the IPL North deposit (the Proposal) at its Eneabba Mineral Sands Mine at Eneabba, WA.

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- Native vegetation and flora
- Fauna
- Noise
- Air quality (dust)
- Groundwater (incl. Eneabba town water supply)
- Rehabilitation and closure

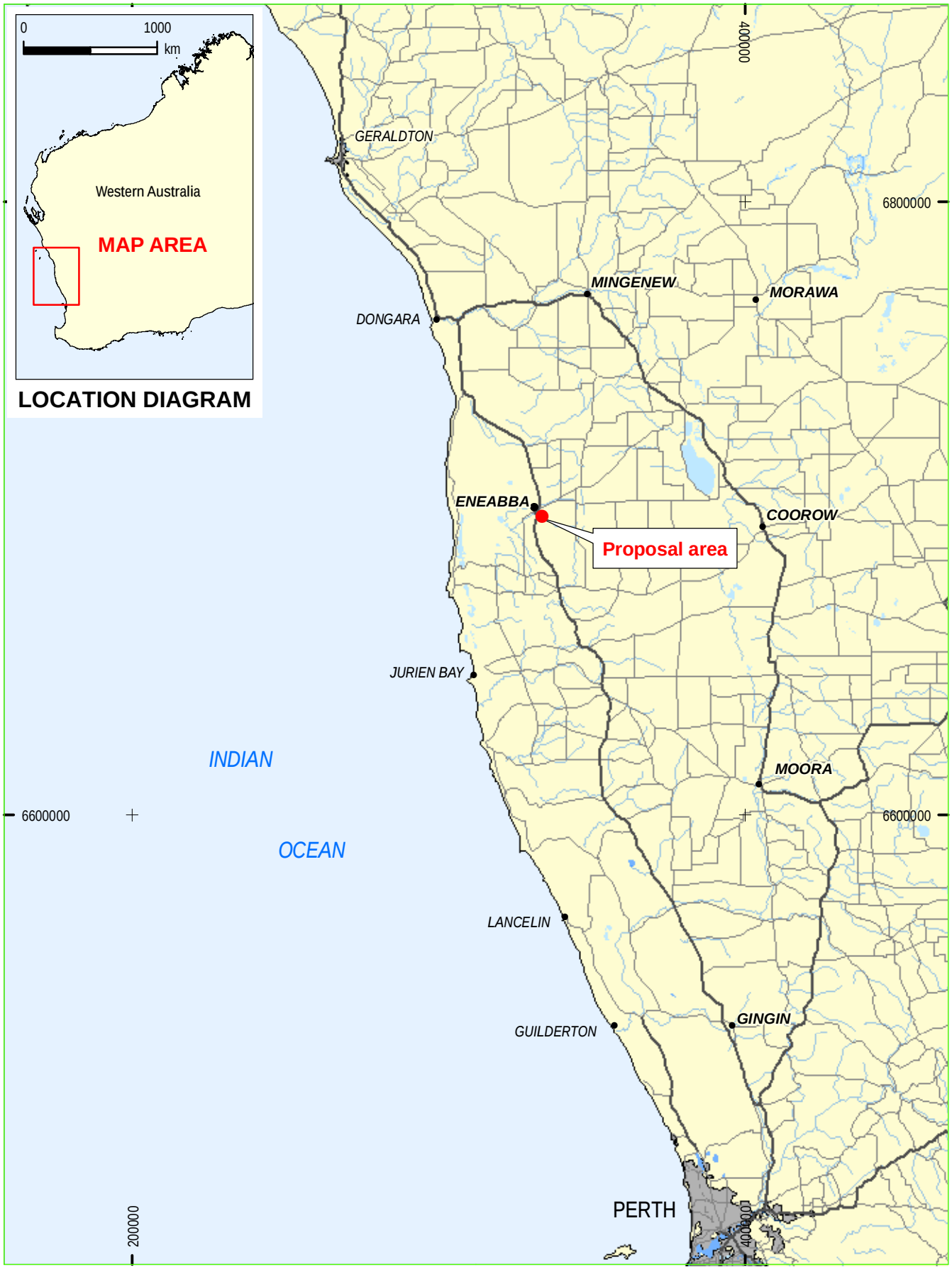
For each of the above key factors, the following relevant aspects were considered:

- EPA objective
- Potential impacts
- Management objectives

Targeted studies will be undertaken to assess the significance of the potential impact of the Proposal. Iluka is committed to operating in a sustainable manner, and considers developing and maintaining sustainable business practices to be of importance.

1.1 Background

Eneabba is located approximately 280km north of Perth and 150km south of Geraldton (Figure 1.1). Mineral sands mining commenced at Eneabba in the 1970s and involved several mining companies. A series of mergers and acquisitions resulted in Iluka taking over all mineral sands mining at Eneabba during 1999. Mining has occurred on Crown Land, including the South Eneabba Nature Reserve (SENR),



N

0 20 40 60 km

MGA coordinates, GDA94

IPL NORTH PROPOSAL

REGIONAL LOCATION

ILUKA

ORIG: A Joubert DRAWN: D.L.S. SCALE: 1:1,750,000 (A4) DATE: May 2012 DWG No: 219072v00

FIGURE: 1.1

and freehold land largely cleared for agricultural purposes but containing some areas of native vegetation.

Previous and existing dry mining methods at the Iluka Eneabba operations have predominantly been used to extract mineral sand deposits, however some dredge mining has also occurred at West Mine. Rehabilitation at the Eneabba Mineral Sands Mine is ongoing and methods used have evolved and improved over time.

The Eneabba mineral sands deposit is recognised as containing generally low grade heavy mineral but has numerous concentrated strands. Many of the highest grade strands have already been mined, however the IPL North deposit is the highest grade in-situ reserve remaining at Eneabba.

In August 2009, Iluka submitted a Proposal to the EPA that would enable Iluka to group future mining deposits and overcome difficulties experienced when continuously adapting mine plans to dynamic market conditions. This previous Proposal included the Allied Tails, IPL South and IPL North deposits. In June 2010, mining operations at the Eneabba Mineral Sands Mine were idled, and Iluka formally withdrew the Proposal in October 2010 as a result.

During 2011, market conditions warranted the re-start of mining operations at the Eneabba Mineral Sands Mine with mining activities recommencing in December 2011. Iluka is now in a position to commence environmental approval for the proposed development and mining of the IPL North deposit (the Proposal) at its Eneabba Mineral Sands Mine.

1.2 Location and existing land uses

The Proposal is located south and east of the town of Eneabba, north of the Mine Access Road, south of Three Springs Road and is traversed by Mineral Sands Road, railway line and a gas pipeline (Figure 1.2). The gas pipeline runs from Dongara to Pinjarra.

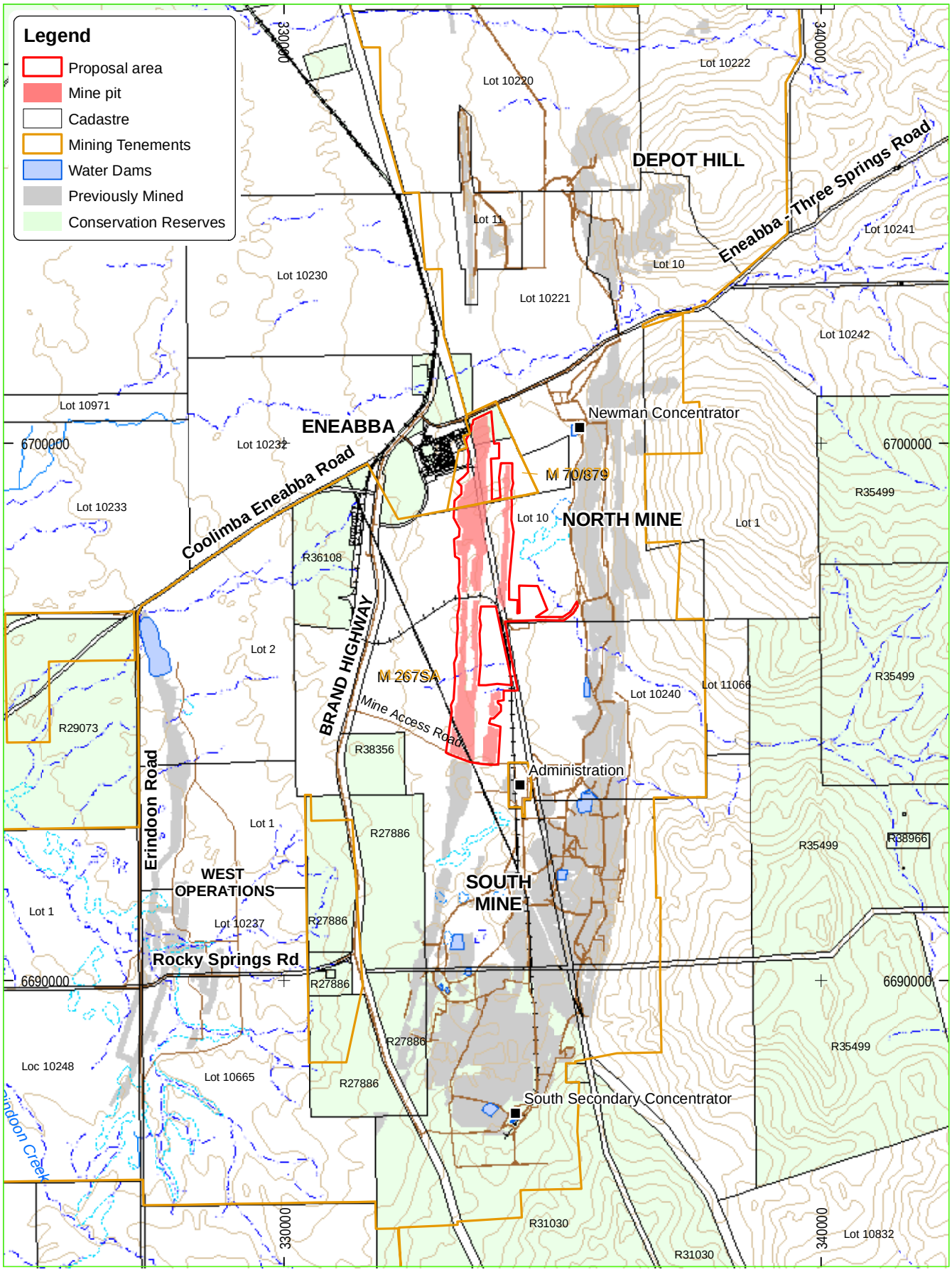
The Proposal falls within the existing mineral sands agreement tenement (AM70/267) and Mining Lease (M70/879). Part of the Proposal is located on Lot 10 which is owned by Iluka with the remainder located on Crown Reserve and Vacant Crown Land. Existing infrastructure and land uses within the Proposal area include roads, railway line, gas pipeline, town water supply production bores and water treatment facilities, motocross, access road to Eneabba rubbish tip (Figure 1.2).

1.3 Applicable legislation

1.3.1 State legislation

State legislation relevant to the Proposal includes:

- *Aboriginal Heritage Act 1972*
- *Agriculture and Related Resources Protection Act 1976*
- *Bush Fires Act 1954*
- *Conservation and Land Management Act 1984*
- *Country Areas Water Supply Act 1947*



IPL NORTH PROPOSAL

PROPOSAL LOCATION

ILUKA

ORIG: A Joubert DRAWN: D.L.S. SCALE: 1:100,000 (A4) DATE: May 2012 DWG No: 219073v00

FIGURE: 1.2

- *Dangerous Goods Regulations 1992*
- *Dangerous Goods Safety Act 2004*
- *Environmental Protection Act 1986* (EP Act)
- *Environmental Protection (Noise) Regulations 1997*
- *Land Administration Act 1997*
- *Local Government Act 1995*
- *Mineral Sands (Eneabba) State Agreement Act 1975* (MSSAA)
- *Mines Safety and Inspection Act 1994*
- *Mining Act 1978*
- *Occupational Safety and Health Act 1984*
- *Rights in Water and Irrigation Act 1914* (RIWI Act)
- *Waterways Conservation Act 1976*
- *Wildlife Conservation Act 1950* (WC Act)

The EP Act is the main governing legislation with regard to environmental protection in Western Australia (WA).

The *Mineral Sands (Eneabba) State Agreement Act 1975* (MSSAA) sets out the rights and obligations of both the proponent and the State Government in regards to the Proposal. Several proposals have been submitted since the initial MSSAA was approved in 1975 and have allowed mining at Eneabba to the present day. The MSSAA requires proposals for mining to be approved by the responsible Minister (currently the Minister for State Development). The MSSAA does not exempt Iluka from the EP Act and several proposals for mining expansion have been referred to the EPA.

The MSSAA also requires the submission of Annual and Triennial Environmental Reports to the State. These reports are required to address the mining conducted and to detail planned future mining activities, and are designed to cover the reporting requirements of both the MSSAA and the EP Act. The reports are referred to the Mineral Sands Agreement Rehabilitation Coordinating Committee (MSARCC) which is chaired by the Department of State Development (DSD).

1.3.2 Commonwealth legislation

Commonwealth legislation relevant to the Proposal includes:

- *Aboriginal and Torres Strait Islander Heritage Protection Act 1984*
- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)
- *Energy Efficiency Opportunities Act and Regulations 2006*
- *National Greenhouse and Energy Reporting Act 2007*
- *Native Title Act 1993*

A Proposal likely to have a ‘significant impact’ on matters of national environmental significance needs to be referred to the Department of Sustainability, Environment, Water, Population and Communities (SEWPAC) under the EPBC Act.

Matters of national environmental significance (MNES) to which the EPBC Act applies, include:

- world heritage sites
- national heritage places
- wetlands of international importance
- nationally threatened species and ecological communities
- migratory species
- Commonwealth marine areas
- the Great Barrier Reef Marine Park
- nuclear actions.

The Proposal will be referred to SEWPAC under Section 68 of the EPBC Act during May 2012 for assessment of its environmental impacts.

1.3.3 Other relevant Policies and standards

Other relevant policies, guidelines and standards that apply to the Proposal include:

- EPA Position Statements and guidance documents
- Department of Mines and Petroleum (DMP) guidelines
- Applicable Australian government policies and standards
- Applicable International standards

2. PROPOSAL DESCRIPTION

2.1 Key characteristics

Open cut mining over approximately six years will extract over 2.1Mt of heavy mineral concentrate (HMC) (mostly zircon and titanium minerals) from the IPL North mineral deposit. Mining will commence at the most southern end of the deposit and progress to the north at an average advance rate of approximately 3m/day. It is expected that mining will occur 24 hours/day for the majority of the Proposal.

All overburden will be returned to the mined-out void with the majority directly returned as mining progresses, i.e. not stockpiled. The sand tails fraction of the mining by-products will be placed in the mined-out void. The clay/slime fraction will be co-disposed with the remaining sand tails in tailings storage facilities within existing operational areas. Rehabilitation will occur on the reinstated land surface behind the advanced open cut.

Mining will not occur below the watertable. Mining will extend to a maximum depth of 30m allowing for 2-3m of undisturbed soil profile between the base of the pit and the watertable. Within the Priority 1 Water Reserve area, an undisturbed soil profile of 3 metres will be retained.

Ore will undergo initial onsite processing to produce HMC. Further processing of the HMC will take place at Iluka's mineral separation plant (MSP) at Narngulu. The MSP will produce commercial products (largely rutile and zircon) for export to overseas markets. By-products from the MSP will either be sold or transported back to the Iluka Eneabba Mineral Sands Mine to be buried within the existing approved storage facility.

The key characteristics of the Proposal are outlined in Table 2.1 with an indicative mine plan shown in Figure 2.1.

Table 2.1 Key characteristics of the Proposal

Proposal element	Characteristic (approximate)
Location	280km north of Perth South and east of Eneabba townsite
Mining operations	
Mine life	6 years depending on market demand
Mining method	Open cut dry mining
Mining rate	850 tonnes per hours (tph)
Indicative overall pit dimensions	Length: 500-3,200m (total length – 6,300m) Width: 100 - 500m Depth: 15-30m
Overburden to be removed	26.0 Mbcm
Ore to be removed	17.9 Mbcm 36.7 million tonnes (Mt)
Strip ratio	1.5:1 (average overburden to ore ratio)
Heavy mineral content of ore	3.31Mt
Processing rate	600 tonnes per hour (tph)
Heavy mineral concentrate (HMC) produced	2.1Mt 350 thousand tonnes per annum (kta)

Proposal element	Characteristic (approximate)
Mining method	Dry mining method above watertable
Mining equipment	One mining unit plant (MUP for life of mine), heavy mobile equipment including trucks, excavators, scrapers, loaders or dozer
Proposal area	545ha
Native vegetation disturbance	Not more than 350ha at the mine site within a 545ha maximum proposal area
Off-path stockpile requirement	2.2Mbcm 57ha
Open (disturbed) mine pit area	30ha
Total open (disturbed) area during mining (excluding infrastructure)	87ha
Fines disposal	Sand tails back into mine pit Clay/slimes and remaining sand tails into other Eneabba mine voids/Tailings Storage Facility
Ore transport	Via rail/road to Narngulu MSP
Hours of operation	24 hours per day, 7 days per week Mining in close proximity of Eneabba townsite according to noise regulations
Rehabilitation	Progressive throughout life of mine of all disturbed areas
Mining infrastructure	
Power supply	Existing on-site power generation system
Water supply	Existing groundwater production bores – 8GL per annum
Workforce	
Full time	65
Contractor	100

The Proposal area covers an area of 545ha and includes areas of native vegetation as well as previously and/or currently disturbed areas such as the railway line, gas pipeline, existing roads, motocross, etc. The proposed locations for the topsoil stockpiles are on existing disturbed land.

The potential disturbance areas are still under investigation and subject to further design. Table 2.2 summarises the various aspects of Proposal area.

Table 2.2 Potential disturbance area

Aspect	Potential disturbance area (ha)[3]
Mine pit	249.7
MUP pad – North	1.3
MUP pad – South	1.3
Access roads[1]	32.9
Indicative noise bund	4.2
Sand stockpile – North	2.9
Sand stockpile – South	2.9
Clay stockpile – South	16.9
Contractor's area	0.5
Topsoil stockpiles[2]	0
ROM stockpile – North	1.0
ROM stockpile – South	1.5
Powerline and pipeline corridors	35
Total potential disturbance area	**350.0**
Proposal area	**545.0**

[1]Includes an existing section of Mineral Sands Road.
[2]Topsoil stockpiles located on previously disturbed land.
[3] The potential disturbance areas are still under investigation and subject to further design.

2.2 Proposal schedule

The indicative Proposal timetable is presented in Table 2.3.

Subject to obtaining all necessary approvals and licences, stripping of soil and overburden is scheduled to begin at the south end of the deposit in Q1 2015. Processing of the ore through the MUP, the wet concentrator plant (WCP), the South Secondary Concentrator (SSC) and transport of HMC to Narngulu will begin in Q2 2015. Processing at the deposit is expected to conclude in Q2 2021.

Topsoil replacement over the deposit is expected to occur progressively throughout the life of the operations.

Table 2.3 Indicative Proposal schedule

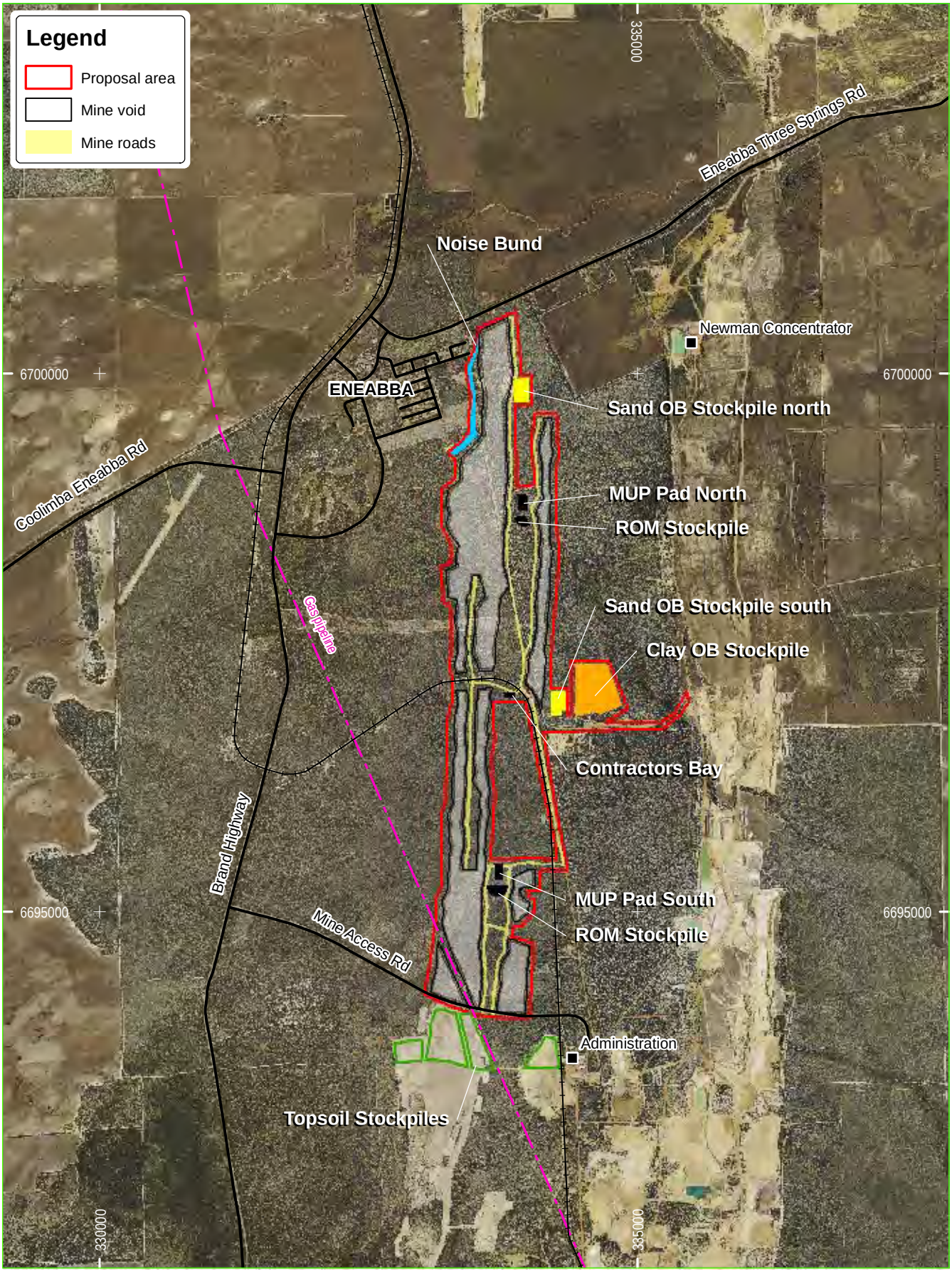
Phase	Activity	Timeframe
Pre-mining	Complete environmental approvals	late 2014
	Mine mobilisation	late 2014
Mining	Topsoil removal commences	early 2015
	Ore mining commences	early 2015
Processing	MUP operation commences	mid 2015
	HMC production commences	mid 2015
	Rutile and zircon sales	mid 2015
Post-mining	Topsoil and subsoil replacement[1]	mid 2015
	Final rehabilitation works commence	mid 2021

[1]Pit backfill and topsoil replacement will occur progressively throughout the mining operation.

2.3 Mining operations at Eneabba

In general, mining within the Proposal area will involve the following steps:

- Pre-mining site preparation including targeted searches for Declared Rare Flora (DRF), Priority flora species and native fauna as appropriate.
- Establishment of mine infrastructure
- Seed collection and vegetation clearing (where necessary).
- Removal of topsoil and subsoil with conventional earthmoving equipment including tractors, scoops and scrapers.
- Removal of overburden with conventional earthmoving equipment including excavators, bulldozers, scrapers, front-end loaders and trucks.
- Ore removal and transfer to MUP with conventional earthmoving equipment (e.g. excavators, bulldozers, scrapers, front-end loaders and trucks).
- Ore screening and production of ore slurry at the MUP.
- Pumping of ore slurry from the MUP to the Newman WCP.
- Gravity separation of mined ore at the Newman WCP to produce HMC.
- HMC is trucked to the SSC for further separation and drying.
- Transport of HMC via rail/road to Narngulu MSP.
- Processing of HMC into zircon, rutile and ilmenite products at the Narngulu MSP.
- Return of non-saleable by-products from Narngulu MSP to the mine.
- Progressive rehabilitation of the mined area.



Aerial Photography flown Nov. 2011

N

0 1 2 km

MGA coordinates, GDA94

IPL NORTH PROPOSAL

INDICATIVE MINE PLAN

ILUKA

ORIG: A Joubert DRAWN: D.L.S. SCALE: 1:50,000 (A4) DATE: May 2012 DWG No: 219074v00

FIGURE: 2.1

Prior to mining, topsoil and subsoil are stripped and stockpiled for re-spreading during rehabilitation. Seeds from vegetation are collected and stored at the Eneabba nursery where Iluka maintains seed banks and nursery operations for eventual replanting activities. Topsoil removal is typically conducted using carrygraders and is managed according to its source (e.g. vegetation type, *Phytophthora* Dieback status, previous mining history, etc.).

Topsoil and subsoil removal rates will be dictated by the requirement to remove soils and overburden in advance of the mine face. Where possible, topsoil is returned directly to areas ready for rehabilitation. Topsoil removal from areas of native vegetation will be stockpiled to a maximum height of 2m within areas of disturbed land.

Overburden is removed to stockpile initially, then directly returned behind the advancing ore face. Dry mining utilises scrapers or trucks to collect and transport the ore to a nearby Mining Unit Plant (MUP) which is either dozer pushed or loaded into a hopper. Overburden stockpiles will have a height of approximately 10m and will be formed using conventional earthmoving equipment. All stockpile heights and widths are nominal at present and may be subject to minor changes.

At the MUP, the ore is screened to remove oversized material (>4mm), including rock and other debris, which is returned to the mine pit. The sand fraction (<4mm) is pumped to the Newman WCP as a slurry.

The Newman Wet Concentrator Plant (WCP) is designed to produce a high grade of heavy mineral concentrate (about 98% heavy mineral content). The ore is de-slimed and washed through a series of spiral separators that exploit differences in mineral specific gravity to separate the heavy mineral sands from the lighter quartz and clay.

The sand residue and gangue minerals from the concentration process is pumped through a pipeline back to the mine pit and discharged into the mine void. The sand is re-contoured before overburden and topsoil replacement and is then ready for rehabilitation.

The concentrate obtained from the Newman WCP is sent to the South Secondary Concentrator (SSC) for further separation and drying. The HMC produced at SSC are transported via train to Narngulu for processing and export (Figure 2.2).

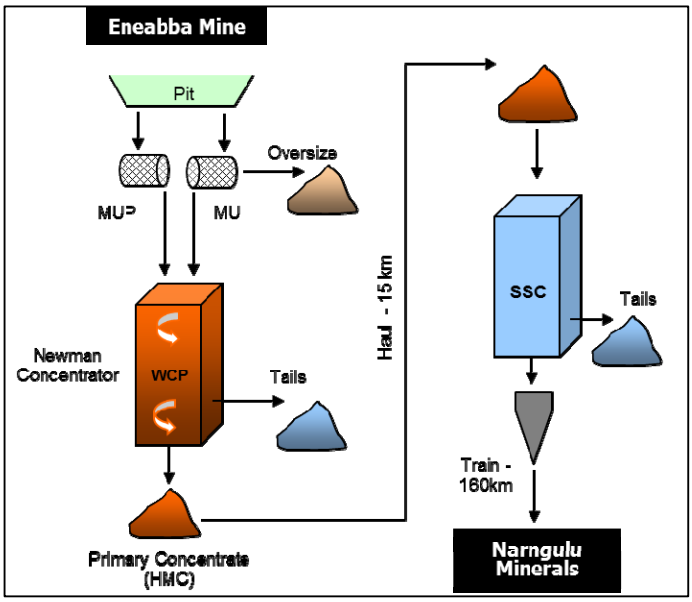


Figure 2.2 Mineral sands processing at the Eneabba Mineral Sands Mine

To minimise clearing, and optimise rehabilitation outcomes, the Proposal has modified the mining method from that typically used at the Iluka Eneabba operations. To minimise overburden rehandle and maximum topsoil replacement, the mine sequence was scheduled using sand tails backfill. Sand tails deposition drains rapidly to allow almost immediate overburden replacement, thereby significantly reducing the amount of open area required for stockpiling. The sand fraction will be split out from the WCP tailing to enable sand tails deposition into the IPL North mine pit. The higher clay/slime fraction will be co-disposed with the remaining sand tails in a tailings storage facility within existing operational areas.

To ensure a soil profile is returned that will support the re-establishment of Kwongan vegetation, the clay overburden will be backfilled to a design surface, followed by sandy dune soils (where applicable), subsoil and topsoil. Mine planning indicates the backfill strategy will support a significant component of direct topsoil replacement.

It is proposed to use one MUP at the deposit thereby minimising disturbance by reducing the number of MUP locations and reducing rehandle by limiting the number of open mining faces. The MUP will be located outside of the mine pit and will be moved once during the mining period. The IPL North deposit is approximately 6.3km long with the railway dividing the deposit into two halves. By placing the MUP in the middle of each half, it provides a maximum haul distance of 1.5km. A total of two MUP locations over the six years are thus proposed for the deposit (Figure 2.1). The overburden and soil stripping will occur approximately 250m ahead of the mine face.

Using the above mining schedule, approximately 20-30ha of the mine pit area is open (disturbed) at any given time during operation and an additional 57ha is required for off-path stockpiling. The lag distance between the mining and backfill faces is approximately 150m.

The Proposal does not involve any increase to the mine throughput, and hence there will be no increase to unit (i.e. daily) water consumption, unit electricity consumption, unit waste and wastewater production. The Proposal will have a processing rate of approximately 600tph (which is 50% of the Newman WCP capacity), will produce around 350kta of HMC and use approximately 8GL per year (GL/yr) of water for processing.

Table 2.4 shows the indicative tonnages of soil, overburden, ore and HMC contained within the material to be excavated within the IPL North deposit. Tonnages include material moved as part of the mining (i.e. on-path material) but exclude rehandled topsoil, subsoil and overburden from stockpiles.

Table 2.4 Indicative mine material tonnages

Soil (Mt)		Overburden (Mt)	Ore (Mt)	HMC (Mt)
Topsoil	Subsoil			
0.75	0	52.0	36.7	2.1

2.4 Mine infrastructure

The Proposal will continue to utilise existing roads, infrastructure corridors and supply networks as per current mining operations. The proposed mining will continue to source groundwater for mineral separation, slurrying processes, vehicle washdown, nursery development and dust suppression from existing production bores (under existing groundwater licences). Haul roads will be located adjacent and within the mine paths (Figure 2.1).

2.4.1 Water supply

Water supplies for the Iluka Eneabba operations are drawn predominantly from the deeper Yarragadee aquifer. Groundwater production licences (GWL) administered by the Department for Water (DoW) allow the extraction of 4GL of water per annum from the Twin Hills sub-area from six bores (GWL104709) and 12GL of water per annum from the Eneabba Plains sub-area from 22 bores (GWL104700). Process water is used to transport ore through the various stages of the ore processing system from the MUP to the WCP and SSC. Water is recovered and recycled where possible from tailings dams to minimise losses to evaporation and infiltration.

2.4.2 Electricity supply

Prior to idling mining activities in 2010, Iluka's electrical power supply (maximum demand 26MW) was serviced from the main grid by Western Power Corporation (WPC). The majority of the WPC network capacity was surrendered during 2010, with 2MW retained for ongoing rehabilitation work. Upon restarting mining operations, a maximum demand of 14MW was required, resulting in a shortfall of 12MW. The supply of additional electrical power from the WPC grid has been limited as no spare capacity will be available until power supply lines are upgraded in the Midwest region. As a consequence, a temporary on-site power generation system was constructed utilizing gas fired reciprocating engines to supply the shortfall. Construction and commissioning work for the power station was undertaken under DEC Works Approval W5057/2011/1. Power lines will run from the temporary on-site

power generation system along the existing road from Mineral Sands Road to the Proposal area.

The Proposal will utilise this temporary on-site power generation until the upgrade of the power supply lines are complete.

2.5 Transport

HMC from the Iluka Eneabba operations is transported to the Narngulu MSP via the designated railway line installed in the 1970s in accordance with the MSSAA. Generally one train per day carries approximately 2,800 tonnes of HMC from Eneabba to Narngulu. QR National (formerly ARG) is responsible for rail transport.

Non-saleable by-products are returned from Narngulu to Eneabba via pocket road trains. Around three to four loads of these by-products (approximately 52 tonnes per load) is delivered daily with trucks returning to Narngulu loaded with HMC.
The transport route is via the south access onto the Brand Highway via Rudds Gully Road and Gould's Road into Narngulu.

2.6 Workforce

The Proposal will utilise the current workforce at the Eneabba Mineral Sands Mine including 65 full-time and approximately 100 contractor positions.

3. PROPOSAL JUSTIFICATION AND ALTERNATIVES

3.1 Proposal justification and context

Iluka is a major producer of zircon globally and one of the largest producers of the high-grade titanium dioxide products of rutile and synthetic rutile, with operations in Australia and USA. The Eneabba Mineral Sands Mine has been operating for over 30 years under various approval arrangements and by a range of operators. Iluka holds tenements in the Eneabba region under the mineral sands agreement tenement (AM70/267), various Mining Lease tenures and under Exploration Leases (Figure 3.1).

The Iluka Eneabba operation is a major contributor to the local and regional economy and is a key component of the Iluka operations in Western Australia. Mineral sand derived from Eneabba makes a significant contribution to world trade in zircon and titanium products.

The Iluka Eneabba operations generate substantial economic activity in the region with the re-start generating approximately $110M of revenue annually. Mineral sands mining in the region also makes an important contribution to the local and regional economies and the Iluka Midwest Operations (Eneabba and Narngulu).

As mentioned in Section 2.3, the IPL North deposit is the highest grade in-situ reserve remaining at Eneabba.

3.2 Alternatives considered

Iluka undertook an economic assessment of the IPL North deposit in light of the current market conditions. Several mine schedules and mine plans were evaluated to best meet Iluka's project goals, environmental management requirements, technical achievability, legislative compliance and company expectations.

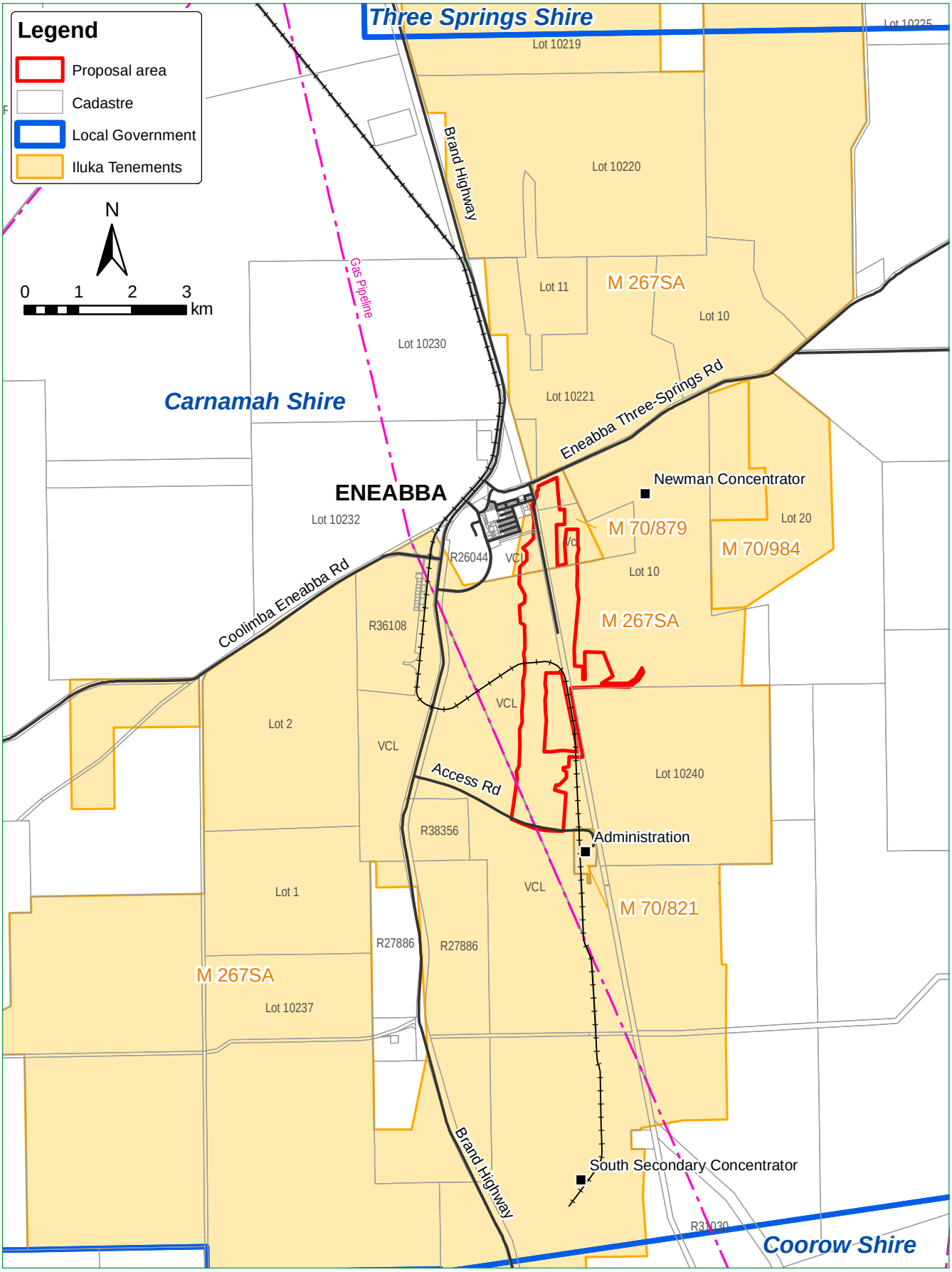
During design of the Proposal, the following criteria of mining and rehabilitation practises were taken into account:

- Prioritise direct-placement of topsoil and aim to achieve better than 50%.
- Minimise disturbance footprint by reducing rehandle and placement of stockpiles.
- Deposit tails a minimum of 4m below the surface.
- Return the overburden and soils back to similar soil profile.

3.2.1 'No development' option

The IPL North deposit is located within an area covered mostly with native vegetation including Declared Rare Flora (DRF) and Priority flora species. It also extends into the P1 and P2 Water Reserve areas of the Eneabba town water supply (Figure 4.8). Although the 'no development' option would eliminate any environmental impacts associated with the Proposal, Iluka discarded the 'no development' option for the following reasons:

- IPL North deposit is the highest grade in-situ reserve remaining at Eneabba.
- The Proposal has an anticipated mine life of approximately six years from commencement of production.



IPL NORTH PROPOSAL

ILUKA TENEMENTS AND LOCAL GOVERNMENT BOUNDARIES

ILUKA

ORIG: A Joubert DRAWN: D.L.S. SCALE: 1:100,000 (A4) DATE: May 2012 DWG No: 219075v00

FIGURE: 3.1

- The Proposal is part of Iluka's ongoing Midwest Operations, and ensures continuation of operations and supply to customers as other HMC reserves are depleted.

Development of the IPL North deposit is desirable for the company, State Government via taxes and royalties, the regional economy in the Midwest and the township of Eneabba.

3.2.2 Current mining practices

The conventional tailing method at the Iluka Eneabba operations is co-disposal of the sand and clay/slimes tails. The thickener at Newman WCP pumps the clay/slimes fraction back into the sand tails stream for co-disposal into discreet basins. These basins include:

- mined out voids;
- cells within operating pits, with in-pit walls separating the co-disposal from the mining face; or
- external Tails Storage Facility (TSF).

The length of time required for co-disposed tails to dry sufficiently to replace an overburden cap is uncertain, but experience dictates it can be anything from six to 12 months or more. Co-disposal of tails into an operating mine void also increases the overburden rehandle, reduces direct topsoil placement and increases disturbance.

The mine schedule for co-disposal of tailings indicated overburden/soils rehandle of 40% or 10.5Mbcm that would require stockpiling off-path. Approximately 100ha of mine pit area would be open (disturbed) at any time during operation, and an additional 80ha is required for off-path stockpiling. Direct topsoil replacement would be significantly less than 50%.

Considering the above, the current mining practices would not meet the criteria set out during the design of the Proposal.

3.2.3 Preferred option

The Proposal includes modification to the existing mining methods at the Iluka Eneabba operations, as discussed in Section 2.4.

The mine schedule for disposal of sand tails in the mine pit indicated overburden/soils rehandle of 8% or 2.2Mbcm that would require stockpiling off-path. Approximately 20-30ha of mine pit area would be open (disturbed) at any time during operation and an additional 57ha is required for off-path stockpiling. Direct topsoil replacement of more than 50% could be achieved.

There is a 48% reduction in disturbance area from using the preferred mine schedule for disposal of sand tails in the mine pit (87ha disturbance vs. 180ha disturbance using co-disposal) (Table 3.1).

The preferred option meets the criteria set out during the design of the Proposal.

Table 3.1 Key differences between current mining practices and preferred option

Aspect	Tails disposal	
	Co-disposal of tailings in mine pit (current practice)	**Sand tails disposal in mine pit (preferred)**
Overburden/soils rehandle	40%	8%
Off-path stockpile requirement	10.5Mbcm 80ha	2.2Mbcm 57ha
Open (disturbed) mine pit area	100ha	30ha
Total open (disturbed) area during mining (excluding infrastructure)	180ha	87ha

4. EXISTING ENVIRONMENT

This section provides an overview of the existing environment in a regional and local context to the Proposal area. Impacts of the Proposal on key environmental aspects are further described in Section 5.

4.1 Scope of environmental investigations

During the environmental approvals process during 2007-2009 for the Proposal (including the Allied Tails, IPL South and IPL North deposits), various environmental investigations were undertaken. Many of these studies were consulted during the design and planning for this Proposal. Other environmental investigations undertaken relevant to the Proposal area were also consulted. Table 4.1 notes key environmental investigations undertaken in and adjacent to the Proposal area.

Table 4.1 Key environmental investigations

Investigation	Date	Author	Description
Flora			
Summary report of flora and vegetation studies 2001 to 2011	2012	Woodman Environmental Consulting	Unpublished report prepared for Iluka Resources Limited (Appendix A)
Flora and vegetation study – Floristic Community Types	2011	Woodman Environmental Consulting	Unpublished report prepared for Iluka Resources Limited
Flora, vegetation and fauna impact assessment	2009	Woodman Environmental Consulting	Unpublished report prepared for Iluka Resources Limited
Flora conservation significance assessment, IPL North and IPL South	2009	Woodman Environmental Consulting	Unpublished report prepared for Iluka Resources Limited
Flora and vegetation study – Floristic Community Types	2009	Woodman Environmental Consulting	Unpublished report prepared for Iluka Resources Limited
Eneabba Regional Vegetation Assessment	2008	Woodman Environmental Consulting	Unpublished report prepared for Iluka Resources Limited and Tiwest Pty Ltd
Survey of P1 and Hopkins area	2007	Woodman Environmental Consulting	Unpublished report prepared for Iluka Resources Limited
Survey of the Depot Hill/Brandy Flat, IPL North and IPL South areas	2002	Woodman Environmental Consulting	Unpublished report prepared for Iluka Resources Limited
Fauna			
Further assessment of significant habitat for Carnaby's Cockatoo (*Calyptorhynchus latirostris*) in the Eneabba region	2009	Johnstone, R.E, Johnstone, C. & Kirkby, T	Unpublished report prepared for Iluka Resources Limited (Appendix B)
Fauna investigations of Iluka's proposed Eneabba future mining operations with a focus on IPL North and IPL South deposits.	2009	Bamford Consulting Ecologists	Unpublished report prepared for Iluka Resources Limited
Survey for the Shield-backed Trapdoor Spider (*Idiosoma nigrum*) in Iluka lease areas at Eneabba	2007	Bamford Consulting Ecologists	Unpublished report prepared for Iluka Resources Limited
Fauna values of proposed	2007	Bamford Consulting	Unpublished report prepared for

Investigation	Date	Author	Description
future mining areas in the Eneabba region.		Ecologists	Iluka Resources Limited
Fauna review, Eneabba`	2006	Bancroft, W.J & Bamford, M.J.	Unpublished report prepared for Iluka Resources Limited
Baseline fauna survey for IPL Central and IPL North	2001	Halpern Glick Maunsell Pty Ltd (HGM)	Unpublished report prepared for Iluka Resources Limited
Eneabba invertebrate and vertebrate fauna monitoring	1998	Halpern Glick Maunsell Pty Ltd (HGM)	Unpublished report prepared for Iluka Resources Limited
***Phytophthora* Dieback**			
Eneabba mining area – Dieback assessment	2007	Glevan Consulting	Unpublished report prepared for Iluka Resources Limited
Survey for the presence of disease caused by *Phytophthora* species	2001	Glevan Dieback Consultancy Services	Unpublished report prepared for Iluka Resources Limited
Aboriginal heritage			
(Ethnographic) Aboriginal heritage survey of E70/2634 at Eneabba	2005	O'Connor, R. & E.	Unpublished report prepared for Iluka Resources Limited
Report on an (ethnographic) Aboriginal heritage survey of the Eneabba South Project (i.e. M70/1061 IPL South Project)	2005	O'Connor, R. & E.	Unpublished report prepared for Iluka Resources Limited
(Ethnographic) Aboriginal heritage assessment report – mining lease 70/879	2004	Wanati Pty Ltd	Unpublished report prepared for Iluka Resources Limited
Archaeological and ethnographic survey for Aboriginal sites – AMC Mineral Sands project, Eneabba	1992	McDonald, Hales & Associates	Unpublished report prepared for Iluka Resources Limited
Soils			
Acid sulphate soil survey for Eneabba minesite	2008	Soil Water Consultants (SWC)	Unpublished report prepared for Iluka Resources Limited
Groundwater & surface water			
Surface, subsurface and groundwater dependant ecosystem impact assessment	2009	Soil Water Consultants (SWC)	Unpublished report prepared for Iluka Resources Limited
Wetland mapping, classification, evaluation and impact assessment associated with Iluka Resources Limited mineral sand mining in the region of Eneabba	2009	V&C Semeniuk Research Group (VCSRG)	Unpublished report prepared for Iluka Resources Limited
Eneabba east mine aquifer review and ERMP area impact assessment	2009	ENSR Australia Pty Ltd	Unpublished report prepared for Iluka Resources Limited
Eneabba water reserve P1 groundwater study	2009	ENSR Australia Pty Ltd	Unpublished report prepared for Iluka Resources Limited
Noise			
Noise monitoring and compliance assessment for Eneabba	2011	SVT Engineering Consultants	Unpublished report prepared for Iluka Resources Limited
Environmental noise impact	2009	SVT Engineering	Unpublished report prepared for

Investigation	Date	Author	Description
assessment for the proposed Eneabba mining operations		Consultants	Iluka Resources Limited

4.2 Land use

The current land uses within and adjacent the Proposal area include agriculture, mining and Eneabba townsite infrastructure. Broad-acre agriculture is the major land use in the Eneabba region which is dominated by a mix of cereal cropping and annual pastures for sheep and beef cattle. Within the wider region, there has been an increase in horticultural land use over the past decade including olive plantations, citrus and nut orchards. Other mining activities in the region include iron ore, oil, gas, lime sands, gypsum and limestone.

Eneabba is serviced by major transportation routes including the Brand Highway and railway line which transports mineral sands to Geraldton for processing at Narngulu and shipping through the Geraldton Port.

4.3 Climate

The Eneabba region has a Mediterranean-type climate with hot, dry summers and mild, wet winters. There is a Bureau of Meteorology weather station located on McGowen Place within the Eneabba town site. Mean maximum summer temperatures range between 19°C and 36°C. Mean maximum winter temperatures range between 19°C and 20°C (BOM 2012).

Average annual rainfall is roughly 500mm. Rainfall varies seasonally from approximately 7mm (lowest) in January to approximately 280mm (highest) in June. Approximately 90% of rainfall occurs between April and September (BOM 2012). Regional annual evaporation ranges between 2,000 and 2,400mm per year.

Sea breezes which come mainly from a south-south westerly direction off the Indian Ocean attain average speeds of 18 km/hr when they reach Eneabba during summer months (Stuart-Street 2007). Winter winds are varied by climatic conditions such as cold fronts coming off the Indian Ocean, which are mainly from an east to north-west direction before the cold fronts, and from a west to south-westerly direction behind cold fronts (Stuart-Street 2007).

The climate presents challenges in mine rehabilitation methods due to the hot dry summers and strong prevailing winds. Rainfall trends in recent years for the region have declined compared to the calculated long-term averages. This trend is an important consideration not only in planning for rehabilitation but also when considering new information on vegetation and fauna distribution.

4.4 Demographics

The Proposal area is located in the Shire of Carnamah and the closest town is Eneabba (Figure 3.1). In 2006, the Australian Bureau of Statistics (ABS 2012) estimated the resident population of Eneabba at 250. The most common industries of employment during the 2006 Census for persons aged 15 years and over include:

- metal ore mining (28.0%)
- land development and site preparation services (20.5%)

- sheep, beef cattle and grain farming (13.6%)
- accommodation (6.8%)
- school education (6.1%)

Agricultural activities dominate the Eneabba region with a mix of cropping, predominately of cereals, and livestock, which consists of mainly sheep and beef cattle. Within the wider region there has been a growth in horticulture with extensive olive plantations, as well as areas of citrus and nut orchards. The coastal towns of Leeman, Jurien, Greenhead and Cervantes feature active fishing and tourism industries.

4.5 Landform and soils

The Proposal is located within the Eneabba Plain, a northward extension of the Bassendean Dune System of the Swan Coastal Plain, between the coastal belt and the Gingin Scarp. It is built up of early Pleistocene (or late Tertiary) shoreline, lagoon and dune deposits with high concentrations of heavy minerals (e.g. ilmenite, rutile, leucoxene and zircon).

Soils of the Proposal area typically consist of the Geraldton Coastal soil-landscape zone. Stuart-Street (2007) describes the Geraldton Coastal unit as being “dunes with alluvial plains and sand sheets. Low hills of Pleistocene Tamala Limestone, recent calcareous and siliceous dunes. Yellow/brown shallow sands, Yellow deep sands, Calcareous deep and shallow sands and Pale deep sands.”

The Arrowsmith Region (Playford *et al.* 1976) occurs between the Swan Coastal Plain and Dandaragan Plateau, intersecting the eastern edge of the Proposal area (Figure 4.1). This region is bounded between the Dandaragan Scarp and Gingin Scarp and is to the east and south of the Eneabba area. The Arrowsmith Region is an undulating sandy region with laterite breakaways occurring at the crest of hills. Some hills are flat topped and in many areas the laterite surface slopes towards the present drainage channels (Mory and Lasky 1996). The Arrowsmith Region is much more dissected than the Dandaragan Plateau with surface drainage generally ephemeral, terminating in lakes and swamps on the Swan Coastal Plain.

4.6 Biogeographical region

The Proposal area is located within the Geraldton Sandplains Interim Biogeographical Region and the Lesueur Sandplain subregion (Environment Australia 2000). The Geraldton Sandplains bioregion comprises mainly proteaceous heaths and scrub-heaths, rich in endemics, on the sandy earths of an extensive, undulating, and lateritic sandplain mantling Permian to Cretaceous strata (Desmond and Chant 2002).

The Geraldton Sandplains Bioregion falls within the EPA (2004) classification of Bioregion Group 1. These are bioregions where extensive clearing has taken place. The Geraldton Sandplains Bioregion is of particular interest as it is transitional between the broad bio-regions of the Bassian South-West and the interior Eremeaen or Eyrean (Bancroft and Bamford 2006). As a consequence, the flora and fauna

contain elements of both bioregions, with many species at the periphery of their range.

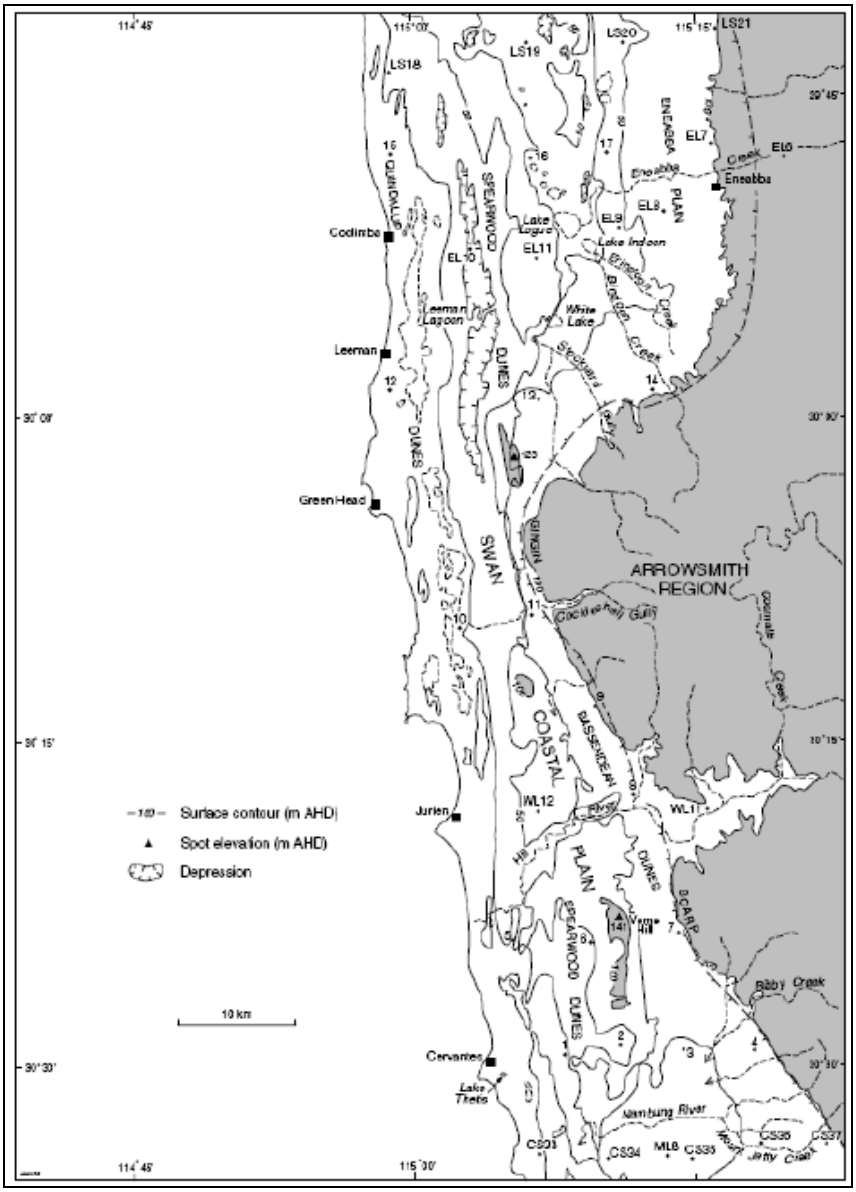


Figure 4.1 Physiography of the Eneabba region (Kern 1997)

4.7 Vegetation

4.7.1 Regional vegetation

The Iluka Eneabba lease areas are located within the Irwin Botanical District (Northern Sandplains Region) within the Southwest Botanical Province as defined by Beard (1990). The Northern Sandplains Region covers the area along the coastline, extending to the Darling Fault in the east, Shark Bay in the north and Badgingarra to the south (northern limit of *Banksia* low woodland). The area was originally covered

by various types of 'Kwongan'[1] vegetation, *Acacia* scrub (with or without scattered trees) and *Eucalypt* woodlands (Beard 1990). Dominant plant families within the Irwin Botanical District include Proteaceae (*Grevillea, Banksia*), Myrtaceae (*Eucalyptus, Melaleuca*), Mimosaceae (*Acacia*), Casuarinaceae (*Casuarina, Allocasuarina*), Asteraceae (daisies), Chenopodiaceae (salt bushes) and Poaceae (grasses) (Woodman Environmental 2012).

Vegetation systems within the Eneabba region include the Tathra and Erindoon Systems (Figure 4.2). The Iluka lease areas are predominantly located on the Tathra System which is the largest in the area and consists of a sandplain with a fairly uniform scrub heath assemblage, with some *Melaleuca* thicket, and woodland. Several different types of heath are located within this System, including low, lateritic heath and scrub heath. The low, lateritic heath is dominated by species such as *Hakea auriculata*, Banksia *fraseri*, *Melaleuca scabra*, *Allocasuarina humilis*, *Petrophile* spp., *Melaleuca radula* and Restionaceae spp. The northern and western sections of the Iluka Eneabba operations are located on the Eridoon System which is characterised by a sandplain community of scattered small trees up to 5m tall, an open layer of tall shrubs to 3m and a closed layer of small heath-like shrubs <1m (Woodman Environmental 2012). These systems were further divided into vegetation community types (associations), related to physiognomy by Shepherd *et al.* (2002). There are four vegetation associations located within the Eneabba region with the total extent of each of these vegetation systems shown in Table 4.2.

Table 4.2 Vegetation systems within the Eneabba region

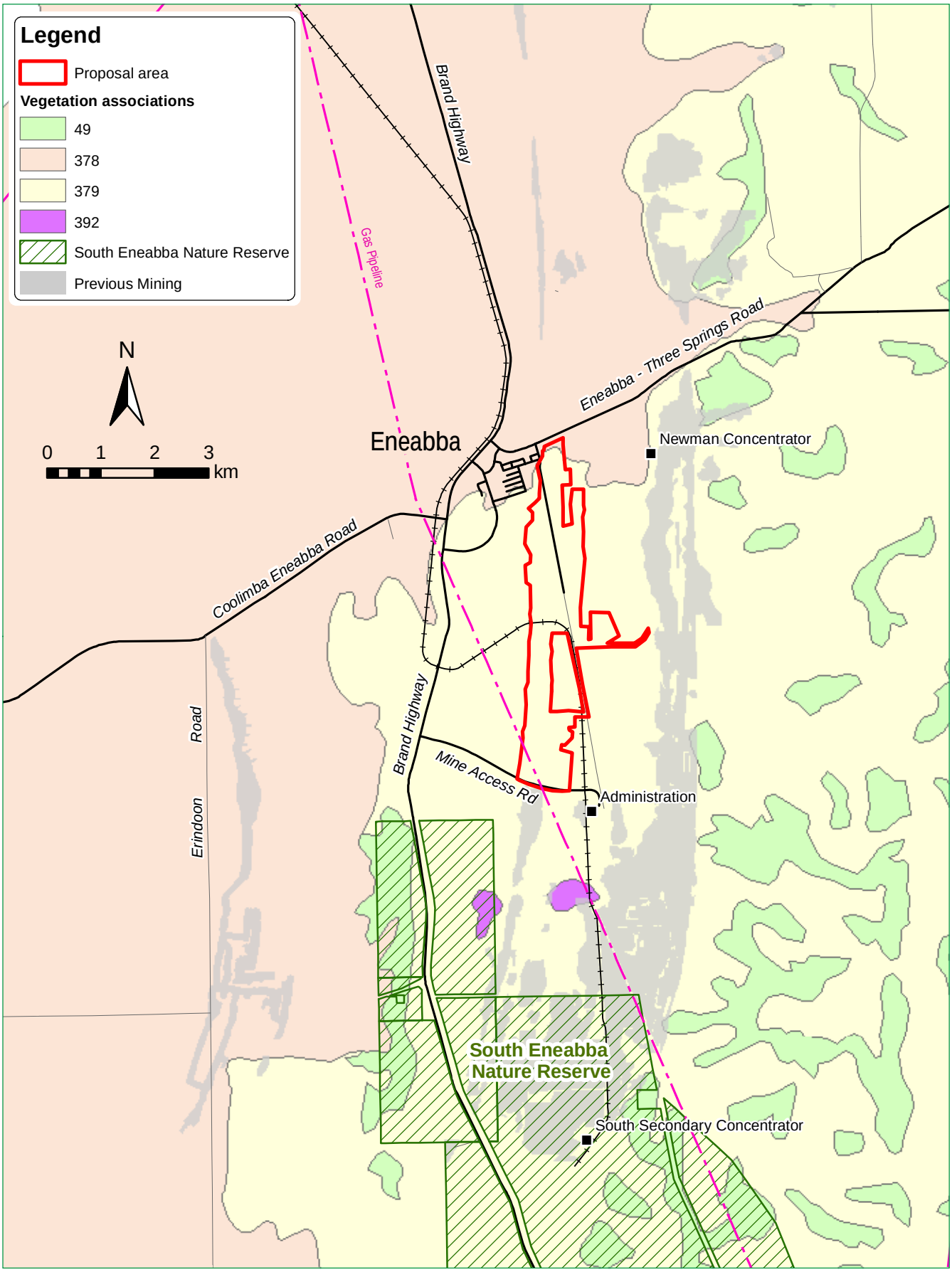
Vegetation association	Description	Current extent (ha)	Percentage of Pre-European extent remaining	Percentage held in IUCN Class Reserves
49	Shrublands; mixed heath	59,113	40.4	45.5
378	Shrublands; scrub heath with scattered *Banksia* spp., *Eucalyptus todtiana* and *Xylomelum angustifolium* on deep sandy flats	68,049	62.0	21.1
379	Shrubland; scrub heath on lateritic sandplains	128,007	20.2	20.3
392	Shrublands; *melaleuca thoides* thickets	1,554	42.6	16.4

*Source: Woodman Environmental 2012

A search of the Department of Environment and Conservation (DEC) Threatened Ecological Community (TEC) database was conducted for the region. This lists two TECs as being present within the Iluka lease areas including:

- TEC72 Ferricrete: 'Ferricrete floristic community (Rocky Springs type)' (Endorsed by the Minister for the Environment, considered to be Endangered).
- TEC116 Assemblage 3.1: 'Wheatbelt Assemblage 3.1 ubiquitous wetland taxa distributed in various wetland habitats throughout the south-west' (Not endorsed by the Minister for the Environment).

[1] Hnatiuk and Hopkins (1981) defined the term 'Kwongan' as 'sclerophyllus shrubland or sandplain vegetation'.



IPL NORTH PROPOSAL

VEGETATION ASSOCIATIONS

ILUKA

ORIG: A Joubert DRAWN: D.L.S. SCALE: 1:100,000 (A4) DATE: May 2012 DWG No: 219076v00

FIGURE: 4.2

Neither of these TECs is listed on the EPBC Act and no Priority Ecological Communities (PECs) as listed by the DEC (September 2011) are known from the Iluka lease areas.

A total of 1,012 vascular plant taxa belonging to 75 plant families have been recorded within the Iluka lease areas up to 2011. A full species list can be found in Appendix A of Woodman Environmental (2012) (Appendix A).

A total of fifteen Threatened Flora (Declared Rare Flora – Extant) species as defined by Schedule 1 of the *Wildlife Conservation Act 1950* have been previously recorded within the Eneabba region. Twelve of these taxa have been recorded within the Iluka Study Area by Woodman Environmental and the DEC (Woodman Environmental 2012). These were *Eleocharis keigheryi*, *Eremophila glabra* subsp. *chlorella*, *Eucalyptus crispata*, *Eucalyptus impensa*, *Eucalyptus johnsoniana*, *Eucalyptus suberea*, *Grevillea althoferorum* subsp. *althoferorum*, *Grevillea curviloba* subsp. *incurva*, *Leucopogon* sp. ciliate Eneabba (F. Obbens & C. Godden s.n. 3/7/2003), *Leucopogon obtectus*, *Paracaleana dixonii*, *Tetratheca nephelioides* and *Thelymitra stellata*.

A total of 103 Priority Flora species have been recorded within the Eneabba region by Woodman Environmental, other consultants and the DEC with 79 of these recorded within the Iluka lease areas (refer Table 6 in Woodman Environmental 2012).

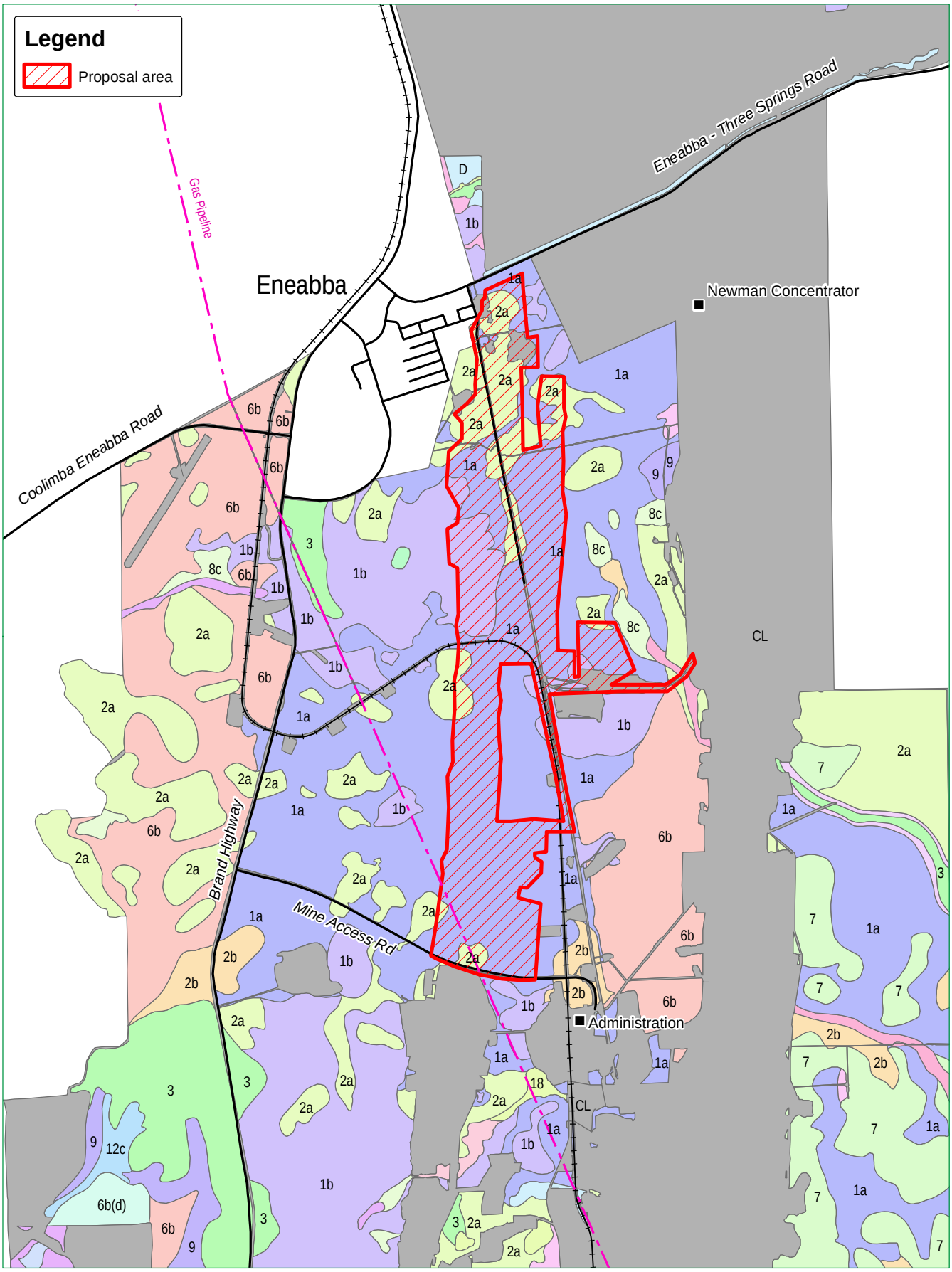
Regional floristic mapping of the Northern Sandplains area (which includes the Iluka Eneabba lease areas as well as the Tiwest Dongara lease area) undertaken by Woodman Environmental in 2007/2008 considered a total of 810 taxa during the statistical analysis to determine the Floristic Community Types (FCTs) within this area. A total of 42 FCTs were identified during the statistical analysis of the regional dataset, 30 of which were recorded within the Iluka lease areas (Woodman Environmental 2012).

During 2010, Woodman Environmental surveyed established quadrats to improve the accuracy of the dataset and record any herbaceous annual or perennial species that may not have been recorded during the initial survey in 2007/2008. Previously disturbed areas including pastureland, rehabilitation and land cleared of vegetation for mining and infrastructure have been collectively categorised as being ‘cleared’.

4.7.2 Vegetation within the Proposal area

The Proposal area intersects the Tathra Vegetation System with a small northern section falling within the Eridoon Vegetation System (Figure 4.2). In total, five FCTs (FCT1a, FCT1b, FCT2a, FCT6b and FCT14) occur within the Proposal area (Figure 4.3; Woodman Environmental 2012):

- FCT1a: Open Low Woodland to Open Low Scrub of *Eucalyptus pleurocarpa* and/or *Eucalyptus todtiana* over mixed shrubs dominated by *Banksia* spp. and *Hakea* spp. over sedges on grey to brown sands with very occasional laterite



IPL NORTH PROPOSAL
FLORISTIC COMMUNITY TYPES

ILUKA

ORIG: A Joubert DRAWN: D.L.S. SCALE: 1:50,000 (A4) DATE: May 2012 DWG No: 219077v00

FIGURE: 4.3

influence on lower to mid slopes. FCT1a is the dominant community type within the Proposal area.

- FCT1b: Open Woodland to Scrub of *Eucalyptus* spp. and/or *Banksia* spp., with occasional *Xylomelum angustifolium*, over mixed shrubs dominated by myrtaceous spp., *Banksia* spp., and *Jacksonia* spp. on grey sand on mid to upper slopes.
- FCT2a: Low Woodland of *Banksia attenuata* and occasional *Banksia menziesii* and *Xylomelum angustifolium*, over Low Scrub of mixed species including *Banksia leptophylla* var. *leptophylla*, *Banksia candolleana*, *Melaleuca leuropoma* and *Hibbertia hypericoides* on brown or grey sand on upper slopes.
- FCT6b: Shrublands and Heaths, with occasional Low Woodland of *Eucalyptus pleurocarpa*. Common species include *Allocasuarina microstachya*, *Melaleuca leuropoma*, *Melaleuca trichophylla*, and *Verticordia* spp. over sedges on grey-brown sands, sandy clays and or gravel on flats, swales and lower-slopes.
- FCT14: Low Woodland of *Eucalyptus accedens* over Open Low Scrub dominated by *Baeckea* spp and *Melaleuca* spp. on sandy gravels or sandy clay on flats and lower slopes.

Neither of the TECs listed under the WC Act or EPBC Act are located within the Proposal area. No Priority Ecological Communities (PECs) as listed by the DEC (September 2011) are known to occur within the Proposal area (Woodman Environmental 2012).

Threatened, Declared Rare and Priority Flora known to occur within the Proposal area are listed in Table 4.3. Figure 4.4 show the respective locations.

Table 4.3 Threatened, Declared Rare and Priority Flora within the Proposal area

Taxon Name	State Conservation Code*	Commonwealth classification
Banksia cypholoba	P3	
Calytrix chrysantha	P4	
Calytrix eneabbensis	P4	
Calytrix superba	P4	
Desmocladus elongates	P3	
Eucalyptus macrocarpa subsp. *elacantha*	P3	
Grevillea biformis subsp. *Cymbiformis*	P3	
Grevillea rudis	P4	
Haemodorum loratum	P3	
Hermiandra sp. Eneabba (H. Demarz 3687)	P3	
Hypocalymma gardneri	P3	
Mesomelaena stygia subsp. *deflexa*	P3	
Paracaleana dixonii	T	Endangered
Persoonia filiformis	P2	
Pityrodia viscida	P4	

Taxon Name	State Conservation Code*	Commonwealth classification
Schoenus sp. Eneabba (F. Obbens & C. Godden I154)	P2	
Verticordia argentea	P2	
Verticordia aurea	P4	
Verticordia fragrans	P3	

Source: Woodman Environmental (2012); *T – rare or likely to become extinct, P1 – Priority 1, P2 – Priority 2, P3 – Priority 2, P4 – Priority 4

The condition of the vegetation in the Proposal area is generally in very good condition although more disturbances from mining associated activities are present (Woodman Environmental 2012).

4.7 *Phytophthora* Dieback

Seven species of *Phytophthora* Dieback have been identified within the Iluka Eneabba operational areas in surveys conducted since 1991 (Hart Simpson and Associates Pty Ltd 1991, 1992a, 1992b, 1993; Glevan Dieback Consultancy Services 2001; Glevan Consulting 2007, 2009). One species, *Phytophthora cinnamomi*, has been identified as having the greatest impact on native vegetation communities. During 2008, the sites used in the previous assessments were re-sampled and proposed new disturbance areas were mapped (Glevan Consulting 2009).

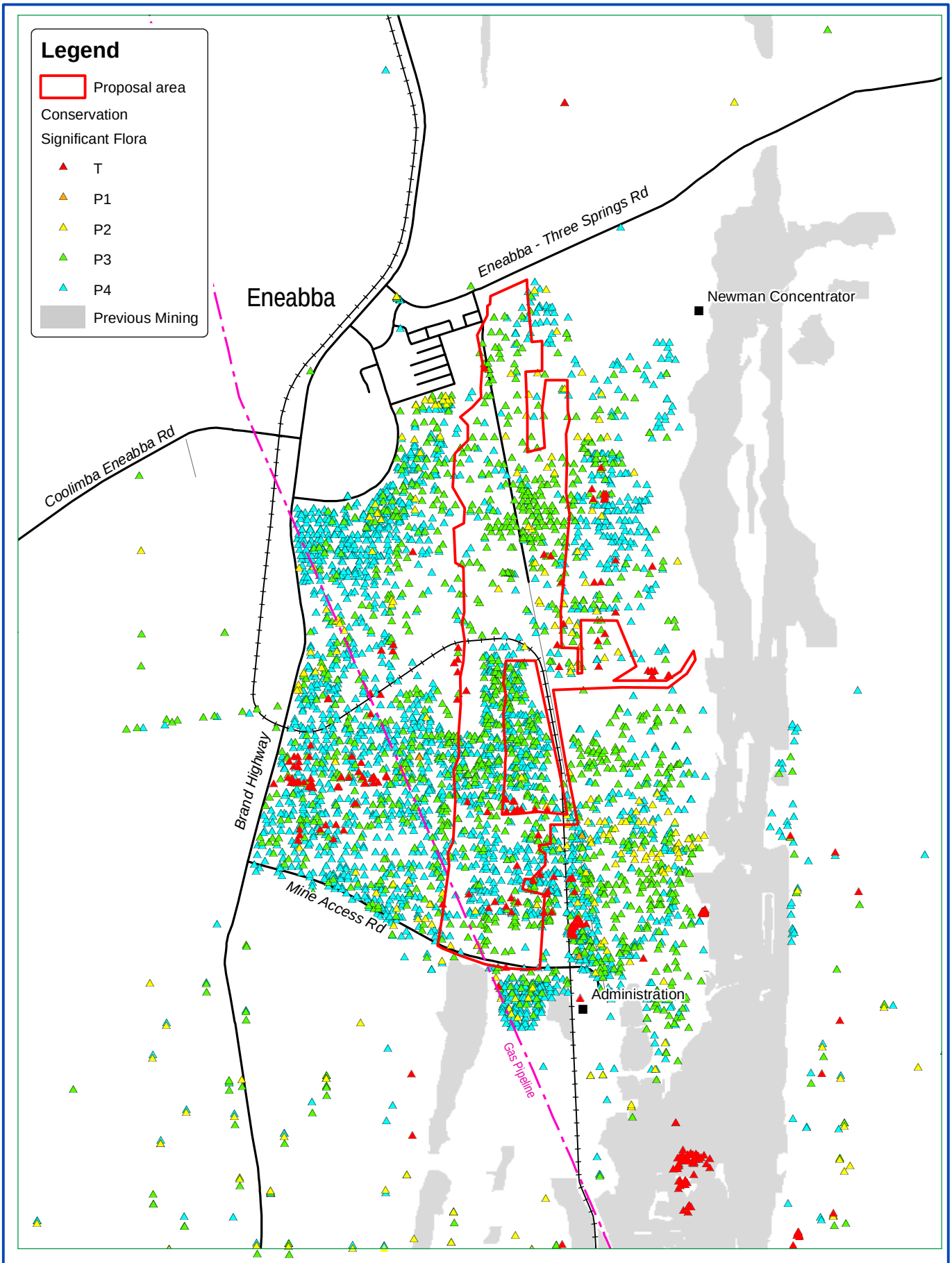
The plant communities in the Eneabba region include many rare and threatened plant species (Landcare Services Pty Ltd 1998; Woodman 2005), some of which are susceptible to *Phytophthora* Dieback.

The Eneabba mining tenements have been surveyed extensively for *Phytophthora* Dieback since 1991. Several species of *Phytophthora* have been identified since surveying commenced with one species, *P. cinnamomi*, being identified as having the greatest impact on native vegetation communities.

A *Phytophthora* Dieback assessment was undertaken by Glevan Consulting in 2007 and assessed sites in the North and South Mine, Depot Hill and in an adjacent area not covered by this Proposal (i.e. West Mine). Glevan Consulting undertook a detailed assessment of existing and proposed operational areas and areas under rehabilitation in November 2008 (Glevan Consulting 2009).

Current interpretation areas are based on disease status 'categories' as defined by DEC, formerly Department of Conservation and Land Management (CALM), manual "*Phytophthora cinnamomi*[2] and disease caused by it, Volume 1, Management Guidelines"(CALM 2003). Disease interpretation categories are defined in Table 4.4.

[2] Prior to publication of the *Best Practice Guidelines-Management of Phytophthora Dieback in Extractive Industries* (Dieback Working Group 2005), most documents relating to the management of *Phytophthora* Dieback have only referred to *Phytophthora cinnamomi*. In this Supporting Document, the term *Phytophthora* Dieback refers to *Phytophthora cinnamomi* and the other species of *Phytophthora* that have been recorded in the area.



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IPL NORTH PROPOSAL
CONSERVATION SIGNIFICANT FLORA

ILUKA

ORIG: A Joubert DRAWN: D.L.S. SCALE: 1:50,000 (A4) DATE: May 2012 DWG No: 219078v00

FIGURE: 4.4

Table 4.4 *Phytophthora* Dieback assessment categories

Category	Definition
Unmappable	Areas that is sufficiently disturbed so that *P. cinnamomi* occurrence mapping is not possible at the time of inspection. Further categorisation may be possible after variable regeneration periods for different types of disturbance.
Mappable – infested	Areas that a qualified person has determined to have plant disease symptoms consistent with the presence of the pathogen *P. cinnamomi*
Mappable – uninfested	Areas that a qualified person has determined to be free of plant disease symptoms that indicate the presence of the pathogen *P. cinnamomi*
Mappable – uninterpretable	Areas where indicator plants are absent or too few to determine the presence or absence of disease caused by *P. cinnamomi*

Further to the definition in Table 4.4, unmappable areas can include cleared land that is being mined, land that has been rehabilitated to pasture and roads and infrastructure. Mining areas that have been rehabilitated to native vegetation are categorised as being uninterpretable if there are insufficient disease indicator species present or if the vegetation is not yet established to determine the cause of susceptible species mortality.

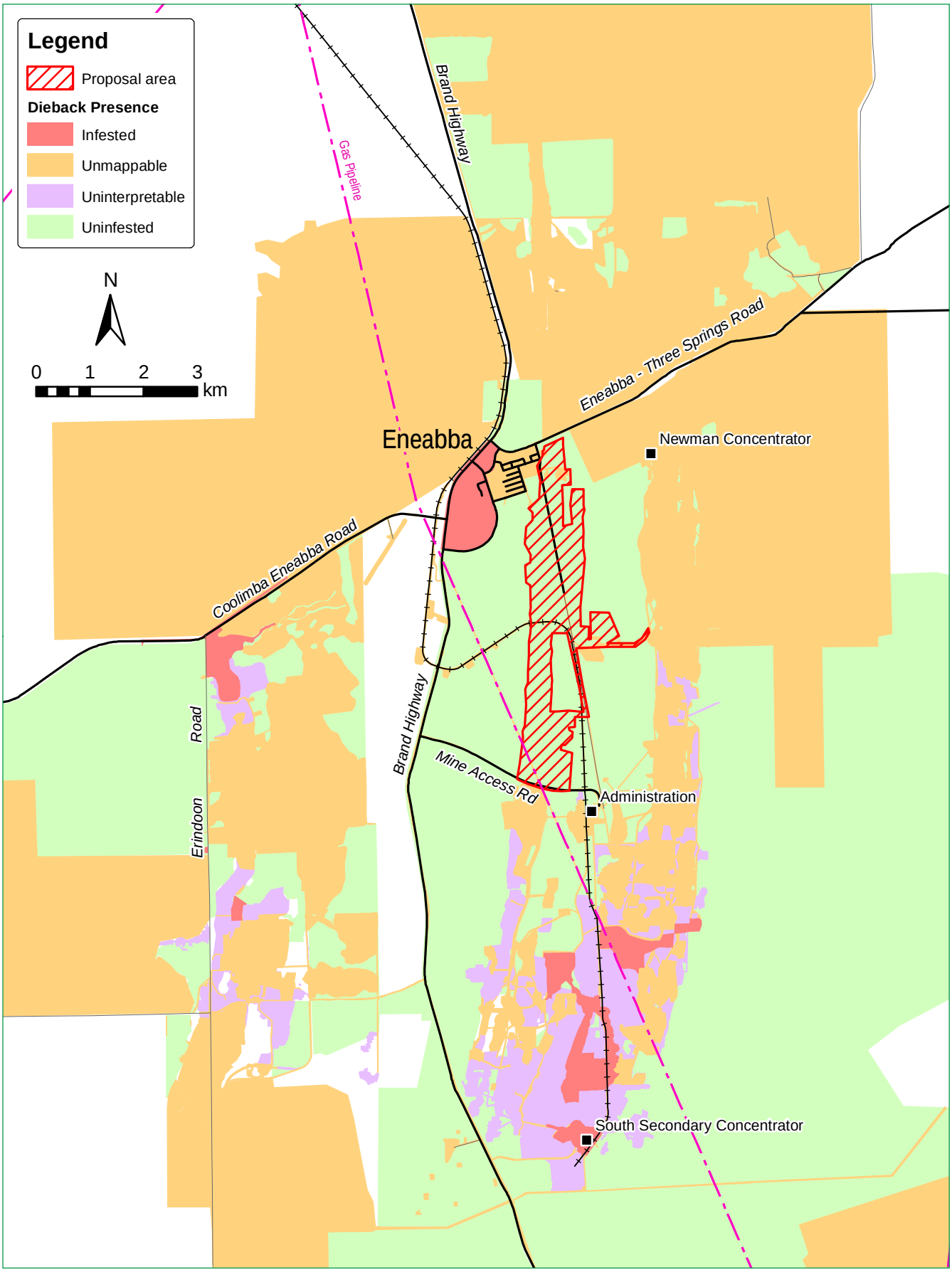
The results from sampling, conducted in November 2008 and field occurrence mapping completed in January 2009 by Glevan Consulting, confirm that the Iluka Eneabba lease areas currently contain seven areas infested with *Phytophthora* Dieback as well as several identified infestation sites outside the Iluka Eneabba lease areas.

Glevan Consulting also undertook an assessment of the remnant and rehabilitated vegetation within the Iluka Eneabba operations areas for the presence of *Phytophthora* Dieback in 2010. A total of 41 samples were taken during two separate sampling programs conducted in March and November of 2010, all of which, returned negative results for the presence of *P. cinnamomi*. The November program targeted several known infestations in an attempt to prove that 'false negative' sample results were being attained at sites where the pathogen was definitely present. Pathogen dormancy at the time of sampling is thought to be the reason for the false negative sample results, and further sampling will be carried out to determine optimum sampling timing (Glevan Consulting 2011).

The area to the west of the Eneabba townsite is infested *Phytophthora* Dieback with the Proposal area currently uninfested with some areas as 'unmappable'. A portion of the Proposal area falls within a Dieback Risk Area (DRA) (Figure 4.5).

4.8 Weeds

The presence of introduced weed species within the native vegetation at Eneabba varies depending on the size of the remnants and their proximity to pasture areas. Generally large blocks of native vegetation at the Iluka Eneabba operations are weed free with only low covers of annual species such as *Aira caryphyllea* and *Briza* spp. present. Smaller remnants surrounded by cleared pasture usually have higher weed incursion particularly in wet areas along drainage lines. Unfenced remnant vegetation within pasture areas is generally heavily impacted by weed species.



IPL NORTH PROPOSAL
PHYTOPHTHORA DIEBACK OCCURENCE

ILUKA

ORIG: A Joubert DRAWN: D.L.S. SCALE: 1:100,000 (A4) DATE: May 2012 DWG No: 219079v00

FIGURE: 4.5

The Iluka Eneabba leases have undergone extensive flora and vegetation studies, which have included weed identification components (Wells 2002; Woodman Environmental 2002, 2005, 2006, 2007, 2008).

A total of 46 introduced (weed) taxa have been recorded within the Iluka Eneabba leases (Table 4.5). In general, weed invasion into native vegetation is very low but weeds are prevalent in disturbed areas adjacent to farming properties surrounding the Iluka Eneabba leases. High weed impact has been recorded in IPL South along the drainage line in the south-western portion of this area. The majority of the Proposal area is considered weed free (Woodman Environmental 2012).

Table 4.5 Introduced flora recorded within the Iluka lease areas

Species	Species
**Aira caryophyllea*	**Hedypnois rhagadioloides* subsp. *cretica*
**Arctotheca calendula*	**Hypochaeris glabra*
**Avellinia michelii*	**Isolepis marginata*
**Avena barbata*	**Lagurus ovatus*
**Avena* sp.	**Lolium ?rigidum*
**Brassica tournefortii*	**Lotus angustissimus*
**Briza maxima*	**Lupinus* sp.
**Briza minor*	**Lysimachia arvensis*
**Bromus ?rubens*	**Monoculus monstrosus*
**Bromus diandrus*	**Parentucellia latifolia*
**Carpobrotus ?edulis*	**Pentameris airoides* subsp. *airoides*
**Centaurea melitensis*	**Petrorhagia dubia*
**Centaurium pulchellum*	**Polycarpon tetraphyllum*
**Centaurium ?spicatum*	**Raphanus raphanistrum*
**Cotula coronopifolia*	**Sagina* sp.
**Dischisma arenarium*	**Sisymbrium orientale*
**Echium plantagineum*	**Sonchus asper*
**Ehrharta calycina*	**Sonchus oleraceus*
**Ehrharta longiflora*	**Trifolium arvense* var. *arvense*
**Erodium aureum*	**Ursinia anthemoides*
**Erodium botrys*	**Vulpia muralis*
**Erodium* sp.	**Vulpia myuros*
**Eucalyptus* sp.	**Wahlenbergia capensis*

*Source: Woodman Environmental 2012

In addition to the regional baseline vegetation surveys conducted in the Eneabba area, weed species have also been recorded in the site Rehabilitation Monitoring Database during the annual rehabilitation monitoring program. This internal database is updated annually and records all perennial and annual weed species in each of the rehabilitation block transects.

Of the weed species identified, *Echium plantagineum* (Paterson's Curse) is listed as a Declared Plant and is found in disturbed agricultural areas (Department of Agriculture and Food 2012). Its status as a Declared Plant requires the prohibition of movement of seeds and the plant within the State and prevention of the spread of

infestation from properties via livestock, fodder, grain, vehicles and/or machinery whilst seeking to destroy/prevent all seed-set on all plants.

4.9 Fauna

4.9.1 Fauna assemblage

Considerable information on fauna assemblage, including vertebrate and invertebrates, is available from historical studies for the Eneabba region. A comprehensive review of these studies was undertaken by Bancroft and Bamford (2006) and provides a basis for assessment the impacts of the Proposal on native fauna. Due to the availability of this large amount of information on the fauna of the Eneabba region, targeted fauna investigations were carried out during the previous environmental approvals process in 2009. Table 4.1 provides a summary of key faunal investigations undertaken within and adjacent to the Proposal area (refer Section 4.1).

The vertebrate assemblage in the Eneabba region is rich with considerable biogeographic overlap, including:

- species from the south at northern edge of their range
- arid zone species on south-western limit of their range
- species endemic to the northern sandplains

Table 4.6 indicate the number of vertebrate species recorded during previous fauna investigations compared to the expected regional fauna assemblage as documented in the literature review (Bancroft and Bamford 2006; Bamford Consulting Ecologists 2009). Invertebrate species within the Eneabba region is more difficult to define that the vertebrate assemblage. Whilst invertebrates has been studied intensively and a comprehensive list of fauna encountered on the Iluka Eneabba mining leases has been generated during surveys, many of these invertebrates are not described yet and their habitats not understood (Bamford Consulting Ecologists 2009).

Table 4.6 Vertebrate species expected and recorded in the Iluka lease areas

Taxon	Number of expected species	Number of recorded species
Freshwater fish	3	-
Frogs	12	10
Reptiles	60	35
Birds	160	101
Mammals	29	18
Total	**264**	**164**

Source: Bamford Consulting Ecologists (2009)

Of the 264 species of that may occur within the vicinity of the Iluka lease areas, three reptiles, 24 birds, two mammals and four invertebrate species of conservation significance (under the WC Act and EPBC Act) have been identified as occurring or potentially occurring in the vicinity of the Iluka Eneabba leases (Bamford Consulting Ecologists 2009). Of these conservation significant fauna, the following species are considered to be of high importance with regard to minimisation of impacts from mining (Bamford Consulting Ecologists 2009):

Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*)

The Carnaby's Black Cockatoo is an Endangered species under the EPBC Act and WC Act. It is endemic to the southwest of Western Australia. This bird species occurs in uncleared or remnant areas of Eucalypt woodland, principally Salmon Gum or Wandoo, and shrubland or kwongan heath dominated by *Hakea, Dryandra* and *Banksia* species (DEC undated). Johnstone *et. al.* (2009) conducted a study of this species within the Eneabba region and specifically at the Iluka Eneabba operations. No evidence of breeding or any suitable breeding habitat of the Carnaby's Black Cockatoo was found within the Proposal area or in the vicinity of Eneabba. The birds that do occur at Eneabba are non-breeding autumn-winter visitors most likely from breeding sites north-east and east of Eneabba (i.e. Three Springs – Carnamah region).

During the 2009 assessment of the significance of habitat for Carnaby's Black Cockatoo in the Eneabba region the outcomes of this study showed that this cockatoo forage extensively on a very wide range of plants in the area on remnant vegetation as well as rehabilitated mine site vegetation (Johnstone *et al*., 2009). Roosting was also observed in planted Eucalyptus trees at the Eneabba townsite where approximately 300 birds roost regularly during non-breeding season. There is no breeding habitat for this species within the region (Figure 4.6). Important food within the Eneabba region includes *Banksia* spp., *Hakea* spp., and *Lambertia multiflora*. FCT1a and FCT1b (as identified by Woodman Environmental 2009a) contain foraging flora species for the Carnaby's Black Cockatoos. Refer Appendix B for Johnstone *et al*. (2009) report.

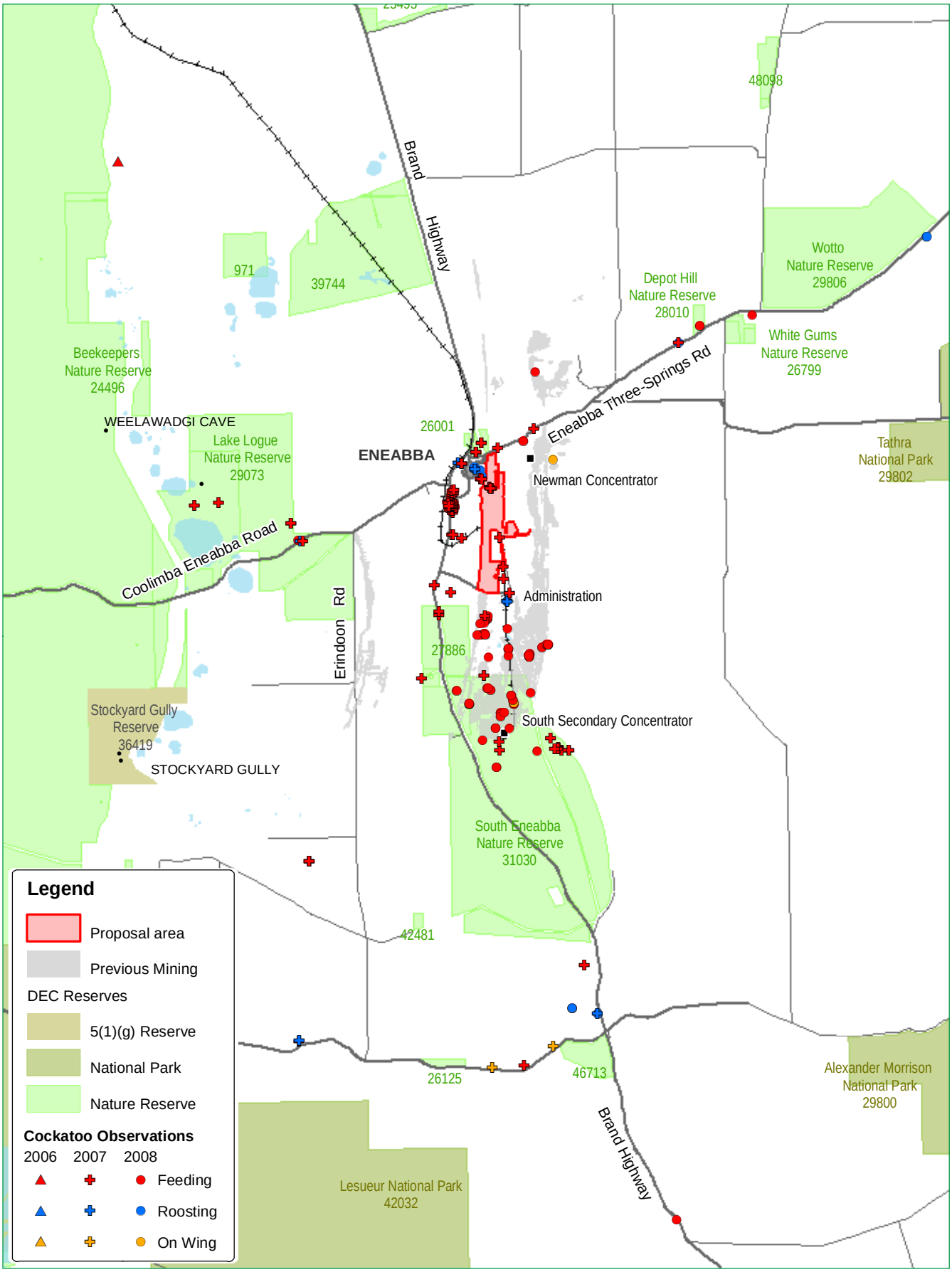
During 2011, Iluka personnel observed that the Carnaby's Black Cockatoos continued to use local roosting areas in the Eneabba township and minesite. Feeding areas/patterns and observed range did not vary from those reported previously in Iluka's Annual Environmental Reports with population numbers remaining constant (approximately 400 birds). One to two small groups of birds numbering six to ten, presumably non-breeding individuals, remained within the Eneabba area during the period the larger flock migrated northwards during the breeding season. No death/injuries of conservation fauna species were reported on the minesite (Iluka Resources Limited 2012).

Western Ground Parrot (*Pezoporus wallicus flaviventris*)

The Western Ground Parrot is listed as Endangered under the EPBC Act and although this bird is unlikely to be present at Eneabba (Bamford Consulting Ecologists 2009). Western Ground Parrots are known to exist in three areas, namely Fitzgerald River National Park, Cape Arid National Park and the Mount Manypeaks area (CALM 1997). Habitat of this parrot can be characterised as sedgelands, temperate shrub heaths, temperate graminoid heaths or sub-tropical graminoid heaths (Meredith 1984 in CALM 1997).

Rufous Fieldwren (*Calamanthus campestris montanellus*)

The Rufous Fieldwren is widespread on the heaths within the Eneabba region however numbers have been declining due to agricultural clearing. This bird is



IPL NORTH PROPOSAL

CARNABY'S BLACK COCKATOO OBSERVATIONS 2006 - 2008

ILUKA

ORIG: A Joubert DRAWN: D.L.S. SCALE: 1:250,000 (A4) DATE: May 2012 DWG No: 219080v00

FIGURE: 4.6

widespread in the area and that it is probably sedentary (Bamford Consulting Ecologists 2009).

Shield-backed Trapdoor Spider (*Idiosoma nigrum*)
This species was collected near the SSC during the 1970s by P. McMillan but further attempts to locate this species have failed. It occurs on gravelly loam soils, often on the lower slopes (M. Bamford pers. obs. in Bamford Consulting Ecologists 2009). The burrow of this spider is distinctive, about 20-30cm in depth and lined with silk in heavy clay soils. They have also been found to nest in granite soils (Main 1992 in Avon Catchment Council 2007). The SENR roughly contains a similar environment as well as to the east of current and past mine areas along the Gingin Escarpment. Searches in these areas have been unsuccessful (Bamford Consulting Ecologists 2009).

Phasmid-mimic Cricket (*Phasmodes jeeba*)
The Phasmid-mimic Cricket has not been recorded within the Proposal area and its distribution may be further west with the only two locations of specimens given are near Jurien and south of Dongara. Both these locations are coastal sites suggesting it is unlikely to be found at Eneabba (Bamford Consulting Ecologists 2009).

Scorpion Fly
The Scorpion Fly (*Austromerope poultoni*) is most abundant in moist areas of forest in the southwest and abundant amongst moist leaf-litter near Boddington (Faithfull *et. al.* 1985 in Bamford Consulting Ecologists 2009). This species is listed on the DEC Threatened Fauna Database for the Eneabba region and is probably confined to very moist locations (Bamford Consulting Ecologists 2009).

Millipede *Antichiropus* Eneabba 1
The Millipede *Antichiropus* Eneabba 1 is a short range endemic known from near Eneabba and at one location along Mount Adams Road (approximately 50km north). This species precise location within the Eneabba region is unknown but fragments of exoskeleton were found in a seasonally damp location within the SENR in November 2008. It is possible that the fragments of exoskeleton were from this species which was found adjacent to Rocky Springs Road (Bamford Consulting Ecologists 2009). This location consists of shrublands and thickets dominated by *Melaleuca* spp. and *Banksia* spp. on grey or brown sandy clays and sandy loams with some lateritic gravel on flats, depressions and creek-lines (Woodman Environmental 2009a).

Previous fauna investigations involved targeted surveys for species of State and Commonwealth Government conservation significance including migratory bird species and opportunistic observations of common species. The locations of the targeted surveys are shown in Figure 4.7 with details of investigations listed in Table 4.7.

Table 4.7 Observations at locations of targeted surveys during 2008

Figure 4.7 reference	FCT present	Fauna observations
1	FCT1b but mostly heath with stunted Banksias in shrub stratum. Sedges in vegetation.	Tawny-crowned Honeyeater, Black-faced Woodswallow, Rufous Fieldwren, Rainbow Bee-eater, Gwarder, Bardick, Fox
2	FCT1a and FCT1b. Woody pear and extensive heath.	Black-faced Cuckoo-shrike, Black-faced Woodswallow, Brown Honeyeater, White-cheeked Honeyeater, Bobtail, *Ctenophorus maculatus* (Spotted-military dragon)
3	FCT1a with sedges, merging with FCT1b on slightly higher ground.	Tawny-crowned Honeyeater, White-checked Honeyeater
4	FCT1a and some FCT1b but mostly in area previously mulch harvested (4-5 years). Vegetation density still sparse with evidence of some wind erosion.	Tawny-crowned Honeyeater, Rufous Fieldwren, Emus in cereal crops.
5	Evening listening in FCT1a and FCT1b – walked along tracks to cover ground.	Tawny-crowned Honeyeater, Rufous Fieldwrent, White-cheeked Honeyeater, Variegated Fairy-wren, White-winged Fairy-wren. No *Phasmodes jeeba* but other crickets, mantids and phasmids active.

Source: Bamford Consulting Ecologists 2009

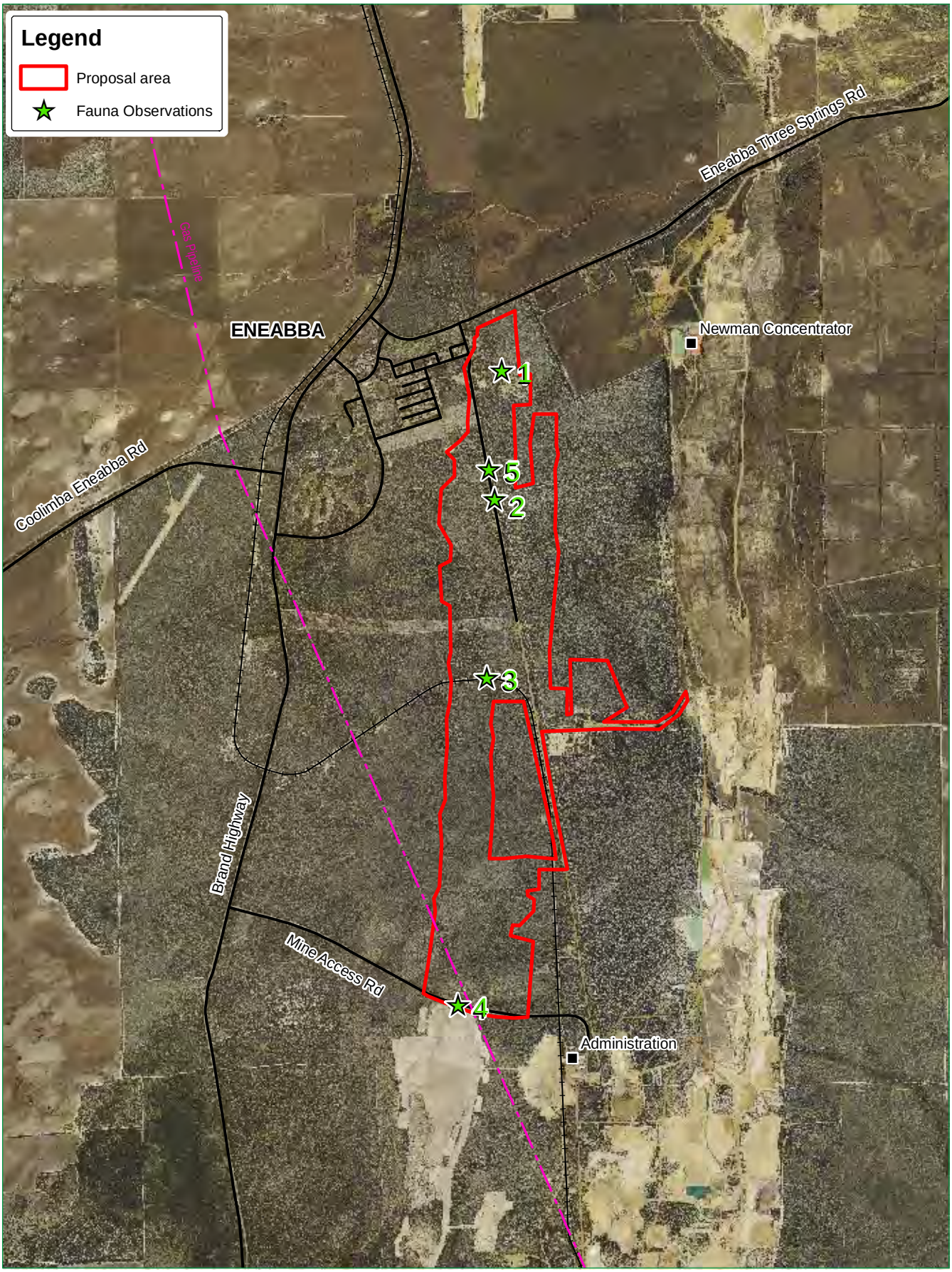
4.9.2 FCTs as fauna habitats

The IPL North deposit is a long and slender deposit that follows old shorelines where mineral sands were deposited. It lies on sandy soils of the coastal plain west of the lateritic rise of the Gingin Escarpment. It includes dune swales and areas within the Proposal area are elevated in the landscape. The FCTs located within the Proposal area include FCT1a, FCT1b, FCT2a, FCT6b and FCT14 with all of these support native vegetation (refer Section 4.7; Figure 4.3).

FCTs do not equate directly for fauna habitat as habitat values overlap FCT boundaries. Fauna move between FCTs in search of specific habitat for breeding and foraging and vegetation characteristics such as structure, life form and species composition influence fauna abundance within an area.

Bamford Consulting Ecologists (2009) surmised that 'FCTs do not equate directly to fauna habitat but rather fauna habitat is that component of the environment utilised by the fauna species'. Components of the environment that are of particular significance to fauna were recognised by Bamford Consulting Ecologists (2009) through observations on significance fauna (refer Section 4.9.1) and through field observations made in the area. These components include:

- Diversity of flowering plants – some FCTs are species rich however species-poor FCTs in the regional context also contribute to species richness. Small FCTs may be important due to the foraging and nesting sites that may not be found elsewhere in larger, more widespread, FCTs.



Aerial Photography flown Nov 2011

N

0 1 2 km

IPL NORTH PROPOSAL

FAUNA OBSERVATIONS 2008

ILUKA

ORIG: A Joubert DRAWN: D.L.S. SCALE: 1:50,000 (A4) DATE: May 2012 DWG No: 219081v00

FIGURE: 4.7

- Banksias – these flora species are important to a range of fauna species but most noticeably for the Carnaby's Black Cockatoo and nectarivores such as the Honey Possum.
- Areas of FCT diversity support more fauna species.
- Distinctive soil and surface geology may support different species.
- Areas of surface hydrology with distinctive vegetation and soils may be more preferable to fauna (Bamford Consulting Ecologists 2009).

4.10 Conservation reserves

Areas of significant flora and unique landscapes occur in the region and are protected in National Parks and other nature conservation reserves (Table 4.8; Figure 4.8). Iluka's mineral tenements stretch into the South Eneabba Nature Reserve (SENR).

Table 4.8 National Parks and Nature Reserves in the Eneabba region

Number	Name	Class	Shire	Status	Approximate distance from Proposal area (km)
29805	Tathra National Park	A	Carnamah	National Park	17.9
24496	Beekeepers Reserve	C	Carnamah	Nature Reserve	15.1
36419	Stockyard Gully Reserve	A	Carnamah	Nature Reserve	14.5
29073	Lake Logue Nature Reserve	C	Carnamah	Nature Reserve	5.7
27886 & 31030	South Eneabba Nature Reserve	C	Carnamah	Nature Reserve	1
28010	Depot Hill Nature Reserve	C	Mingenew	Nature Reserve	10.6
29807	Wotto Nature Reserve	C	Carnamah	Nature Reserve	14
29800	Alexander Morrison National Park	A	Coorow	National Park	28.4
42032	Lesueur National Park	A	Dandaragan	National Park	23.3
26001	Unknown	C	Carnamah	Nature Reserve	0.04
39744	Unknown	C	Carnamah	Nature Reserve	8.4
26799	White Gums Nature Reserve	C	Carnamah	Nature Reserve	11.7

4.11 Groundwater

The Eneabba region overlies the Dandaragan Trough, which is part of the Perth Basin, extending east to the Urella and Darling Fault and west to the coast. The trough consists of Quaternary sediments of the Superficial Formation overlaying early Jurassic to late Cretaceous sediments of the Yarragadee Formation.
The site geology consists of unconsolidated superficial sediments comprised of undifferentiated sandy clay and clayey sand and minor sand which are typically between 15m to 20m thick (ENSR 2009).

4.11.1 Hydrogeology

Beneath the Eneabba Mineral Sands Mine, groundwater occurs only in the Yarragadee Formation in multi-layered water-bearing zones that are unconfined to confined (ENSR 2009). On a regional level, groundwater is recharged to the Yarragadee Formation via rainfall and surface runoff infiltration through the overlying unsaturated superficial sediments.

N

0 5 10 km

IPL NORTH PROPOSAL

NATIONAL PARKS AND NATURE RESERVES

ILUKA

ORIG: A Joubert DRAWN: D.L.S. SCALE: 1:350,000 (A4) DATE: May 2012 DWG No: 219082v00

FIGURE: 4.8

Locally, groundwater is recharged by seepage from the 250 Dam and Mids Storage Dam, and from tailings facilities. Groundwater flow in the Eneabba area is considered to be broadly in a north-westerly direction due to the north-south trending Warradarge Fault that acts as a partial hydraulic barrier to westerly flow towards the coast. More locally, groundwater flows are impacted by the minesite operations. Groundwater depressions from extraction at some production borefield sites and groundwater mounding from seepage of water from dams and tailings facilities, locally reverse groundwater gradients and flow patterns (ENSR 2009).

Ambient groundwater is sodium chloride type, but typically has relatively higher proportions of calcium/magnesium where, coupled with relatively higher Total Dissolved Solids (TDS) concentrations of around 1000 mg/L, the groundwater has been impacted by past seepage from tailings facilities and/or process dams used as part of the historical Zircon Upgrade Plant (ZUP) operations. In general, lower salinity (TDS) groundwater occurs in the relatively 'deeper' water-bearing zones and based on historical data for production bores, groundwater in these aquifer(s) is typically between 200mg/L and 800mg/L. The TDS of groundwater in the 'shallower' aquifer(s) is up to around 1,000mg/L and in some instances up to 1,300mg/L (AECOM 2012).

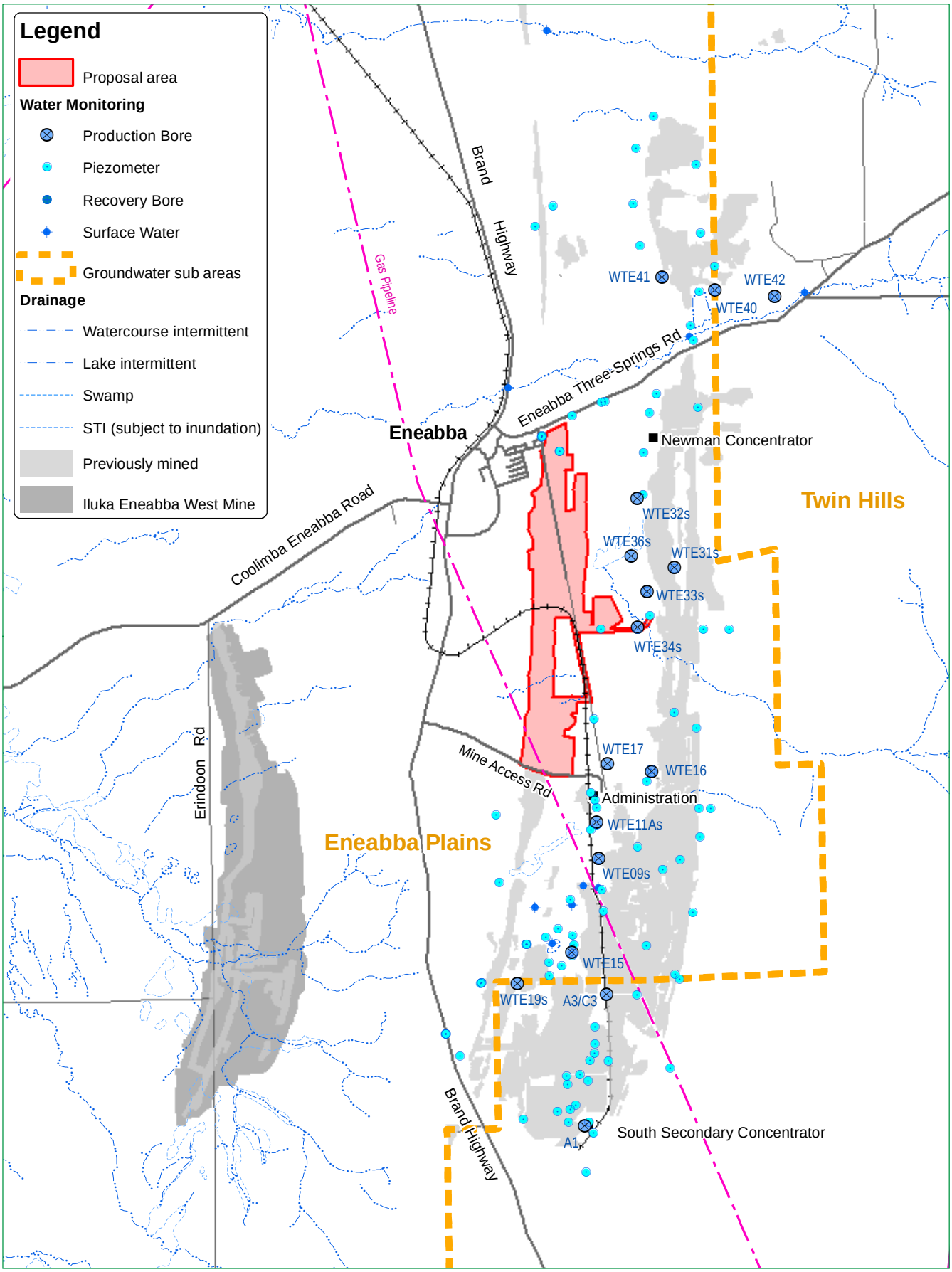
Groundwater level is shallower around the SSC in the south and deeper in the north. Around the Proposal area, groundwater levels are typically between 30-35m (AECOM 2012).

4.11.2 Groundwater use

The Eneabba Mineral Sands Mine is located in the Arrowsmith Groundwater area which includes the Eneabba Palins sub-area and the Twin Hill sub-area. ENSR (2009a) note that a search of the Department of Water (DoW) database indicates 150 groundwater bores within a 15km radius of the Eneabba townsite. Groundwater is used for a number of purposes including production for the Iluka Eneabba operations, stock and domestic, and irrigation purposes. With the exception of the Iluka Eneabba operations abstractions, groundwater resources in the Yarragadee Formation are virtually undeveloped although demand for irrigated agriculture is increasing (DoW 2008).

Groundwater abstraction from the Yarragadee Aquifer at the Iluka Eneabba operations is licenced under two groundwater licences (GWLs) issued by the DoW. Originally water abstraction for mining was licensed to take a total of 21GL per year, however, in 2008 this amount was reduced to 16GL when regional water allocations were reviewed. A maximum of 12GL can be abstracted under GWL104700 from 22 bores in the Eneabba Plains sub-area and a maximum of 4GL from GWL104709 from six bores in the Twin Hills sub-area (Iluka Resources Limited 2012). The Proposal will require the abstraction of approximately 8GL per annum.

Locations of the bores and groundwater sub-areas are shown in Figure 4.9.



IPL NORTH PROPOSAL

GROUNDWATER SUB-AREAS AND WATER MONITORING

ILUKA

ORIG: A Joubert DRAWN: D.L.S. SCALE: 1:100,000 (A4) DATE: May 2012 DWG No: 219083v00

FIGURE: 4.9

4.11.3 Eneabba Water Reserve

The Eneabba Water Reserve was proclaimed in 1992 under the *Country Areas Water Supply Act 1947* (CAWS Act) for the purpose of protecting the public drinking water source from potential contamination (DoW 2008). The Eneabba townsite is supplied with drinking water from one Water Corporation bore (bore 1/89) located in the Eneabba Water Reserve, east of the town. Bore 2/75, which acted as a secondary supply bore, was decommissioned in 2011. Bore 1/89 draws water from the Yaragadee Formation which is overlain by up to 30m of sand and clay (unsaturated superficial formation) and is screened between 81m below groundwater level. The bore has a static water level of approximately 31m below groundwater level. Abstracted water from the bore contains elevated levels of iron and is treated and stored in ground level storage tanks prior to being pumped into an elevated storage tank for town water supply. Water Corporation is licensed to abstract up to 200ML per year under GWL73006(4) for public water supply (DoW 2008).

A new town water supply bore (bore 1/11) was installed in 2011 north of the Proposal area (Figure 4.10). Water Corporation is currently seeking approval from the DoW's Drinking Water Quality Branch for use of this bore as town water supply. It is screened at 101m and has a static water level of approximately 31m below groundwater levels.

The Eneabba Water Reserve is located on Crown Reserve 26075 and Eneabba townsite Lot 396. Crown Reserve 26075 is covered with native vegetation and used for water supply purposes only whilst Lot 396 is zoned for parks, recreation and conservation. Lot 396 is predominately used for water supply purposes but motocross and rifle range facilities are present in proximity to bore 2/75 (DoW 2009).

The aquifer is unconfined in the vicinity of the bores and is at risk of contamination from surrounding land uses in the vicinity of the borefield including mineral sands mining, recreational activities, a drum muster and waste recycling depot and a light industrial area. The Eneabba landfill is located approximately 3.8km south of the borefield and is managed by the Shire of Carnamah.

The Eneabba Water Reserve Drinking Water Source Protection Plan – Eneabba town water supply (2008) recommended amendments to the boundary of the water reserve and in 2009, the amended reserve was gazetted. The amended reserve includes three priority areas (Figure 4.10):

- Priority 1(P1) – Crown Reserve 26075, Lot 396 and additional area zoned for parks, recreation and conservation located west of Mineral Sands Road.
- Priority 2 (P2) – Private land owned by RGC Mineral Sands Ltd (i.e. Iluka) (Lot 10) and Vacant Crown Land.
- Priority 3 (P3) – land west of Mineral Sands Road zoned for industrial purposes.

Mineral sand mining and extensive agriculture are considered compatible land uses within the P2 area whilst light industrial, recreational and residential land uses are considered compatible within the P3 area. The Plan recommends that no mining

occurs within the P1 area with particular reference to no tailings deposition (DoW 2008).

Wellhead Protection Zones were also gazetted in 2009 and are defined around each bore to protect the drinking water sources from contamination in the immediate vicinity of the bores. The zones include 500m in the P1 area and 300m in the P2 and P3 classification areas (DoW 2008).

4.12 Surface water

Eneabba is located within the Logue Catchment which is one of eight catchments in the West Midlands. This catchment is fed by watercourses that originate on the Dandaragan Plateau and Arrowsmith region and drain into large swamps or lakes in interdunal depressions on the Swan Coastal Plain. These chains of swamps and lakes are usually filled at the end of winter forming broad streams. The major lakes are generally permanent and in hydraulic connection with the unconfined superficial aquifer. The surface drainage pattern is towards the west reflecting the general slope of the landscape of the sedimentary basin.

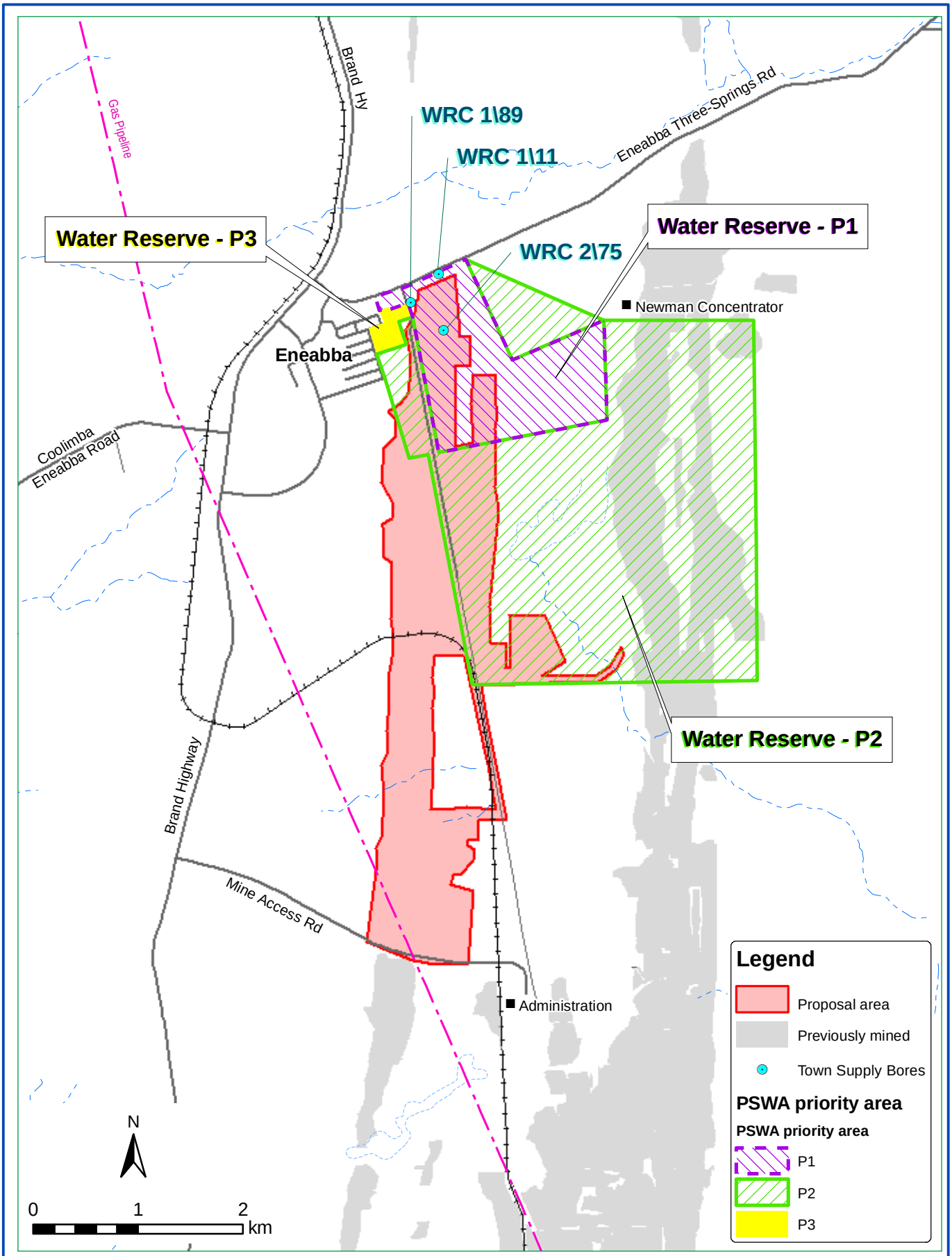
Iluka commissioned Soil Water Consultants (SWC) in 2009 to identify surface water flow regimes in the Eneabba area as well as potential impacts on surface, subsurface and groundwater dependant ecosystems during the previous environmental approvals process.

Surface water flows are generally considered to be low in the Eneabba region due to the predominately sandy nature of the surface soils and their corresponding high infiltration rates (SWC 2009). Although these soils have high saturated infiltration rates and hydraulic conductivities, their permeability decreases significantly when in an unsaturated condition (e.g. drought). Given these low unsaturated permeabilities, surface runoff is expected to occur following rapid and intense rainfall events following extended dry periods (SWC 2009).

The soils along the eastern margin of the Iluka Eneabba operations (i.e. Gingin Scarp) consist of relatively shallow sands and gravelly sands overlying a defined lateritic horizon or ferricrete. Along the Gingin Scarp, erosion of the surficial sands has exposed the ferricrete at the surface and this material has a low infiltration capacity. Rainfall rapidly runs off the lateritic surface, generating surface flows downslope and along drainage lines (SWC 2009).

The main watercourses in the vicinity of the Proposal area are the Arrowsmith River and the Eneabba Creek. The Arrowsmith River is located to the north of the Proposal area, commences north-west of Three Springs and flows westerly for approximately 85km towards the coast near Cliff Head. The Eneabba Creek runs adjacent to the Three Springs Road (Figure 4.11). The Eneabba Creek is a proclaimed surface water area under the *Rights in Water and Irrigation Act 1914* (RWI Act).

Minor drainage lines are located in the Brandy Flats North area (North Mine) flowing west towards Lake Arro, and within the Adamson mining area (North Mine) flowing



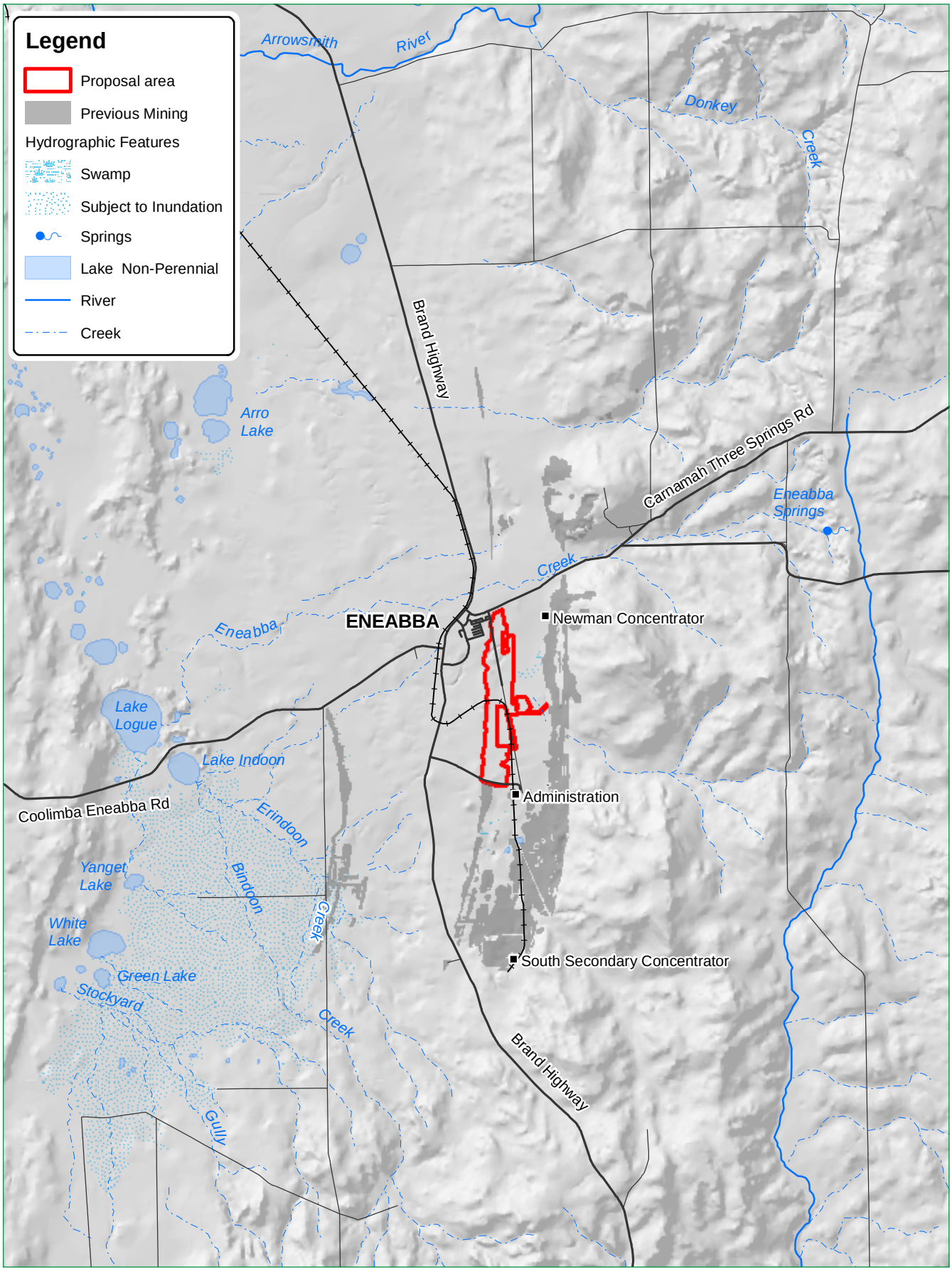
IPL NORTH PROPOSAL

ENEABBA P1, P2 & P3 WATER RESERVES AND TOWN PRODUCTION BORES

ILUKA

ORIG: A Joubert DRAWN: D.L.S. SCALE: 1:50,000 (A4) DATE: May 2012 DWG No: 219084v00

FIGURE: 4.10



IPL NORTH PROPOSAL

TOPOGRAPHICAL DRAINAGE FEATURES

ILUKA

ORIG: A Joubert DRAWN: D.L.S. SCALE: 1:200,000 (A4) DATE: May 2012 DWG No: 219085v00

FIGURE: 4.11

west through a re-constructed and rehabilitated diversion channel built during historical mining operations.

The Proposal area is outside the mapping areas of the following State datasets:

- *Environmental Protection (Swan Coastal Plain Lakes) Policy 1992*
- Geomorphic Wetlands of the Swan Coastal Plain (DEC)

In addition, the Proposal area does not contain any wetlands listed in the Register of Protected Wetlands[3], under the *Environmental Protection (South West Agricultural Zone Wetlands) Policy 1998*.

The Lake Logue-Indoon System is listed in the Directory of Important Wetlands in Australia (DIWA) as it:

- Is a good example of a suite of linked seasonal freshwater/brackis basins that occur in the bioregion.
- Is a major feeding stop-over, staging area for dispersal and a drought refuge for waterbirds.
- Supports a population of declared vulnerable plant *Eremophila microtheca* which occurs on seasonally waterlogged flats (DEC 2009).

It is situated 12km west of the Proposal area and consists of Lake Logue (a large historically freshwater lake which is now brackish), Lake Indoon (a smaller historically freshwater lake which is now brackish) and smaller, ephemeral wetlands and intermittent creeks and drainage lines to the north and south of Lake Logue (Figure 4.12). Lake Logue is the largest feature of the Lake Logue-Indoon System and covers an area of 425ha and fills occasionally following heavy rain in the catchment (DEC 2009).

Lake Indoon covers 104ha of the Lake Indoon Reserve, with a depth varying from approximately 1.5m to 5m depending on the season and rainfall. Lake Indoon is fed from the Erindoon and Bindoon creeks and overflow from Lake Indoon flows back into the Lake Logue system (SEWPAC 2012).

Iluka has previously identified a single wetland south of the Proposal area (Eneabba South wetland), located northeast of the O3 concentrator. The wetland is seasonally inundated and perched and has no connection with the deeper water table. A management plan was developed for the wetland in 1997 (Iluka Resources Limited 1997) and since that time, access has been restricted by the implementation of a 200m buffer zone with fencing and the water levels and fringing vegetation has been routinely monitored.

Iluka commissioned V&C Semeniuk Research Group (VCSRG) in 2008 to map and classify all wetlands within and adjacent to mining operations at Eneabba. The

[3] As per EPA website http://www.epa.wa.gov.au/article.asp?ID=1087&area=Policies&CID=20&Category=Environmental+Protection+Policies+%28EPP%29 (7 July 2008) and EPA Guidance Statement No. 33 (2008).

results of the VCSRG study showed the Iluka Eneabba operations is dominated by complexes of alluvial fans that manifest themselves as creeks (seasonally inundated channels), wadis (intermittently inundated channels), barlkarras (intermittently inundated flats), floodplains (seasonally inundated flats) and palusplains (seasonally waterlogged flats) (Figure 4.12). The complexes of alluvial fans were named as follows (from north to south):

- Arrowsmith River wadi/barlkarra complex
- Old Arro Well wadi/barlkarra complex
- Eneabba Creek wadi/barlkarra complex
- Lake Indoon wadi/barlkarra complex
- Outliers of the Lake Indoon wadi/barlkarra complex
- Southern part of the Lake Indoon wadi/barlkarra complex, including sections of Bindoon and Erindoon Creeks

A focus was placed on the creeks and wadis that deliver water to Lake Indoon as the lake is the receiving basin of the abovementioned channel forms. Also, these channels are well-defined and are largely vegetated. In contrast, the wadi/barlkarra systems of the Arrowsmith River, Old Arro Well and Eneabba Creek are diffuse outflow systems of the alluvial fans. They comprise part of the general through-flows of the region, thus impacts along the channel ways of the wadi/barlkarra systems are dispersed widely downstream. As diffuse through-flow conduits, the wadis would have supported very little wetland vegetation even if the majority had not already been cleared (VCSRG 2009).

The study showed that in addition to the South Eneabba wetland identified and protected by Iluka, there are several other wetlands south of the Proposal area that have varying degrees of significance. There are no wetlands within the Proposal area with the nearest identified wetland approximately 1km south of the Proposal area (Figure 4.12).

4.13 Heritage

4.13.1 Native title

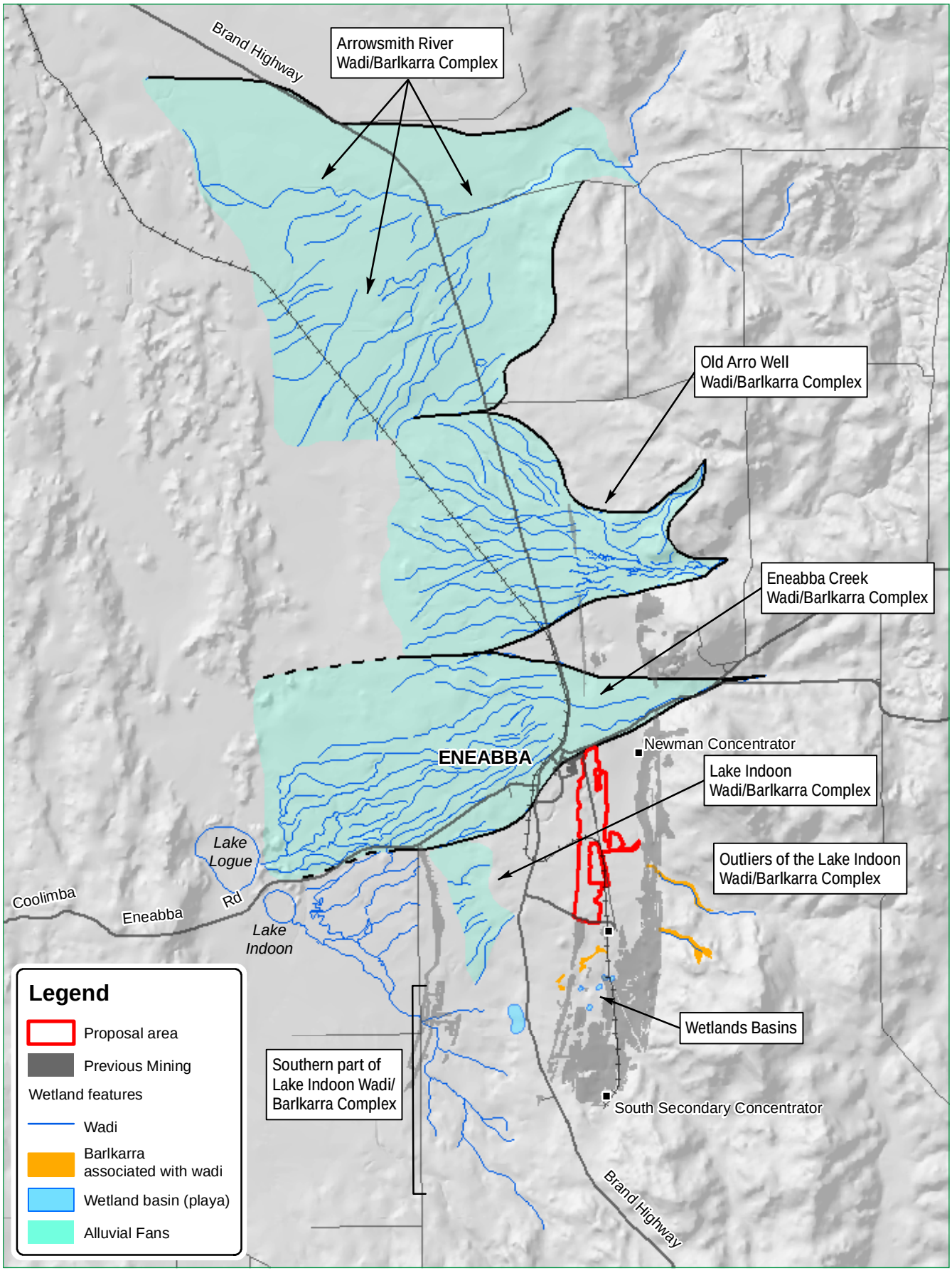
The Proposal area is overlapped by one registered native title claimant group (Figure 4.13):

- Amangu People (WC04/2)

4.13.2 Aboriginal heritage

Archaeological and ethnographic surveys have been conducted on a number of Iluka Eneabba tenements (AM70/267, M70/821, M70/1039, E70/2634, M70/872, M70/879, M70/1039 and M70/1061). Refer Table 4.1 for the various surveys.

One archaeological site comprising a small quartz artefact scatter was discovered adjacent to the South Eneabba Wetland. Based on the size and type of material, the authors concluded that this site did not represent intensive use of the wetland by Aboriginal people (McDonald *et al.* 1992). The location of this site adjacent to the



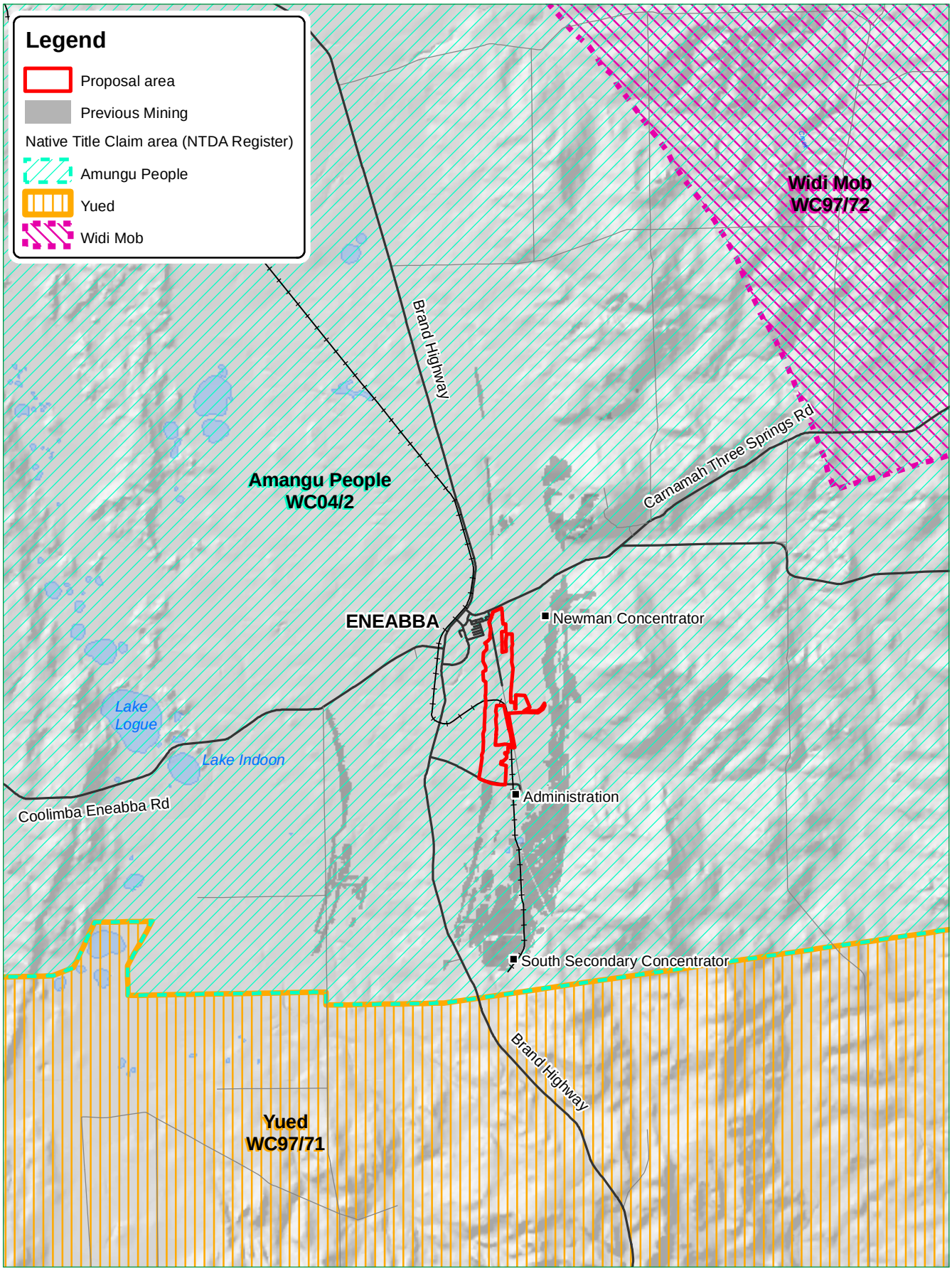
IPL NORTH PROPOSAL

WETLANDS OF THE ENEABBA REGION

ILUKA

ORIG: A Joubert DRAWN: D.L.S. SCALE: 1:200,000 (A4) DATE: May 2012 DWG No: 219086v00

FIGURE: 4.12



N

0 2 4 6 km

IPL NORTH PROPOSAL

NATIVE TITLE CLAIMANT GROUPS

ILUKA

ORIG: A Joubert DRAWN: D.L.S. SCALE: 1:200,000 (A4) DATE: May 2012 DWG No: 219087v00

FIGURE: 4.13

wetland has ensured that the site has remained undisturbed due to the conservation of the wetland by the Iluka Eneabba operations.

McDonald *et al.* (1992) concluded that only one site was identified as Eneabba is less significant for Aboriginal heritage than the coast. This reasoning supports the general absence of archaeological material in the area rather than any other factors (McDonald *et. al.* 1992).

Ethnographic surveys within the investigated Iluka Eneabba tenements have not recorded any features of Aboriginal significance. An ethnographic survey with the Franks native title claimants (with regard to M70/879) has 'indicated that the absence of any surface water sources in the Eneabba area had meant that it was not extensively used by Aboriginal people in the past. Sites of cultural significance are located much further to the west, associated with springs, lakes and cave systems closer to the coast' (Wanati Pty Ltd 2004). This supports the findings of other heritage surveys undertaken on the Iluka Eneabba tenements as noted above for the archaeological survey of AM70/267.

A search of the DIA Register of Aboriginal Sites conducted in March 2012 indicated that no sites were registered on the Iluka Eneabba tenements.

4.13.3 European heritage

The State Register of Heritage Places is managed by the Heritage Council of WA and includes buildings, structures, gardens, cemeteries, landscapes and archaeological sites. A search of the State Register of Heritage Places in March 2012 indicated no places of State significance located within or around the Proposal area.

A search of the Places Database in March 2012 indicated 13 sites of heritage significance are found within the Eneabba region (Table 4.10). The Places Database, which is managed by the Heritage Council of WA, includes heritage places listed on local government heritage inventories, Commonwealth heritage lists and the List of Classified Places managed by the National Trust of Australia (WA), or include surveys and studies. A number of sites of heritage significance were listed on the Register of National Estate (RNE). The RNE was closed in 2007 and on 19 February 2012 all references to RNE were removed from the EPBC Act and *Australian Heritage Council Act 2003*. The RNE is maintained on a non-statutory basis as a publicly available archive and educational resource.

Table 4.9 Heritage sites in the Eneabba region

Heritage No.	Name	Location	LGA	Construction date	Listing
18110	Arro Well	Reserve 971, track south of Beekeepers Road, Eneabba	Carnamah	Sunk possibly before 1889	Other
18111	Casuarina Well	Track north from Beekeepers Road, Eneabba	Irwin	Unknown	Other
6178	Eneabba club Rooms	Eneabba Drive	Carnamah	1972	Municipal Inventory

Heritage No.	Name	Location	LGA	Construction date	Listing
6177	Eneabba Horseman's Hall	Eneabba	Carnamah	1962 (demolished 2004)	Other
17433	Eneabba Police Station	Eneabba Drive, Eneabba	Carnamah	1989	Other
6175	Eneabba Primary School	Clark Place, Eneabba	Carnamah	1960	Municipal Inventory
6182	King's Homestead	Eneabba-Coolimba & Gould Simpson Roads, Eneabba	Carnamah	1982	Municipal Inventory
6181	Lake Indoon	South of Eneabba-Coolimba Road, Eneabba	Carnamah	Not applicable	Municipal Inventory
6180	Original Eneabba School (fmr)	Eneabba	Carnamah	1958	Municipal Inventory
6179	Original Eneabba Springs – site	Eneabba	Carnamah	1925	Municipal Inventory
6174	Original Eneabba Store	Corner of King & Gooch Streets, Eneabba	Carnamah	1964	Municipal Inventory
6176	School Teacher's House	Dewar Street, Eneabba	Carnamah	1960	Municipal Inventory
6183	WSLC – War Service Depot	Eneabba-Three Springs Road & Second North Road, Eneabba	Carnamah	Not applicable	Municipal Inventory

None of these sites are within the immediate vicinity of the Proposal area and as such, no further management measures are required.

4.14 Noise

At the Iluka Eneabba operations, the primary noise sources include the fixed plant and mobile mining equipment within the mining pits. The fixed plant includes (Figure 2.1):

- Newman WCP located approximately 2km from the Eneabba townsite.
- SSC located approximately 11.5km south of the Eneabba townsite.

Mobile equipment utilised during the mining operations include those involved in the removal of topsoil, subsoil and overburden and those used in the mining and processing of the ore (i.e. dozers, frontend loaders, excavators, trucks).

SVT have previously assessed ambient noise in the vicinity of Iluka's Eneabba operations in 2006, 2007 and 2011. Previous noise logging showed that that the underlying background noise level in the vicinity of the Eneabba townsite is relatively low (SVT 2009, SVT 2011).

4.15 Air quality (dust)

Dry mining operations typically generate fugitive dust associated with mining, processing and transport activities. The generation of dust emissions are reliant upon

soil moisture conditions and strength of prevailing winds. Eneabba experiences strong wind conditions in a dry environment.

At the Iluka Eneabba operations, there are two sources of airborne particulates, namely non-mining sources (including other natural processes) and those that can be attributed to mining operations.

Non-mining sources of airborne particulates in the vicinity of the mine include:

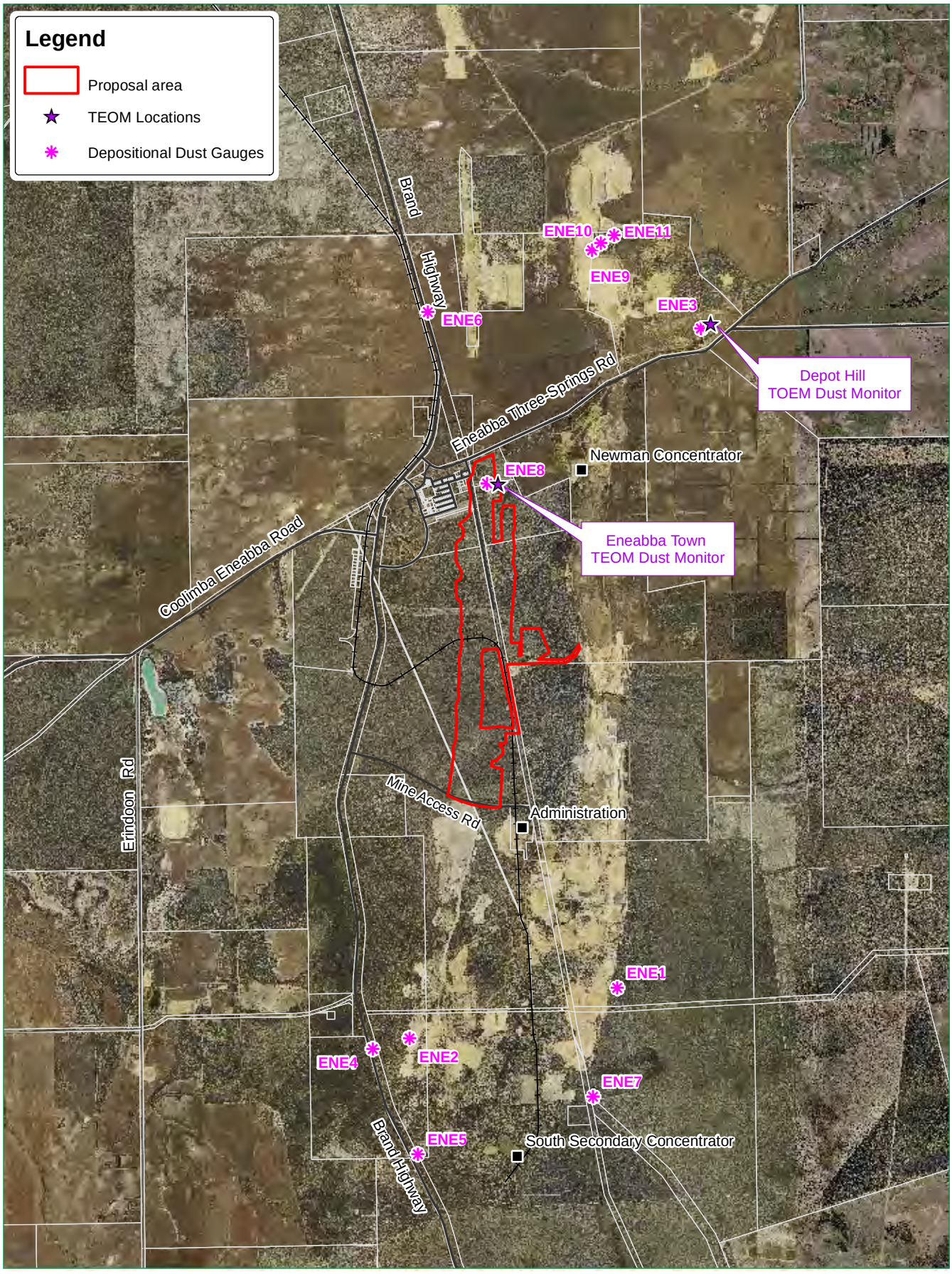
- Mechanical land disturbance from surrounding agricultural properties (e.g. clearing of vegetation, tillage).
- Dust generated from strong winds blowing across cleared agricultural land.
- Vehicle movement along unsealed roads, rail line, tracks and paddocks (including entrained material and emissions).
- Livestock movements and grazing (particularly overstocking).
- Burning and incineration (e.g. backyard burning, residential wood-fired heaters, wildfires, burn-off).

A wide range of mining activities can generate dust. These are usually visible and readily identifiable. The potentially significant sources of airborne particulates from the operations have been assessed as being limited to:

- Dust lift off from exposed mining areas, open areas or surfaces undergoing rehabilitation.
- Dust lift off from stockpiles (overburden, subsoil, topsoil and mined concentrate).
- Dust lift off from haul roads and tracks resulting from light vehicle and heavy earthmoving traffic.
- Dust generation from crushing and screening processes, prior to wet separation process (e.g. mining units).
- Loading and transportation of ore material.

The Iluka Eneabba operations currently operate under the dust management obligations as set out in DEC Licence 5646. The licence includes a requirement to comply with a Dust Management Plan which was endorsed by the DEC regional office in Geraldton. Iluka is also required to comply with the *Environmental Protection (Unauthorised Discharges) Regulations 2004* for generation of dust within the premises. Dust monitoring is undertaken on a continual basis at the Iluka Eneabba operations using both ambient particulate monitoring (PM_{10}) and total suspended particulate (TSD) methods.

Continuous particulate dust monitoring (PM_{10}) is undertaken at the location of the 'most sensitive receiver' (i.e. Eneabba townsite) to monitor respirable dust conditions. A network of depositional dust gauges has also been deployed to monitor nuisance dust conditions along the property boundary and sensitive vegetation locations (Figure 4.14).



N

0 1 2 3 4 km

Aerial Photography flown Nov. 2011
Regional Aerial Photography flown 2006

IPL NORTH PROPOSAL

DUST MONITORING LOCATIONS

ILUKA

ORIG: A Joubert DRAWN: D.L.S. SCALE: 1:100,000 (A4) DATE: May 2012 DWG No: 219088v00

FIGURE: 4.14

5. PROPOSAL IMPACTS

This section contains information on the potential environmental impacts of the Proposal, the proposed management mechanisms to be implemented to minimise and mitigate for these impacts, and how the principles of the EP Act have been addressed by the Proposal.

5.1 Principles of Environment Protection

Consideration has been given to the five principles of environment protection as set out in Section 4A of the *Environmental Protection Act 1986* (Table 5.1).

Table 5.1 Consideration of the five principles of environment protection

Principle	Principle description	Proposal
1. The precautionary principle	Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, decisions should be guided by: (a) careful evaluation to avoid, where practicable, serious or irreversible damage to the environment; and (b) an assessment of the risk-weighted consequences of various options.	A large amount of technical and biological data/investigations is available for the Iluka Eneabba operations and specifically the Proposal area. These investigations were used to assess the potential impacts and management measures for this Proposal. During the development of the Proposal, Iluka undertook to develop a mine schedule that is environmentally sustainable. Additional studies will be undertaken to further assist with the development of the mine plan and schedule.
2. The principle of intergenerational equity	The present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.	The Proposal was designed (with regard to mine schedule and plan), and will be implemented and managed to ensure the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations. In addition, a key focus area for the Proposal and the wider Iluka Eneabba operations is the implementation of its rehabilitation program, nursery development and research.
3. The principle of the conservation of biological diversity and ecological integrity	Conservation of biological diversity and ecological integrity should be a fundamental consideration.	Various fauna and flora surveys and impact assessments have been undertaken throughout the life of the Iluka Eneabba operations as well as the Proposal area. Additional biological studies are planned and the results used to develop mitigation and management measures to minimise potential impacts to the biological environment.
4. Principles relating to improved valuation, pricing and incentive mechanisms.	(1) Environmental factors should be included in the valuation of assets and services. (2) The polluter pays principle – those who generate pollution and waste should bear the cost of	The cost of managing and implementing the Proposal has been factored into the design and development of the Proposal. The objectives for each of the environmental factors have been established and are described in Section

Principle	Principle description	Proposal
	containment, avoidance or abatement. (3) The users of goods and services should pay prices based on the full life cycle costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any wastes. (4) Environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, which enable those best placed to maximise benefits and/or minimise costs to develop their own solutions and responses to environmental problems.	5.
5. The principle of waste minimisation.	All reasonable and practicable measures should be taken to minimise the generation of waste and its discharge into the environment.	Iluka maintains a detailed waste inventory of all waste disposal at Eneabba and implements the waste hierarchy of avoid, reuse, reduce, recycle and treat in the daily operations.

5.2 Key environmental impacts

The potential environmental impacts of the Proposal were identified by:

- Consulting with various regulators (historic and current) including:
  - Office of the Environmental Protection Authority (OEPA)
  - Department of Environment and Conservation (DEC)
  - Department of Water (DoW)
  - Department of Mines and Petroleum (DMP)
- Reviewing historical data for the Iluka Eneabba operations.
- Considering the various technical studies undertaken to date (fauna and flora surveys, groundwater and surface water assessment, noise modelling, etc.).
- Reviewing the consultation responses received during previous Referral applications for the Iluka Eneabba operations.

Considering the above identification of potential environmental impacts for the Proposal, the key environmental factors include:

- Flora and vegetation
- Fauna
- Noise
- Air quality (dust)
- Groundwater (incl. Eneabba town water supply)
- Rehabilitation and closure

Each key environmental factor includes a short description of the existing (baseline) environment which has the potential to be impacted by the Proposal, methods or actions to reduce or mitigate potential impacts. The aim of this is to reduce the residual impacts to an environmentally acceptable level.

5.3 Flora and vegetation

5.3.1 EPA objective

To maintain the abundance, diversity, geographic distribution and productivity of flora at species and ecosystem levels through the avoidance or management of adverse impacts and improvement in knowledge.

5.3.2 Potential impact

Extensive vegetation surveys have been undertaken across the Iluka Eneabba tenement areas (refer Section 4.1). The Proposal area covers an area of 545ha however the area of clearing required for the Proposal has been conservatively estimated at approximately 350ha. These areas allow for the establishment of the mine pit, overburden (clay and sand) stockpiles (if not directly returned), ROM stockpiles, MUP pads, noise bund, access and haul roads, lay-down areas and off-mine path infrastructure.

Of the two vegetation associations the Proposal will have the greatest impact on the Tathra Vegetation System.

Mining within the Proposal area has the potential to impact on the following FCTs 1a, 1b, 2a, 6b and 14, all of which have a conservation significance ranking of 4 due to the presence of DRF species and/or restricted distributions and presence of Priority flora species (Table 5.2). A quantitative impact assessment is recommended in order to determine the significance of the proposed impacts to each of these FCTs (Woodman Environmental 2012).

Table 5.2 Approximate FCT disturbance within the Proposal area

FCT code	Total FCT present in NSSA* (ha)	Iluka Eneabba lease areas (ha)	FCT within Proposal area(ha)	FCT within Proposal area (%)
1a	2,540.55	2,540.55	355.9	14
1b	1,411.83	1,411.83	55.7	4
2a	6,172.16	3,347.66	95.7	3
6b	926.21	926.21	0.3	0.03
14	78.48	78.48	0.3	0.4
Cleared areas	-	-	37.6	-
Total	**10,124.54**	**10,124.54**	**545**	

* Northern Sandplains Study Area (NSSA) includes Iluka Eneabba lease areas and Tiwest Dongara lease areas (Woodman Environmental 2012)

Searches of the Proposal area have been conducted over many years and as recently as 2011. These searches have identified 19 conservation significant flora species that will potentially be impacted. A quantitative impact assessment will be undertaken in order to determine the number of plants of the conservation significant species that will potentially be impacted on (Section 4.7).

Of these species the most significant in terms of impact assessment are *Paracaleana dixonii, Stylidium carnosum* subsp. Narrow leaves (J.A. Wege 490), *Persoonia filiformis, Scaevola eneabba* and *Schoenus* sp. Eneabba (F. Obbens & C. Godden I154). *P. dixonii* is widespread through the Proposal area and as such will be very difficult to avoid during any proposed mining. The mine plan was developed with the

intention to avoid as many of this DRF as possible. Mining will result in impact to this species and environmental approvals will require a Permit to Take pursuant to the WC Act. The remainder of these species with a P1 or P2 conservation ranking will be avoided where possible as they generally have restricted distributions and or populations.

The Proposal area forms a connecting corridor between the Nature Reserve to the west of the existing mine, remnant native vegetation west of the Brand Highway and the remnant vegetation on the Gingin Scarp and Dandaragan Plateau to the east of the existing mine. The Proposal area has also been extensively drilled for mineral resource definition and contains significant areas of disturbance from roads, railway, gas pipeline and historic harvesting of mulch material for the mine rehabilitation programme. A narrow strip of mining has also occurred near the base of the Scarp further dissecting the corridor and as such the value of the existing corridor is somewhat compromised. Additional mining in the area will further compromise the value of the existing corridor and effort will be made to remediate open areas as soon as is practicable with best practice rehabilitation in order to re-instate habitat within the corridor.

The following impacts to significant flora and vegetation have been identified as having the potential to occur if adequate management is not implemented:

- Clearing of native vegetation outside of approved clearing boundaries has the potential to impact biodiversity values for the region.
- Fragmentation of vegetation as a result of land clearing for mining can have an impact on fauna movements and, therefore, plant pollination, seed dispersal and, consequently, the distribution range of plant species.
- Poor hygiene management and practices can potentially result in the spread of weeds within areas of native vegetation. The establishment of weeds within areas of native vegetation can alter the structure and composition of vegetation communities.
- Poor hygiene management practices can potentially result in the introduction of *Phytophthora* Dieback into previously uninfested areas of native vegetation, resulting in vegetation decline and loss of biodiversity and fauna habitat.
- Poor rehabilitation:
  - Incorrect soil profile and landform reconstruction may result in the vegetation in rehabilitation areas being unsustainable.
  - Alteration or incorrect reinstatement of natural watercourses and drainage channels has the potential to have an impact upon riparian and/or floodplain vegetation.
- Generation of fugitive dust can potentially impact vegetation health and reproduction.
- Poorly controlled stormwater drainage has the potential to impact surface hydrology and vegetation/habitat values through sedimentation and erosion.
- Inappropriate fire management can impact on the composition and structure of a community if:
  - weeds species supplement the fuel load resulting in excessively hot burns;

- o resprouting species stems and/or lignotubers are not mature enough to survive and regenerate after fire; and
- o obligate seeder species in areas that have been harvested for native mulch or have been recently burnt (within seven years) have not yet matured enough to set seeds.

5.3.3 Management objectives

The overarching objective for the protection of native vegetation and flora is to avoid, minimise and mitigate impacts to flora and vegetation as a result of mining of the Proposal area. This also includes the protection of conservation significant species.

Key management strategies for native vegetation and flora impact are progressive mining and rehabilitation of disturbed areas. The total area of disturbance an any one time will be minimised through progressive clearing and rehabilitation thereby ensuring that only the immediate area to be mined is disturbed (refer Section 2.4). By implementing a progressive mining schedule, the removal of DRF and Priority flora will also be progressive over the life of the mining operation. This progressive removal of flora will be offset by the progressive rehabilitation of the mined areas. Direct return of topsoil and translocation of Priority flora (where possible) will result in the regeneration of Priority flora species on disturbed areas.

Management strategies for native vegetation and flora are summarised in Table 5.3.

Table 5.3 Environmental objectives and proposed management strategies for the protection of DRF, Priority flora and native vegetation

Objective	Management strategies
All flora and vegetation to be adequately surveyed, understood and assessed for conservation significance prior to disturbance.	• Defined impact areas shall be surveyed and assessed for conservation significance prior to disturbance. • The assessment shall include both local and regional impacts to vegetation and flora.
Avoid direct impacts to flora and vegetation in excess of what has been approved via statutory approvals, e.g. Clearing Permits	• Clearing cannot commence without appropriate government approvals in place. • Clearing proposals shall consider the following principals: o Avoid clearing native vegetation wherever possible o Minimise the amount of native vegetation that is cleared o Reduce the impacts on any environmental value associated with proposed clearing. • Clearing or disturbance to native vegetation or native rehabilitation areas will not proceed without the completion and sign-off of an Iluka Ground Disturbance Permit (GDP) by the appropriate Area Managers, Environmental Department, Rehabilitation Department and the Mine Manager or their delegate. • Clearing cannot commence without a map clearly showing the intended clearing area superimposed over the government approved clearing area. The plan must include all areas required for mine support and infrastructure. This map shall accompany the GDP. • Clearing areas shall be delineated in the field by using a GPS and demarcated with flagging tape used solely for that purpose. • No disturbance to DRF without being granted a ‘Permit to

Objective	Management strategies
	Take' from the Minister for the Environment under the WC Act.
Minimise impacts to area of high value fauna habitat.	• Desktop study and reconnaissance surveys to be undertaken to ensure that proposed disturbance areas minimise impacts to high value fauna habitat areas.
Minimise impacts to flora and vegetation adjacent to operational areas, that may potentially result from: • Generation of fugitive dust. • Accidental fires. • Stormwater run-off from roadways or areas of mining infrastructure.	• Potential impacts to DRF and Priority Flora will be considered in all mine planning phases and will refer to management actions noted in this document as a minimum. • Appropriate monitoring will be undertaken to identify and quantify impacts identified for operational areas. This may include, but not be limited to: o Vegetation monitoring (disease/health status) o Soil erosion o Soil sedimentation
To promote and educate employees and contractors on issues related to conserving vegetation biodiversity.	• Induction Programme for all employees and contractors will address: o Potential for mining activities to impact vegetation and flora o Highlight flora of conservation value o Highlight sensitive areas close to operational activities o How to report environmental incidents

5.3.4 Proposed investigations

A quantitative impact assessment will be conducted in order to determine the significance of the proposed impacts of the Proposal to each of the FCTs, DRF and Priority flora.

5.4 Fauna

5.4.1 EPA objective

To maintain the abundance, diversity, geographic distribution and productivity of native fauna at the species and ecosystem levels through avoidance or management of adverse impacts and improvement in knowledge.

5.4.2 Potential impact

Fauna of the Eneabba region is well documented as a consequence of mining being established in the area in the early 1970s. Numerous baseline and research studies have been undertaken since this time (refer Section 4.1).

The Proposal will result in the loss of fauna habitat and fragmentation which is a result of direct clearing and potential changes to hydrological processes (Woodman Environmental 2009b). Other impacts to fauna include increased mortality due to roadkill, increased predation by feral animals, general mining activities such s altered lighting, dust vibrations and noise, hydro-ecological impacts to habitat and structural and compositional changes to habitat.

The Proposal will require the disturbance of FCT1a, FCT1b and FCT2a which is also known to be foraging habitat for the Carnaby's Black Cockatoo.

The local impact to habitat of conservation significant species known or presumed to occur is listed in Table 5.4.

Table 5.4 Potential impact to conservation significant species

Species	DEC current ranking (Feb 2012)*	Likelihood of occurrence	Habitat preference	Nature of impact	Potential of impact
Black-striped Snake (*Neelaps calonotos*)	P3	Yes		Habitat loss, fragmentation, roadkill	Habitat widespread in region. Mine path temporary barrier & rehabilitation should correct for fragmentation.
South West Carpet Python (*Morelia spilota imbricate*)		Yes	Prefers rocky areas, unlikely to occur in sandier areas	Habitat loss, fragmentation, roadkill	Habitat widespread in region. Mine path temporary barrier & rehabilitation should correct for fragmentation.
Woma (*Aspideites ramsayi*)	P1	Nil	Southwest of WA: woodlands, shrublands and heath, often with spinifex. Suitable habitat does not occur on Iluka leases	Habitat loss, fragmentation, roadkill	Species probably not present (last records from general area are Watheroo in 1989 and from Marchagee in 1986 (B. Maryan, pers. comm. In Bamford Consulting Ecologists 2009).
Malleefowl (*Leipoa ocellata*)	VU	Yes - probably vagrant only	Semi-arid & arid regions in shrubland & low woodlands dominated by mallee (SEWPAC 2012b)	Habitat loss, disturbances to breeding (i.e. removal of mounds), roadkill	Species probably not present as breeding population. No mounds have been recorded.
Carnaby's Black Cockatoo (*Calyptorhnchus latiorostris*)	EN	Yes - recorded in local area	Open forests and woodlands, Kwongan heath, sand plains, suburban vegetation & pine plantations. Likely to forage in heathland vegetation. Known to forage in rehabilitated minesite.	Foraging habitat loss, roadkill	Foraging habitat in Eneabba region is widespread. No breeding habitat affected. Mine vehicles generally travelling too slowly for major risk of roadkill.
Western Ground Parrot (*Pezoporus flaviventris*)	CR	Possible	Sedgelands, temperate shrub heaths, temperate graminoid	Habitat loss, fire	Foraging habitat is extensive in area. Known population on the south coast only.

Species	DEC current ranking (Feb 2012)*	Likelihood of occurrence	Habitat preference	Nature of impact	Potential of impact
			heaths or sub-tropical graminoid heaths (Meredith 1984 in CALM 1997).		
Rufous Fieldwren (*Calamanthus campestris montanellus*)	P4	Yes – recorded in area	Saltbush, bluebush, spinifex, roly-poly bush & low shrubs.	Habitat loss, fragmentation	Habitat is extensive in area but suitable habitat in impact area. Species may be sensitive to habitat fragmentation – sedentary species. Known to colonise rehabilitation areas.
Peregrine Falcon (*Falco peregrinus*)		Yes – recorded in area	Cliffs, gorges, timbered watercourses & tall man-made infrastructure.	Minor loss to habitat	Foraging habitat extensive in region and unlikely to be solely reliant on Iluka lease areas. No sign of nesting sites in impact area.
Fork-tailed Swift (*Apus pacificus*)		Yes – vagrant only	Highly aerial vagrant that may pass over Proposal area.	None	Aerial species unlikely to be affected by limited ground-based activities.
Rainbow Bee-eater (*Merops ornatus*)		Yes – recorded in area	Open woodlands, sand ridges, sand pits, riverbanks, beaches, dunes, cliffs, mangroves & man-made grassed fields; given suitable habitat, may be a regular visitor and possibly breed in area.	Habitat loss	Widespread species that is to some extent opportunistic in nest-site selection.
Great Egret (*Ardea alba*)		Yes – vagrant only	Estuaries, tidal flats, rivers, freshwater lakes, sewage ponds and dams; likely to occur only in wetland areas.	None	Vagrant to area; may utilise wetlands created by previous mining. No wetlands present in Proposal area.
Common Greenshank (*Tringa nebularia*)		Yes – vagrant only	Estuaries, tidal flats, mangroves, rivers, wetlands,	None	Vagrant to area; may utilise wetlands created by previous mining including

Species	DEC current ranking (Feb 2012)*	Likelihood of occurrence	Habitat preference	Nature of impact	Potential of impact
			sewage ponds & saltfields; likely to be restricted to wetland areas as a summer migrant.		dams and water retention ponds. No wetlands present in Proposal area.
Wood Sandpiper (*Tringa glareola*)		Yes – vagrant only	Estuaries, tidal flats, mangroves, rivers, wetlands, sewage ponds & saltfields; likely to be restricted to wetland areas as a summer migrant.	None	Vagrant to area; may utilise wetlands created by previous mining including dams and water retention ponds. No wetlands present in Proposal area.
Common Sandpiper (*Tringa hypleucos*)		Yes – recorded in area (vagrant only)	Estuaries, tidal flats, mangroves, rivers, wetlands, sewage ponds & saltflats	None	Vagrant to area; may utilise wetlands created by previous mining including dams and water retention ponds. No wetlands present in Proposal area.
Red-necked Stint (*Calidris ruficollis*)		Yes – recorded in area (vagrant only)	Tidal flats, estuaries, salt marshes, beaches, wetlands & sewage ponds; likely to be restricted to wetland areas as a summer migrant.	None	Vagrant to area; may utilise wetlands created by previous mining including dams and water retention ponds. No wetlands present in Proposal area.
Sharp-tailed Sandpiper (*Calidris acuminate*)		Yes – recorded in area (vagrant only)	Tidal flats, estuaries, salt marshes, beaches, wetlands & sewage ponds; likely to be restricted to wetland areas as a summer migrant.	None	Vagrant to area; may utilise wetlands created by previous mining including dams and water retention ponds. No wetlands present in Proposal area.
Curlew Sandpiper (*Calidris ferruginea*)			Tidal flats, estuaries, salt marshes, beaches, wetlands & sewage ponds; likely to be	None	Vagrant to area; may utilise wetlands created by previous mining including dams and water retention ponds. No wetlands present in

Species	DEC current ranking (Feb 2012)*	Likelihood of occurrence	Habitat preference	Nature of impact	Potential of impact
			restricted to wetland areas as a summer migrant.		Proposal area.
Grey Plover (*Pluvialis squatarola*)			Tidal flats, estuaries, salt marshes, beaches, wetlands & sewage ponds; likely to be restricted to wetland areas as a summer migrant.	None	Vagrant to area; may utilise wetlands created by previous mining including dams and water retention ponds. No wetlands present in Proposal area.
Crested Bellbird (southern) (*Oreoica gutturalis gutturalis*)	P4	Possible	Arid scrublands, saltbush, mallee, spinifex & woodlands. Likely to occur in areas of taller vegetation.	Habitat loss	Species has not been recorded and may not be present in area; would occur in woodlands and shrublands that are extensive in region.
White-browed Babbler (*Pomatostomus superciliosus ashbyi*)	P4	Possible	Dry, scrubby woodland, mulga, mallee, native pine & shrubby areas; there may not be enough taller vegetation to support a permanent population of this species.	Habitat loss	Species has not been recorded and may not be present in area; would occur in woodlands and shrublands that are extensive.
Australian Bustard (*Ardeotis australis*)	P4	Yes – vagrant only	Grasslands, spinifex, open scrublands & pastoral lands; may be a seasonal summer visitor to area.	Habitat loss	Species probably only a vagrant to area.
Bush Stone-curlew (*Burhinus grallarius*)		Possible	Woodland, often adjacent to watercourses in the Pilbara; probably only occurs in woodland areas, for example watercourses in area.	Habitat loss	Species either not present, or present as vagrant only.
Hooded Plover	P4	Yes	Oceanic	None	May occur on salt

Species	DEC current ranking (Feb 2012)*	Likelihood of occurrence	Habitat preference	Nature of impact	Potential of impact
(*Charadrius rubricollis*)			beaches & salt lakes; unlikely to be suitable habitat on site.		lakes in region; may use wetlands created by mining. No wetlands present in Proposal area.
Shy Heathwren (*Hylacola cauta whitlocki*)	P4	Possible	Mallee, native pine, heath with *Banksia* or *Leptospermum* spp.; may occur in dense heath; occurs in south-west and South-east of Australia	Habitat loss	No suitable habitat - Species probably not present.
Brush Wallaby (*Macropus irma*)	P4	Yes	Open forest or woodland favouring open, seasonally wet flats with low grasses & open scrubby thickets. Found in some areas of mallee and heathland.	Habitat loss, roadkill	Species has not been recorded in the local area despite numerous field surveys.
Western Freetail-bat (*Mormopterus* sp.4)		Possible	Tall forests, open woodland, mallee & coastal heath; species may occur on the southern Iluka Eneabba lease area however this would be at the northern-most limit of its range.	Habitat loss	Likely roosting habitat outside of southern Iluka Eneabba lease areas. Unlikely within the Proposal area.
Shield-backed Trapdoor Spider (*Idiosoma nigrum*)	VU	Yes – recorded in region but not recently	Coastal plain; inhabits gravelley loam soils, often on lower slopes	Habitat loss	Most likely habitat associated with gravelly-loam soils within South Eneabba Nature Reserve, but outside of Proposal area.
Phasmid-mimic Cricket (*Phasmodes jeeba*)	P2	Possible	Possibly near-coastal areas. Known locations include Jurien & Dongara	Habitat loss	Proposal area outside range of species.
Scorpion Fly (*Austromerope poultoni*)	P2	Possible	Associated with forest litter; potential habitat in moist sites.	Habitat loss	Known locations in moist areas of forests in the south-west, however it's noted on

Species	DEC current ranking (Feb 2012)*	Likelihood of occurrence	Habitat preference	Nature of impact	Potential of impact
					the DEC threatened fauna database as being in the Eneabba area.
Millipede (*Antrichiropus* Eneabba sp.1)		Yes – recorded in region	Possibly associated with moist/seasonally damp areas.	Habitat loss; hydrological impacts to habitat.	Short range endemic, possibly restricted to damp areas. Unlikely to be present in Proposal area.

Source: Bamford Consulting Ecologists 2009 unless referenced in table. *DEC current threatened and Priority fauna rankings (17 February 2012) - VU: Vulnerable, CR: Critically Endangered, EN: Endangered, P1: Taxa with few, poorly known populations on threatened lands, P2: Taxa with few, poorly known populations on conservation lands, P3: Taxa with several, poorly known populations, some on conservation lands, P4: Taxa in need of monitoring

Direct impacts to fauna include habitat loss, potentially leading to fragmentation and loss of connectivity, which reduces the capacity for fauna movement and, ultimately, genetic exchange within species. Indirect impacts to fauna include the risk of altered fire regimes, weeds, *Phytophthora* Dieback, feral animals and changes to behavioural patterns due to noise, vibration, dust and light.

Potential impacts to fauna as a result of the Proposal are summarised below:

- Loss of foraging, nesting and breeding habitat due to vegetation clearing.
- Noise produced by mining activities may alter fauna behaviour and distribution.
- Fauna mortalities due to heavy earth moving machinery and light vehicles along mine access road and Brand Highway.
- Entrapment of fauna in tailings pits.
- Competition from introduced fauna for resources (e.g. hollow logs or other shelter, food, etc.).
- Increase in feral animals due to increased availability of food scraps, encouragement of feral fauna by staff or improved access to native fauna habitat along access tracks and haul roads.
- Loss of habitat due to introduction of *Phytophthora* Dieback and weeds into uninfested areas.
- Alteration of natural fire regimes can significantly impact composition and structure of fauna habitats.

5.4.3 Management objectives

The overarching objective for the management of native fauna is to ensure that impacts on protected fauna identified within the Proposal area are adequately identified and avoided in the first instance. If unavoidable, impacts will be minimised and mitigated.

Iluka has established a set of internal objectives for the management of native fauna. These include:

- Ensuring that any impacts on protected fauna identified within the Proposal area are adequately identified and avoided in the first instance. If unavoidable, impacts will be minimised and mitigated.
- Minimising and mitigating the impacts to fauna and their habitat.
- Adaptively responding to results and recommendations from monitoring programmes.
- Promoting awareness and education of employees and contractors on issues related to protecting fauna.

To reduce the temporal nature of impacts to fauna and their habitat, mining will be undertaken progressively and areas of vegetation disturbance will be rehabilitated as soon as practicable possible.

Management of impacts will focus on the following principles:

- Avoid, minimise and mitigate impacts to conservation significant fauna.
- Search and rescue native fauna prior to vegetation clearing activities (where practicable).
- Minimise habitat clearing
- Vegetation clearing is to be undertaken progressively in areas as they are required, so fauna have the opportunity to relocate.
- Monitor fauna in accordance with recommended ongoing research and studies.
- Record significant fauna events (protected species register, fauna mortalities, introduced species, changes to fauna movement, breeding or abundance).
- Rehabilitation will consider habitat requirements for conservation significant species recorded in the Proposal area.
- Progressive rehabilitation will be conducted to encourage fauna re-colonisation.
- Consideration will be given to fauna corridors and barriers to movement when planning clearing activities, to ensure safe passage between larger areas of fauna habitat.
- Feral fauna management (targeted to high impact predatory species.
- Site access being limited to designated access tracks.
- Strict control of firearms, traps and pets within Proposal area.
- Education of all site personnel including contractors and suppliers.

5.4.4 Proposed investigations

A fauna survey will be undertaken to determine the significance of the proposed impacts of the Proposal on fauna and their habitat. The survey will be undertaken in accordance with the EPA *EPA Guidance Statement No. 56: Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia (2004).*

Carnaby's Black Cockatoo foraging habitat will be assessed and surveyed in accordance with the SEWPAC *Draft Referral Guidelines for Three Species of Western Australian Black Cockatoos* (2011) in order to best manage the potential impact on this species foraging habitat.

5.5 Noise

5.5.1 EPA objective

To protect the amenity of nearby residents from noise impacts resulting from activities associated with the proposal by ensuring the noise levels meet statutory requirements and acceptable standards.

5.5.2 Potential impact

The Proposal area is closer to the Eneabba townsite than past mining operations and therefore has the greatest potential to impact on nearby residents.

An acoustic model for the proposed mining activities has previously been developed and will be revised and used to predict noise levels at the selected representative noise sensitive premises in the town of Eneabba for day and night time operations under both worst-case and calm meteorological conditions. In addition, noise contours for the worst-case meteorological conditions will also be provided.

Previous modelling results indicate that the day and night-time noise levels are the same at the same receiver location, but they are influenced by wind directions. Noise levels will increase at the Eneabba townsite as mining operations occur more towards the north of the Proposal area. There is the potential for assigned noise levels to be exceeded at some noise sensitive receivers in the town of Eneabba for worst-case meteorological conditions during the execution of the Proposal if noise attenuation measures are not investigated, identified and implemented.

5.5.3 Management objectives

The overarching objective for noise emissions produced by the Proposal is to ensure that noise levels produced from mining activities do not exceed the noise limits (assigned noise levels) imposed under the *Environmental Protection (Noise) Regulations 1997*.

The most significant contributors to exceedances are the mobile equipment. To achieve full compliance from the mining operations would require a reduction in noise emission from mobile equipment. This could be achieved by a combination of using quieter equipment, by reducing the number of equipment items operating, by installing silencers to reduce exhaust noise, by building additional noise bunds close to the mining pit edges and/or haul roads and/or reducing/restricting hours of operation.

Within the proximity of the Eneabba townsite, mining activities noise levels will be monitored to assess the impact of the mining operation on surrounding residences. If an exceedance is observed, mining personnel can then assess which mobile equipment is causing the noise level exceedance, and hence make changes to reduce the noise impact. Therefore, by using permanent noise monitoring stations Iluka can assess how current operating configurations are contributing to noise and what changes in equipment operations and/or usage should be carried out to ensure compliance is achieved or the noise impact is minimized.

Noise controls to be put in place when mining in the section of the Proposal adjacent to the Eneabba townsite include:

- Restricting certain machines on night shift and weekends.
- Modifying machines to reduce noise (eg. different reversing beepers).
- Cladding of noisy equipment (eg. pumps and parts of mining units).
- Building earthen “noise” bunds between the mine and Eneabba town.

Additional noise attenuation methods will be investigated.

It is expected that with mining activity further away from the Eneabba townsite, noise emissions will be more conservative than predicted. The mining schedule and sequence, as discussed in Section 4.2, also allows for the reduction in noise levels specifically adjacent to the town.

During 2011, Iluka commissioned SVT Engineering Consultants to measure background and ambient noise levels at different locations adjacent to the Eneabba townsite prior to the re-commencing of mining and processing at the Eneabba Mineral Sands Mine in December 2011 (SVT 2011). Data collected from the continuous weather and noise monitoring will be used to review/update the noise model and improve operational efficiencies. This will include reviewing what weather conditions result in noise exceedances (if any), defining what equipment causes the noise exceedances (if any) and reviewing what combination of weather conditions and noise exceedances result in lodged complaints.

In general, actions to manage the potential impact of noise from the Proposal include:

- Induction and training of personnel, including instruction on noise mitigation as part of normal daily activities.
- Utilisation of the quietest possible machinery and restricting the use of equipment that have higher noise emissions to day and evening times.
- Noise testing of all mobile equipment prior to acceptance from the manufacturer.
- Ongoing liaison with adjoining landowners throughout the construction, operation, rehabilitation and closure phases.

Additionally, the Iluka Annual Environmental Report details the activities conducted the monitoring results over the reporting period and also detail compliance with this management plan and the noise regulations.

5.5.4 Proposed investigations

Acoustic modelling of the potential impact of the Proposal will be conducted and used to predict noise levels at the selected representative noise sensitive premises in the town of Eneabba for day and night time operations under both worst-case and calm meteorological conditions. This investigation will also provide recommendations for management and attenuation measure in order to reduce the noise levels during operations. A Noise Management Plan will be developed prior to mining in proximity of the Eneabba town. This Plan will require approval by DEC before mining can proceed and will comply with the *Environment Protection (Noise) Regulations 1997* which ensures adherence to noise levels, particularly during nights and weekends.

5.6 Air quality (dust)

5.6.1 EPA objective

To ensure that emissions to air do not adversely affect environmental values or the health, welfare and amenity of people and land uses by meeting statutory requirements and acceptable standards.

5.6.2 Potential impacts

The majority of any airborne particulates from the Proposal area are likely to be visible dust, with a potential for some fine particulate matter. Combustion or point source stack emissions of particulates are generated from drying stacks associated with dryers at the SSC located approximately 6km south of the Eneabba townsite. A wide range of mining activities can generate dust. These are usually visible and readily identifiable.

Additional sensitive receptors, other than the Eneabba townsite, in relation to the Proposal area include:

- Motorists travelling along the Brand Highway.
- Local native vegetation, in particular Declared Rare and Priority Listed Flora.
- Neighbouring pastoralists.

The Proposal involves significant modification to existing mining methods with open area to be 87ha (at any given time during mining operations), no increase in overall dust emissions is anticipated. The distance to sensitive receptors varies considerably since mining operations progress across large areas quickly; hence, exposure to dusty conditions may be short term or transient in nature.

As discussed in Section 4.15, continuous monitoring of the 10 micron fraction (PM_{10}) has been undertaken at the Eneabba town site since 2004 and at a background site since 2005. The *National Environmental Protection (Ambient Air Quality) Measure* sets a maximum allowable level of 50 $\mu g/m^3$ over a 24-hour period for Ambient Air Quality. This level is used as a trigger level for continuous monitoring of PM_{10} as defined by DEC licence conditions. Any exceedence of this trigger level at the Eneabba townsite monitor is considered in the context of the background reading at the Depot Hill monitor.

5.6.3 Management objectives

Dust generated from the site can be minimised by the careful planning of the development and operation of the site. As mentioned, the Iluka Eneabba operations operates under a Dust Management Plan which was endorsed by the DEC regional office in Geraldton. The primary objective of the Dust Management Plan is to prevent significant impacts on amenity, human health and significant environmental values.

Other environmental objectives that are addressed in the Dust Management Plan include:

- PM_{10} dust emissions generated by mining operations remain below background.
- Nuisance dust generated by mining operations remains contained within the active mining area.

- Particulate emissions from drier stacks at the SSC do not exceed 250mg/m^3.

The following management actions will be undertaken to minimise and manage dust emissions from the Proposal:

- Inductions for all employees will include information on:
  - potential sources of dust;
  - the dust monitoring program;
  - licence conditions;
  - the Loss Control Card system for fugitive dust;
  - speed limits onsite; and
  - the requirement to stay on designated roads.
- Monitoring wind and weather forecasts (Bureau of Meteorology) and suspending nonessential mining operations (i.e. topsoil stripping) during excessively windy conditions.
- Minimise open areas exposed to wind erosion by minimising overburden rehandle and maximising topsoil replacement.
- Operate at least two dedicated water carts during dry, windy conditions and during summer months, across the site to apply water to unsealed operational areas (i.e. roads and loading areas).
- All unsealed roads used for heavy vehicle traffic within the mine area will be treated with dust suppressant additives where appropriate.
- Apply clay fines or oversize material to all non-active stockpiles prone to wind erosion within four weeks of disturbance (depositing or moving) during the summer months.
- Conduct topsoil stripping only during suitable wind and weather conditions. To minimise the generation of dust; topsoil stripping will be conducted in areas proposed for mining prior to mining commencing.
- After re-establishment of the soil profile (post mining), vegetative cover will be established as soon as possible as part of the progressive rehabilitation program.
- Implement loading and unloading procedures to ensure that dust emissions from material handling is minimised (e.g. minimise drop heights).

During windy conditions, it is possible that dust emissions may still be generated from the site even though the abovementioned management actions are being implemented. The following management actions will be undertaken to ensure that dust levels generated by mining activities do not create unacceptable impacts:

- All site staff will be responsible for reporting high or abnormally dusty conditions to the Environmental Superintendent or Mine Manager.
- If an activity is causing high or abnormally dusty conditions (as determined by visual assessment and prescribed licence conditions), the activity will cease until weather conditions change or appropriate dust controls are put in place to ameliorate the dust emissions.
- Dust levels will continue to be monitored in accordance with the commitments of the Dust Management Plan.

Iluka will be committed to effected dust control when mining near the Eneabba town, to ensure minimal impact on the community.

5.7 Groundwater (incl. Eneabba town water supply)

5.7.1 EPA objective

To maintain the quantity of water (surface and ground) so that existing and potential environmental values, including ecosystem maintenance, are protected.

To ensure the quality of water emissions (surface, ground and marine) does not adversely affect environmental values or the health, welfare and amenity of people and land uses, and meets statutory requirements and acceptable standards.

5.7.2 Potential impact

The Proposal will involve the abstraction of water from existing production bores at existing and licensed rates. Whilst there will not be any mining below the water table, disposal of tailings in mined pits (refer Section 2.4) will occur and has been shown to result in localised mounding of the groundwater table. Groundwater mounding can affect local water flows and potentially groundwater quality. Hence, groundwater abstraction and tailings disposal requires ongoing management and attention.

Groundwater from the lower Yarragadee Formation is extracted via a number of site production bores and used for a variety of purposes at the Eneabba mine site including processing, dust suppression, washdown and rehabilitation. No mining will occur beneath the water table; however, groundwater will continue to be abstracted from existing production bores.

The potential impacts to groundwater as a result of the Proposal include:

- Reduction in water levels in Yarragadee Formation from water abstraction. Historical water level data for production and monitoring bores typically show negligible long-term groundwater level reductions as a result of groundwater extraction. As additional groundwater pumping above the current licensed allocation will not be required, it is unlikely that future proposed mining operations will result in additional long-term groundwater level reductions. If long-term reductions from groundwater pumping are apparent at certain bores, these reductions could potentially be managed by reducing extraction rates in production bores at or near these locations.

  AECOM conducted an Annual Aquifer Review for Iluka's East Mine operations in 2011. Water level elevations near the most deep production bores showed steady or increasing trends in 2011 which is indicative of the aquifers' capacity to sustain the minimal groundwater abstraction rates experienced in late 2011. Recovery of water levels in many of the deep bores over the 2011 period, when abstraction was minimal compared to previous years, indicates that the aquifer will recover after extended periods of pumping (AECOM 2012). Most of the monitoring bores near shallow production bores experienced an increase in water level elevations during 2011, suggesting continued aquifer recovery in

response to reduced abstraction continuing from early 2010 when operations were idled (AECOM 2012).

- Direct impact on the Eneabba town water supply.
  The northernmost portion of the Proposal intersects the P1 and P2 Water Reserve area and is in close proximity to production bores 1/89 and 1/11. Iluka has been informed by the Water Corporation that production bore 2/75 has been decommissioned (Figure 4.10).

  Mining is expected to occur in this area for approximately 18 months and discussions with both the Water Corporation and DoW are ongoing. Groundwater abstraction from the deep confined aquifer will be considered because of the depth and lithological layering within the aquifers, is likely to exclude risk of environmental contamination. If a new water source is substituted for the period of mining within the Water Reserve area, a 'new source protocol' will be applied which includes an environmental scan for current or future contaminants and the sampling and testing of the 'new' water.

  Any water supply identified for the town's use must comply with the *Australian Drinking Water Guidelines* (NHMRC, NRMMC 2011) and compliance with the recommendations within DoW's *Policy and Guidelines for Construction and Silica Sand Mining in Public Drinking Water Source Areas* (Waters and Rivers Commission 1999). Discussions with the DoW and Water Corporation are ongoing.

- Mounding of water in superficial aquifer due to placement of tailings in mined pits.
  Significant groundwater mounding of up to around 10m to 15m and up to around 3km in extent, attributable to seepage of tailings water, can occur. Hence, further generation of wet tails from processing of mineral sands ore and subsequent placement in mined pits would be expected to result in additional groundwater mounding (SWC 2009). Further generation of wet tails from processing of mineral sands ore and subsequent placement in mined pits would be expected to result in additional groundwater mounding.

  Investigations by AECOM in 2011 indicated that groundwater depressions from extraction at some production borefield sites (e.g. Depot Hill and the Newman Concentrator) and groundwater mounding from seepage of water from dams and tailings facilities (e.g. 250 and Mid's Storage Dam) locally reverse groundwater gradients and flow patterns. However, a review of the use of some monitoring bores within the Depot Hill area for the construction of a groundwater contour plan revealed there is insufficient information to conclude that a significant drawdown of the superficial aquifer is occurring. By October 2011, water levels in the deeper monitoring bores in that location had recovered by around 1m since October 2010. The hydrographs for these bores indicated the deeper aquifers ability to recover relatively quickly when abstraction ceases (AECOM 2012).

As described in Section 2.4, tailings disposal associated with the Proposal will involve the split of sand tails from the co-disposal to enable sand tails deposition into the IPL North mine pit. The higher clay/slime fraction will be co-disposed with the remaining sand tails in an off-path tailings storage facility and/or other Eneabba mine voids (Figure 2.1). This tailings disposal method is expected to result in considerably less seepage and mounding than previously shown in current tailings methods. Monitoring the impacts of this tailings method on groundwater levels and quality will be undertaken prior to mining within the water reserve.

Monitoring of salinity adjacent to tailings facilities was initiated in 2010 to assess the impact of tailings on groundwater quality. Monitoring results show stable salinity trends since 2010 indicating the impact is minimal (AECOM 2012). Results show minimal impact as expected as the Iluka Eneabba operations relies on gravitational and mechanical separation techniques as against chemical processing.

- Impacts to groundwater dependant ecosystems (GDEs) from groundwater drawdown.
  Potential impacts on GDEs were identified by comparing the maximum depth of soil profile needed to support the transpiration requirements of the native vegetation against the depth to groundwater across the site. It was considered that if the depth to groundwater is deeper than the required rooting depth, then the vegetation will be reliant on soil stored moisture. Conversely, if the depth to groundwater is shallower than the required rooting depth, then the vegetation will be dependent to some extent on the groundwater (SWC 2009).

  From laboratory measured water retention data, it was determined that a maximum soil depth of 8.75m was required to support native vegetation with a transpiration requirement of 700 mm/year (SWC 2009). Groundwater level is shallower around the SSC in the south and deeper in the north. Around the Proposal area, groundwater levels are typically between 30-35m (AECOM 2012). No GDEs have been identified within or adjacent to the Proposal area.

5.7.3 Management objectives

The key management objectives for groundwater are to avoid adverse impacts on the Yarragadee Formation from water abstraction and to ensure the Eneabba town water supply is not adversely affected during and after mining activities.

In general, groundwater is managed at the Iluka Eneabba operations under the approved Groundwater Licence Operating System (GLOS) as approved by the Department of Water (DoW). The GLOS relates to GWL104709 (Twin Hills Sub-area) and GWL104700 (Eneabba Plains Sub-area). Currently the GLOS addresses the following issues:

- Water abstraction methods.
- Administrative requirements, reporting and operating rules.

- Groundwater monitoring (including wetlands) and procedures for responding to monitoring results.
- Vegetation monitoring.
- Measures for protecting the Eneabba town water resource.

Additional issues identified during the Proposal development that required addressing in the GLOS include:

- Measures for protecting the Eneabba town water supply.
- Potential impacts and management of tailings disposal on groundwater mounding and groundwater quality.

Groundwater quality will be protected through the implementation of management actions which include:

- Induction and training of personnel on the importance of protecting groundwater quality.
- Controls on hydrocarbon transport, storage, handling and disposal.
- Hydrocarbon spill clean-up procedures.
- Safe storage, handling and disposal of ablution effluent.
- Groundwater quality monitoring and reporting.
- Strategic positioning of groundwater production bores to minimise mounding from tailings facilities.
- Undertaking works in accordance with approvals and permits under Section 17 of the RIWI Act, where required.

Based on the potential impacts to the Eneabba town water supply (temporarily and future) due to mining within the water reserve and groundwater mounding due to tailings water from backfilling the mine pit with tails, the mine schedule/method was revised and the mine pit will be backfilled with sand tails (refer Section 4.2). This results in dry sand tails and overburden to be placed in the mine pit and as a result groundwater mounding is unlikely to occur directly adjacent to the Proposal area due to this activity.

5.7.4 Proposed investigations

Investigations on the potential impact of mining within the Water Reserve will be undertaken and may include the drilling and equipping of replacement bores of a suitable quality to ensure the continued supply of safe drinking water to the Eneabba townsite. Construction of a new “deeper” bore will be investigated as there is a suspected limited hydraulic connection between the relatively shallower and deeper waterbearing sections of the aquifer(s). Hydrological studies will also be undertaken to ensure there will be no impact on the water supply during mining. All mining within the Proposal is above the watertable.

Due to the modification of tails disposal for the Proposal, an investigation into the water levels of the returned soil profile and the flora dependence on soil moisture will be undertaken. This will assist in determining the most appropriate sand/clay ratio of the tailings.

5.8 Rehabilitation and closure

5.8.1 EPA objective

To minimise environmental impacts resulting from permanent change to ecosystems. This requires the return of rehabilitated areas to self-sustaining and functional ecosystems comprised of local provenance species.

5.8.2 General

Rehabilitation is undertaken progressively to restore native vegetation as soon as possible following mining and to minimise the amount of area open and, therefore, vulnerable to impacts such as wind erosion. Closure is undertaken at the end of mining activities.

Woodman Environmental (2009b) has identified a number of post mining landscape vegetation complexes, referred to as Rehabilitation Vegetation Types (RVTs), for use during the rehabilitation process. The RVTs are an agglomeration of FCTs that have similar soil and topographic associations. RVTs also represent landscape-scale vegetation complexes. By agglomerating FCTs with similar soil/landscape associations, a larger suite of potential species for each unit is identified. This maximises the potential final biodiversity of each unit and provides enough species for each RVT to help establish final communities that will suit the soil type/landform as prescribed in the landform design of each rehabilitation area.

The groupings have been determined based on a qualitative assessment of the FCT mapping of the Proposal area in conjunction with topographic and general soils information.

Details of the indicative horizon thicknesses targeted for rehabilitation are presented in Table 5.5 for each RVT and are based on sampling of local analogue sites via pit excavation and hand augering. These horizon thicknesses will be subject to further amendment in response to ongoing soil investigations that will result in an improved understanding of analogue soil types in each of the FCT's.

Note that the identified RVTs below are subject to further investigation for the Proposal due to direct return of topsoil.

Table 5.5 Eneabba Rehabilitation Vegetation Types indicating target communities for rehabilitation works

Rehabilitation Vegetation Type:	Heath/Scrub flats	Heath on gravely clay	Woodland dune	Creekline thicket	Wetland Basin	Pasture
Vegetation communities*:	FCT 1a, 2b, 3a	FCT 2d, 2e, 5a, 5b, 5c, 5d, 6a, 6b, 16a	FCT 1b, 2a, 2c	FCT 5e, 8, 12 17	FCT 7, 19a	n/a
Landform:	Shallow sand over clay on flats &	lateritic gravel and clayey	Crests to lower slopes of dunes	Drainage lines and wet flats	Drainage basins with	variable

		interdunal swales	sand on upper to lower slopes of Gingin Scarp	(usually Aeolian)		shallow sand over heavy clay or laterite	
Surface Topography		As per design Digital Terrain Model (dtm)					
Horizon thicknesses (cm)	Topsoil	5cm	5cm	5cm	5cm	5cm	20 to 30cm
	Subsoil (i.e. 2nd cut topsoil)	15 to 25cm	15 to 25cm	15 to 25cm	15 to 25cm	15 to 25cm	
	Light grey to yellow/brown sand	0 to 40 (Ave 15) Grading deeper at boundaries with other vegetation types	10 to 80 (avg. 50)	40 to 400+, as per dtm difference	200 to 300	1 to 15	10 to 50
	Yellow/brown clayey sand to sandy clay	0cm	0 to 100cm	0cm	0cm	0 to 15cm	0 to 20cm
Subsurface topography (Gravely clay)		Upper surface of gravely clay as per design dtm Minimum 2m thick layer					

* FCT's were re-assessed in 2010, and a number of changes were incorporated, update for Annual Environmental Report 2011 (Iluka Resources Limited 2012)

Details of the indicative horizon thicknesses are presented in Table 5.6 are subject to further amendment in response to ongoing soil investigations that will result in an improved understanding of analogue soil types in each of the FCTs.

EPA Guidance Statement No.6 (2006) provides a process for identifying and ranking factors that can limit the efficacy of land rehabilitation. The process will be applied to planned rehabilitation areas within the Proposal area.

The main limitations to the success of native vegetation rehabilitation at Eneabba are considered to include:

- Climate unpredictability (in particular drought stress to vegetation)
- *Phytophthora* Dieback risk (autonomous spread)
- Low seed availability and/or seed viability of some flora species
- Ability of rehabilitated vegetation to recover from fire disturbance events

5.8.4 Potential impacts

Poor rehabilitation and closure procedures, planning and management practices may result in a number of undesirable impacts to the receiving environment such as:

- Unauthorised vegetation disturbance as a result of rehabilitation activities has the potential to:

  - impact upon native vegetation in excess of what has been approved, resulting in a non-compliance issue
  - negatively impact upon FCTs, fauna habitat, conservation significant fauna, DRF or Priority species
- Depletion of topsoil resources due to improper topsoil or subsoil stockpiling or long-term storage time including surface erosion and dust generation of unstabilised stockpiles.
- Inappropriate use of soil resources in reconstructed landforms could create compacted layers with poor infiltration rates and/or could minimise rooting depth.
- Improper tailings disposal resulting in:
  - the formation of slime pockets
  - the formation of impregnable slime layers within the soil profile restricting root penetration and water recharge
- Poor vehicle hygiene or ineffective washdown has the potential to carry *Phytophthora* Dieback or weeds in soil to rehabilitated areas.
- Rehabilitation and closure activities may generate dust and noise during landform recontouring, spreading of topsoil and subsoil, and decommissioning of mine infrastructure.

5.8.3 Management objectives

Iluka developed a conceptual Rehabilitation Management Plan and Closure Management Plan in early 2009 as part of the previous Referral process. These plans outline the conceptual closure options, mine closure completion criteria and rehabilitation strategies. These documents will be updated during 2012 to reflect the methodologies now relevant to the rehabilitation practices at Eneabba. Revised completion criteria were submitted to the MSARCC in April 2011 prior to presentation and discussion at the annual MSARCC meeting. Feedback and comments received as a result of the discussion were incorporated into the document and re-circulated. In response to feedback in 2011, the closure completion criteria will be re-submitted with the Mine Closure Plan for Eneabba in 2013 (as required under *Mining Act 1978*).

The objectives for rehabilitation (and subsequently closure) are to:

- create a rehabilitated land surface that is safe, geotechnically stable and consistent with local topography
- create a rehabilitated ecosystem that have equivalent values to surrounding natural ecosystems
- create rehabilitated areas that are able to be managed in the same way as surrounding unmined land
- ensure surface and groundwater hydrology consistent with surrounding areas
- ensure re-constructed soil have equivalent capacity to support the target vegetation community, as adjacent unmined soils
- create a rehabilitated ecosystem that have equivalent functions and resilience as communities in adjacent unmined soils
- create rehabilitated areas that provide suitable habitat for native fauna
- ensure rehabilitated areas are not visually distinct from surrounding unmined areas

The areas that will need to be closed are not limited to rehabilitating the mining pits. Closure involves the complete closure of the Eneabba mine site. Closure involves areas such as the administration, workshop and stores; SSC and associated infrastructure; non-saleable by-products in-pit storage; ancillary facilities such as mining units, groundwater bores, accommodation villages and ancillary infrastructure (e.g. powerlines, roads, pumps, pipelines, transfer stations, sub stations). The main activities that will be undertaken during closure include:

- Disconnection and termination of services, such as power from the grid and termination of sewerage services.
- Demolition and/or removal of buildings and infrastructure.
- In areas with a risk of hydrocarbon spillage (e.g. oil/diesel storage areas), soils will be sampled and analysed for hydrocarbon contamination, bioremediated (if necessary) and reused for rehabilitation.
- Rehabilitation care and maintenance activities until successful relinquishment.

To minimise environmental impacts, Iluka will be reinstating landforms that will have soil structure, vegetation communities and ecosystem values and functions comparable to adjacent native vegetation areas.

Rehabilitated areas will be managed in the same manner as surrounding unmined land. To achieve this, Completion Criteria and qualitative standards have been proposed to ensure the rehabilitated area will meet rehabilitation and closure objectives. Monitoring will be in place to provide a measure of how the rehabilitated area is advancing towards completion, and if any other mitigation is required, to ensure the area is successfully closed.

Iluka is currently conducting a conduct literature review of previous rehabilitation research and practices in order to provide direction for ongoing improvements in rehabilitation into the future. The aim of the review is to provide direction for a Research and Development (R&D) Programme that will support ongoing improvement in the standard of native rehabilitation at the Eneabba Mineral Sands Mine. The review will also identify gaps within current and/or historic ecological studies as well as identify new or innovative areas of research that may assist with the improvement of current rehabilitation practices at Eneabba.

5.9 General environmental impacts and management

5.9.1 *Phytophthora* Dieback

Potential impacts

The main impact of the spread of *Phytophthora* Dieback is the loss of susceptible plant species, alteration of vegetation composition/structure and changes to fauna habitat values and ecological functions. There is also the potential for susceptible Declared Rare and Priority Flora or TECs to be impacted both directly and indirectly.

The Proposal area does not fall within an area that is infested, however areas to the east and south are classified as risk areas (Figure 4.5).

There is a risk within mining operations of infected material being transported from infested to uninfested areas, potentially causing irreversible localised damage to native vegetation. Movement of material within and adjacent to the Proposal area could introduce *Phytophthora* Dieback into previously uninfested areas. Without the necessary hygiene control measures, the risk of mining operations impacting biodiversity values within and adjacent to the mine site through the spread of *Phytophthora* Dieback is high.

Management objectives

The objectives of the management of *Phytophthora* Dieback are:

- Prevent the introduction of new *Phytophthora* Dieback infestations.
- Prevent the non-autonomous spread of existing infestations within the Iluka Eneabba leases.
- Detect, diagnose and map infestations in the field.
- Ensure appropriate education and training is communicated to personnel and contractors.

The risks associated with the spread of *Phytophthora* Dieback within the Proposal area can be effectively managed through implementation of the strategies and management actions outlined in the *Phytophthora* Dieback Management Plan. The updated *Phytophthora* Dieback Management Plan has been reviewed by the Environmental Management Branch of the DEC and assessed as satisfactorily providing for acceptable management of *Phytophthora* Dieback at Iluka Eneabba West and East operational areas.

In general, *Phytophthora* Dieback through the operation of the Proposal will be managed using the following strategies:

- Implementation of the approved *Phytophthora* Dieback Management Plan.
- Development of a robust hygiene plan for the Proposal area with wash stations at all entry points.
- Control access out of Dieback Risk Areas (DRA) and into protectable areas.
- Vehicle hygiene management through the inspection of all vehicles arriving on site and designated permanent wash down facilities at all exit points from DRA and at site entrance.
- Management of road construction and importation of materials that is from 'certified' *Phytophthora*-free areas will be permitted.
- Management of the site nursery as a quarantine area with hygiene accreditation from the Nursery and Garden Industry (WA).
- Undertaking vegetation clearing in accordance with the Iluka Clearing Procedure. *Phytophthora* Dieback infested topsoil will be identified, isolated and returned its original site.
- Inductions and training of staff on *Phytophthora* Dieback awareness, responsibilities and procedures.

Proposed investigations

A *Phytophthora* Dieback assessment will be undertaken for the Proposal and include recommendations on management measures to prevent the spread of the disease.

5.9.2 Weeds

Potential impact

Environmental weed species have the potential to affect biodiversity by influencing genetic diversity, species diversity and ecosystem diversity. At a genetic level, weeds can reduce diversity by diminishing the viability and robustness of populations of native species.

Species diversity can be reduced through changes in community composition as a result of resource competition, altered fire regimes or the prevention of native seedling recruitment. Incidental outcomes of loss in species diversity include loss of native fauna due to a reduction or significant change in habitat.

Impacts to ecosystem diversity can be major and long lasting. These can include the displacement of native flora, alteration of hydrological cycles and alteration of geomorphological processes.

No Declared Plants (as listed by the Department of Agriculture and Food) have been recorded within the Proposal or any of the areas of native vegetation surveyed to date. Declared Plant species are likely to be present within the greater Eneabba region.

Management objectives

The risks associated with the continued infestation and the spread of weeds within the Proposal area can be effectively managed through the implementation of the recently reviewed and updated Weed Management Plan. The Weed Management Plan has been reviewed by the Environmental Management Branch of the DEC during 2009 and assessed as satisfactorily providing for acceptable management of weeds at both Iluka West and East operational areas.

The objectives of the management plan are:

- Reduce or eliminate competition to indigenous plants from exotic plant species.
- Minimise the spread of weed species.
- Prevent the introduction of new weeds species.
- Identify and prioritise the control of weed species and weed sites.

Management actions to control the introduction or spread of weeds will include, but not be limited to:

- Induction training will include promotion of weed awareness and the location of restricted access weed risk areas (i.e. quarantined areas).
- Weed identification and eradication training will be provided for personnel undertaking weed management actions.
- Access restrictions will apply to weed risk areas – personnel authorised by the Rehabilitation Coordinator will be allowed access (e.g. for the purposes of weed control).
- Vehicles, mobile machinery and plant inspection and wash-down procedures will be enforced to manage hygiene requirements for equipment:

  - being brought onto the mine site, vehicle requires inspection as per Vehicle and Machinery Hygiene Inspection Field Sheet
  - moving from a weed risk area to other parts of the mine site
  - being removed from the mine site.
- Topsoil (and vegetation) stripped from weed risk areas will be stockpiled separately and stockpiles will be marked and recorded on relevant plans.
- If weed eradication of topsoil for the purposes of use in rehabilitation is deemed not practicable, topsoil from weed risk areas will be buried on site and covered with at least 2m of clean soil (i.e. soil not sourced from a weed risk area).
- In general, priorities for weed control will be based on the following hierarchy:
  - The level of significance of the target species.
  - The area in which the weed occurs.
- Specific Criteria for prioritisation will be applied (after the general hierarchy is applied) which includes:
  - size of infestation
  - phase of invasion
  - proximity to roads
  - proximity to drainage lines (natural or rehabilitated)
  - estimated time to control
  - susceptibility to wind dispersal
  - proximity to site boundary
  - proximity to nature reserves
  - distribution in the region
  - ability to out-compete native species in rehabilitation

Considering that the Weed Management Plan with its emphasis on hygiene measures, weed control and monitoring will be implemented, the objectives are expected to be met.

5.9.3 Fire

Potential impact

Vegetation within and adjacent to the mining areas provides a source of fuel for fires. The potential sources of fire ignition, within the operations, that require management to minimise fire risk are:

- Vehicle movements (sparks from engines)
- Vehicle refuelling
- Inappropriate storage and handling of hydrocarbons and/or explosives
- Hot work (e.g. welding, grinding, flame cutting)
- Blasting
- Human sources (e.g. inappropriate cigarette disposal)

In addition to these ignition risks, there is the potential for fire to enter the mining operation from external sources, or be initiated from sources not within the control of Iluka. Such sources that have the potential to impact on the Iluka operations can include:

- Fires started by agricultural machinery and operations in the surrounding area.

- Inappropriate cigarette disposal from outside sources (i.e. from motorists on Brand Highway).
- Escaped 'controlled burns' or 'fuel reduction burns' in the surrounding area.
- Electrical pole fires (arcing and ignition in strong winds).
- Arson inside or outside the mining area.
- Lightning strikes

The mine area, including vegetated and cleared areas, presents varying levels of bush fire hazard. The bush fire hazard levels have been assessed for the Eneabba operational area and neighbouring surrounding land uses in accordance with "Planning for Bush Fire Protection" (DPI FESA 2004). The full assessment is located in the Fire Management Plan. The bush fire hazard assessment showed that the areas around and in the Eneabba mine site are predominately classed as Low to Medium risk. One very small High risk area was identified (around buildings) and no Extreme areas were identified.

Management objectives

The objectives of the management plan are:

- Prevent fire ignition related to mining activities.
- Prevent fire spreading from Eneabba operations onto adjacent land and vice-versa.
- Protect the lives of people, buildings and neighbouring properties from severe damage by uncontrolled fire.
- Monitor the effectiveness of controls.
- Continuously improve management in response to identified hazards and/or incidents.

The main management actions in relation to fire include:

- Observing all Shire fire bans and vehicle movement bans
- Instruction of all personnel on prevention, safety and response practices for fire management
- Training of selected personnel on the use of fire fighting equipment
- Establishing and maintaining fire-breaks around operational areas
- Reporting of all fires occurring within the Iluka operations area
- Preparing an incident report for all fire events outlining extent of fire, potential cause of fire, corrective actions required and improvements to procedures/equipment
- Providing and locating fire fighting equipment in accordance with the relevant standards and requirements
- Controlling all fires that are caused by Iluka activities and naturally occurring fires that cause a threat to Iluka facilities or personnel
- Liaising with the DEC with regard to fire management in operational areas that are located within the SENR
- Maintaining emergency response teams trained in fire fighting operations
- Conducting construction activities in clear areas, wherever practicable
- Burning of vegetation associated with bush regeneration is only to be undertaken when a valid and current permit to burn from DEC is obtained
- Smoking is only permitted in designated smoking areas

- Prohibition of hot work activities without a hot work permit
- Having in place a dedicated trained fire spotter with fire fighting equipment
- Fitting spark arrestors to all earth-moving equipment
- Storing of all fuels and chemicals in bunded areas with a surrounding buffer zone and an appropriate drainage system in accordance with Australian Standards.

Considering that implementation of the Fire Management Plan will ensure that fire hazards at the mine are managed to minimise the risk of fire, and ensure the safety of employees, mine infrastructure, fauna, flora and vegetation in adjoining areas outside the mining disturbance footprint, the objectives are expected to be met.

5.9.4 Surface water

EPA objective

To maintain the quantity of water (surface and ground) so that existing and potential environmental values, including ecosystem maintenance, are protected.

To ensure the quality of water emissions (surface, ground and marine) does not adversely affect environmental values or the health, welfare and amenity of people and land uses, and meets statutory requirements and acceptable standards.

Potential impact

Surface water flows in ephemeral creeks in the Eneabba region have episodic flow events as a result of localised rainfall within the catchments. Alteration of surface water and sub-surface water flows can occur as a result of mining activity. There will be reductions in catchment size which could affect both natural hydrological regimes and potential surface water or sub surface water dependant ecosystems. Also, there could be a reduction in the amount of native vegetation available for the ecological functioning of watercourses and wetlands.

The Proposal area does not intersect any wetlands or major drainage lines and this along with the proposed mining plan (refer Section 4.13; Figure 4.11), no impacts on surface drainage are likely to occur.

Water quality can be affected by erosion or sedimentation through run off from roads and open spaces, the clearing of native vegetation and wetland site disturbance, hydrocarbon contamination through spillages and/or inadequate storage facilities and from stormwater entering watercourses and wetlands.

Iluka currently has two water quality monitoring sites at Lake Logue. Water quality within the Lake Logue-Indoon System is subject to impacts from agricultural drainage, vegetation clearing due to agricultural activities and potentially from other resource development projects in the region.

Weed and/or *Phytophthora* Dieback infestation can occur through the introduction of foreign material on machinery and personnel entering the site. Weeds and *Phytophthora* Dieback can also spread autonomously by passive water movement, transporting the pathogen down gradient of infected areas via natural drainage lines.

It is important to note that due to the sandy nature of the soils at Eneabba, the amount of surface water flow will be minimal and water is most likely to flow following heavy rainfall events. Also, predicted impacts are likely to be only temporary as reconstruction of the soil profile and reinstatement of surface flows will occur during rehabilitation post-mining (SWC 2009).

Management objectives

The key objectives for surface water management are:

- Maintain existing surface water hydrology within the operational area.
- Protecting and maintaining significant attributes and conservation values of surface water systems within the mining area.
- Minimising impacts on surface water systems due to mining activities.

Management actions to manage surface water impacts will include, but not be limited to, the following:

- Collect baseline information through the survey of surface contours and by determining baseline flow parameters for watercourse and wetland systems.
- Where drainage diversion is required, ensure drainage is re-instated to original alignment post-mining.
- Identify 1 in 100 year and 1 in 10 year storm event conditions and design appropriate water diversions which can accommodate such events.
- Linear infrastructure (i.e. roads) will avoid altering natural surface water flows by including appropriate structures into design, including:
  - bridges
  - culverts
  - flood ways
- Ensure discharge of mine run-off to wetlands, watercourses or the wetland buffer zones is minimised. Achieved by:
  - installation of sediment traps adjacent to roadways where required, designed to limit the deposition of sediment to wetland areas
  - installation of sufficient drainage areas around workshops/refuelling areas
  - installation of appropriate bunding around hydrocarbon and hazardous goods storage facilities
  - installation of drainage around the landfarm facility
- Provision of spill kits at refuelling/maintenance areas and on refuelling vehicles.
- Training on safe handling and storage of hydrocarobon products, spill prevention, response and clean-up will be provided to all staff and contractors.
- Implementation of surface water monitoring programme to provide ongoing information on wetland system function and monitor direct and indirect impacts to surface water systems. Locations of monitoring sites are shown on Figure 5.1 and Figure 5.2.

Considering that the management strategies for surface water within the Proposal area, the objectives are expected to be met.

N

0 1 2 3 4 km

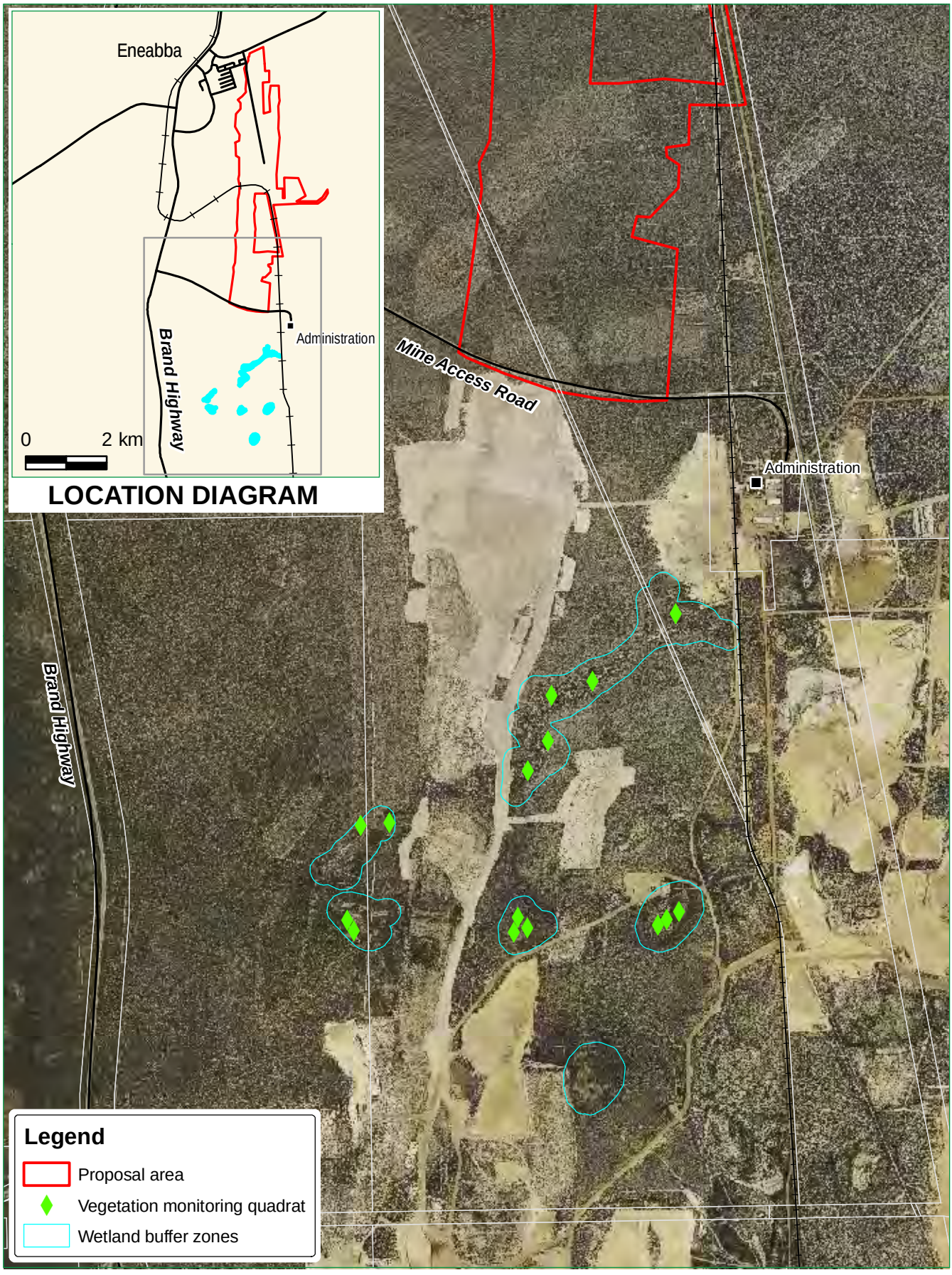
Aerial Photography flown Nov. 2011
Regional Aerial Photography flown 2006

IPL NORTH PROPOSAL
SURFACE WATER MONITORING LOCATIONS

ILUKA

ORIG: A Joubert DRAWN: D.L.S. SCALE: 1:100,000 (A4) DATE: May 2012 DWG No: 219089v00

FIGURE: 5.1



IPL NORTH PROPOSAL
WETLAND VEGETATION MONITORING SITES

ILUKA

Aerial Photography flown Nov. 2011

ORIG: A Joubert DRAWN: D.L.S. SCALE: 1:25,000 (A4) DATE: May 2012 DWG No: 219090v00

FIGURE: 5.2

5.9.5 Visual amenity

EPA objective

To ensure that visual amenity is considered and measures are adopted to reduce adverse visual impacts on the surrounding environment as low as reasonably practicable.

Potential impact

The visual impact of the Proposal has been considered from publicly accessible sensitive receptors, including the Eneabba town site, SENR and Brand Highway. The existing mine operations are visible from Brand Highway, Coolimba Road, Three Springs Road and the Eneabba townsite. Visual amenity may be temporarily reduced in Eneabba townsite and the SENR during mining operations as a result of dust production, disturbance of natural landscape, light spill and the presence of construction equipment; however, operations have been conducted at Eneabba for over 30 years, and it is unlikely that the Proposal will add significantly to the visual impact of the existing operations. Any structures to be installed for noise attenuation (e.g. earthen noise bunds) will be temporary in nature and removed once mining has ceased as part of the rehabilitation practices.

In dry, windy conditions, particulates can be lifted from open or disturbed areas resulting in visible dust emissions. Most airborne particulates that originate from these sources are larger than PM_{10} and are associated with nuisance rather than public health problems. Dust emissions of this type can cause reduced amenity of an area, and reduce visibility for road traffic, potentially creating unsafe driving conditions.

Management objectives

Management actions to protect the visual amenity around the Proposal area will include:

- Prior to moving infrastructure or establishing new mining areas, the potential for visual amenity to be impacted will be reviewed.
- The retention of established vegetation and minimisation of the area disturbed, as far as practicable.
- Vegetating soil bunds.
- Maintaining the site in a neat and tidy condition and keeping plant and equipment in good presentable order.
- Designating appropriate areas for disused equipment.
- Implementing measures to minimise light overspill and glow.
- Completing rehabilitation as soon as practicable following mining
- Dust minimisation strategies during construction and operation (refer Section 5.6).
- Re-establishing disturbed landforms so they are consistent with local landscape values, sympathetic to surrounding areas and resemble the local environment as closely as possible.
- Locating infrastructure in, or near, previously disturbed areas, as far as practicable.

- Consideration of any complaints from the public due to visual amenity as incidences and treated as such.

Considering the implementation of the above-mentioned management actions with their emphasis on appropriate consideration of visual amenity during mine planning, dust mitigation measures, effective rehabilitation and closure of disturbed areas, the objective is expected to be met.

5.9.6 Heritage

EPA objective

To ensure that changes to the biophysical environment do not adversely affect historical and cultural associations and comply with relevant heritage legislation.

Potential impact

The Proposal area has been previously surveyed and no sites of cultural significance were found. Iluka will however continue to undertake consultation with the Amagu native title claimant group as required.

Management objectives

Iluka will continue to implement management measures to ensure Aboriginal heritage values are not compromised by the Proposal and will work closely with its neighbours, employees, indigenous groups and stakeholders to add value to the communities in which the company operates.

Management actions to address Aboriginal heritage issues in the Proposal area will include:

- Undertake heritage surveys of new mining areas not yet surveyed prior to any ground disturbance, in consultation with relevant native title claimant groups and their legal representatives.
- Avoid disturbance to heritage sites where possible and implement measures to protect them.
- Where avoidance of a site is not possible, consent will be sought to disturb the site from the Minister for Indigenous Affairs through a Section 18 application under the *Aboriginal Heritage Act 1972*, in consultation with relevant native title claimant groups and their legal representatives.
- If any Aboriginal cultural material is uncovered or encountered in the course of operations, it will be reported and work in the area will cease immediately until it has been assessed and appropriate approvals sought, if required.
- Ongoing consultation with relevant native title claimant groups and their legal representatives.
- Continuous protection of the South Eneabba wetland artefact site from any disturbance.
- Informing all Eneabba operations personnel and contractors of their responsibilities and obligations under the *Aboriginal Heritage Act 1972.*

Considering the implementation of the abovementioned management actions, with their emphasis on consultation with relevant groups and the commitment to

undertake Aboriginal heritage surveys for not-yet-surveyed areas that are to be mined, the objective is expected to be met.

5.9.7 Greenhouse gas emissions

EPA objective

To ensure that potential GHG emissions emitted from proposed projects are adequately addressed in the planning/design and operation of projects and that:

- *best practice is applied to maximise energy efficiency and minimise emissions;*
- *comprehensive analysis is undertaken to identify and implement appropriate offsets; and*
- *proponents undertake an ongoing program to monitor and report emissions and periodically assess opportunities to further reduce GHG emissions over time.*

Potential impact

Iluka manages GHG emissions by operating consistently within its corporate values and national and local requirements. Iluka is cognisant of federal legislation requirements and is following these requirements to manage its GHG emissions. Changes to legislation are occurring very rapidly; hence, it is necessary to adapt the approach to GHG emissions management with current legislative requirements.

Iluka maintains an annual inventory of GHG emissions and energy consumption in line with the *National Greenhouse and Energy Reporting Act 2007*. Additionally, Iluka has participated in the Federal Government's Energy Efficiency Opportunities (EEO) programme since 1999, the purpose of which is to assess energy use and process efficiencies at operational sites, and to identify and implement opportunities to work in a more energy efficient manner. During the current EEO reporting cycle, 99.1% of Iluka's total energy consumption was assessed, exceeding the requirements of the programme. During 2011, Iluka identified, implemented and pursued a range of energy efficiency projects that deliver gains in energy efficiency and performance. Overall, the energy efficiency opportunities that were operational during 2010 – 2011 equated to a reduction in energy usage of 0.76 petajoules or 8% of Iluka's total energy consumption. Iluka remains focused on sustaining the gains from these energy efficiency opportunities and are committed to ensuring that energy efficiency remains embedded in its operations as part of its continuous improvement process.

Electricity, natural gas and diesel fuel are the main sources of GHG emissions at the Iluka Eneabba operations. Electricity is supplied externally from the Western Power grid and the on-site power generations system and used for powering the concentrators, field generators, groundwater production bores and for general use in the administration buildings and workshops. GHGs are directly emitted from the use of natural gas in the drying process at the South Secondary Concentrator. Diesel fuel is used to run the heavy vehicle mining fleet, mobile pumps, generators and light vehicles.

Management objectives

The objectives of GHG emissions management are:

- Identify GHG emission sources and sinks.

- Estimate the GHG emission or absorption from each source or sink, respectively.
- Ensure that the total net GHG emissions and/or GHG emissions per unit of product are reduced as far as practicable.
- Monitor the effectiveness of controls.
- Adaptively respond to inadequacies in controls.

Management measures are implemented on site and are regularly reviewed to optimise energy use and to reduce GHG emissions. Currently, Iluka has the following measures in place:

- Ensuring that vehicles and equipment are mechanically sound, serviced regularly and fitted with appropriate emission control equipment.
- Identifying opportunities to improve process efficiency, including the replacement of existing equipment with more efficient equipment, where possible.
- Ensuring that mine equipment is correctly sized for production requirements.
- Minimising the size of the mining fleet.
- Minimising haul distances.

Pumping operations are a prominent source of GHG emissions as they use electricity and/or diesel fuel to operate. The following measures are in place to review and maximise efficiency of pumping operations:

- Review and improve slurry pumping requirements to maximise pumping efficiency.
- When purchasing new motors for equipment that operates continuously, “high efficiency type” motors are selected.
- When purchasing motors for pumps that experience, or may experience, load fluctuations, variable speed and/or automatic control motors are selected for use.
- Review and install direct-driven equipment in lieu of belt-driven systems to avoid energy waste via mechanical conversion elements, where technically feasible.

Iluka is committed to continuing to improve energy efficiency and to reducing its GHG emissions by implementing best practice technologies in all of its operations, where practicable. Iluka will continue to pursue GHG reduction measures and offsets to reduce the GHG emissions from the project in line with current legislative requirements, as indicated in the sections above, and in line with the EPA Guidance Statement No. 12 – Minimising Greenhouse Gas Emissions (EPA 2002b).

Considering the implementation of the GHG management strategies will ensure management actions for reducing GHG emissions and energy consumption will be developed on an ongoing basis, the EPA objective is expected to be met.

Furthermore, Iluka has committed to reporting and abatement under the EEO Act which will assist in the continuous improvement of Iluka operations with respect to reductions in GHG emissions and increases in energy efficiency.

6. ENVIRONMENTAL MANAGEMENT SYSTEMS & PLANS

6.1 Environmental management system

Iluka maintains an Environment, Health and Safety Management System (EHSMS) which provides minimum requirements to enable consistent and effective management of environment, health and safety.

The EHSMS consists of 11 standards, five major risk procedures and seven environmental procedures all of which support the EHS Policy.

EHSMS standards:
- Leadership and policy
- Organisation and responsibility
- Communication
- Contractor management
- Risk and hazard management
- Incident investigation, reporting emergency and crisis preparedness
- Procedures and training
- Operational management
- Monitoring
- Change management
- Auditing and assurance

Major risk procedures:
- General vehicles
- Isolation
- Working at heights
- Surface mobile equipment (SME)
- Tailing storage facility (TSF)

Environmental procedures:
- Air quality
- Completion, closure and provisioning
- Flora and fauna
- Land and soil management
- Noise
- Resource efficiency
- Water

Regular auditing is conducted to identify the level of compliance to the EHSMS standards and procedures and the effectiveness at meeting business needs.

6.2 Environmental Management Plans

Iluka has developed a number of specific environmental management plans for the Iluka Eneabba operations that will be reviewed and updated to include the development of the Proposal. These Plans include:
- Dust Management Plan
- Fauna Management Plan
- Fire Management Plan
- Flora and Vegetation Management Plan
- Greenhouse Gas Management Plan
- *Phytophthora* Dieback Management Plan

- Surface Water Management Plan
- Weed Management Plan
- Groundwater Licence Operating Strategy (GLOS)
- Conceptual Closure Plan
- Rehabilitation Management Plan

7. STAKEHOLDER ENGAGEMENT

Mineral sand mining has been occurring in the Eneabba region since the 1970s and it is an established industry in the local community. Iluka has formed ongoing relationships with a range of local and regional stakeholders. Iluka has a key objective to undertake effective communication with stakeholders not only throughout the Proposal process but also throughout operations and rehabilitation.

7.1 Community Relations Policy

To be ‘valued by the community’, Iluka has taken a leading role in working with neighbours, employees, indigenous groups and other stakeholders to enable input to

environmental practices at Eneabba. Iluka seeks to add value to the communities living in adjacent areas to the mining operations.

Iluka has developed a Community Relations Policy (Iluka Resources Limited 2008), which identifies five priorities for community engagement:

- Engage with our stakeholders using open and meaningful communication.
- Be transparent by providing clear, timely and agreed information.
- Collaborate with our stakeholders to support community initiatives which reach beneficial outcomes.
- Ensure we recognise, understand and include all stakeholders.
- Conduct our engagement with integrity and in a manner that fosters mutual respect and trust.

Iluka aims to provide planning and operational information in a timely manner and respond effectively to community concerns.

7.2 Consultation process

7.2.1 Identification of stakeholders

Stakeholders in the immediate surrounds of the Proposal include residents, business owners in the town of Eneabba, people within the local shire, special interest groups (including research organisations), other mining proponents and Decision Making Authorities (Table 7.1).

Table 7.1 Key stakeholders

Group	Stakeholders
Federal government	Department of Sustainability, Environment, Water, Population and Communities (SEWPAC)
State government	Environmental Protection Authority (EPA)
	Department of Environment and Conservation (DEC)
	Department of Mines and Petroleum (DMP)
	Department of State Development (DSD)
	Department of Water (DoW)
	Department of Indigenous Affairs (DIA)
	Mineral Sands Agreement Rehabilitation Coordination Committee (MSARCC)
	Main Roads Western Australia (MRWA)
Utilities	Water Corporation
	Verve Energy
	QR National
Local Government	Shire of Carnamah City of Greater Geraldton
Aboriginal group	Amangu (Yamatji Land and Sea Council)
Non-governmental organisations (NGOs)	Conservation Council of WA
	Wildflower Society of WA
Community	Eneabba town residents and nearby landholders
	Eneabba Progress Association
	Irwin Land Care Group
Research organisations/partners	Kings Park and Botanical Gardens Authority
	University of Western Australia
	Greening WA
	Murdoch University (Centre for *Phytophthora* Science and

Group	Stakeholders
	Management)

7.2.2 Local and Stage Government

Iluka maintains communication with the Shires of Irwin, Carnamah, Three Springs and Coorow through annual meetings, or more often as required. This is undertaken to ensure that the local government authorities are continually aware of the operational planning at the site and for Iluka to plan its operations in a manner that maximises benefits to the community.

State Government agencies are regularly consulted individually with regard to legislative and compliance issues. Liaison is also conducted via the MSARCC which involves an annual meeting between Iluka and State Government representatives to discuss issues pertaining to environmental management and rehabilitation at the Eneabba Mineral Sands Mine.

7.2.3 Consultation objectives

Stakeholder consultation can be undertaken on two levels, termed ‘inform’ and ‘consult’, according to the classification system of DEC (DOE 2003).

Stakeholder consultation is based on the ‘inform’ and ‘consult’ level of involvement through the following mechanisms:

- Providing stakeholders with accurate and accessible information.
- Providing stakeholders adequate opportunities and timeframes to consider the project and to engage in meaningful dialogue.
- Exploring reaction and potential concerns regarding the project.
- Gauging and/or gaining public support for the project.
- Implementing and maintaining a process through which residents, other interested groups and the Shire can communicate effectively with the Company, and encourage the use of this process.
- Ensuring that all issues and disputes are dealt with in a timely manner and followed up effectively.
- Incorporating of stakeholder input into the design and management of the project and report back on these outcomes.

7.2.4 Consultation strategy

The stakeholder consultation program has involved the following:

- A newsletter containing information on the Proposal was distributed to the Eneabba community before the Referral was released for public comment by the EPA.
- A community information session where interested people could receive information, ask questions and give feedback about the Proposal.
- One-on-one consultation with several key stakeholders.
- Commencing consultation with the agencies to facilitate ongoing consultation throughout the assessment process.

7.2.5 Consultation with Agencies and Decision Making Authorities

Iluka has consulted with the DEC, OEPA, DMP, DSD, DoW and Water Corporation regarding the Proposal. Discussions points at these briefings have included, but not limited to, those summarised below:

- The Proposal and mine schedule.
- Additional approvals likely to be required under legislation.
- The key environmental impacts associated with mining the IPL North deposit including impact to DRF and Priority flora, fauna, noise and dust within proximity to the Eneabba townsite, protection of the town water supply and rehabilitation of the disturbed areas.

A summary of consultation is provided in Table 7.2. Overall the Decision Making Authorities considered that a Public Environmental Review (PER) level of assessment is appropriate for the Proposal. However it is recognised that this decision will be made by the Minister for the Environment based on the recommendations of the EPA.

Table 7.2 Agencies and Decision Making Authorities consultation summary

Date	Stakeholder	Discussion/key issues raised	Action
Tuesday 24 April	DMP	Meeting with DMP to present the Proposal. Discussions included need for Closure Plan to be submitted with the Mining Proposal in reference to Mining Lease (M70/879).	Iluka to prepare Mining Proposal for Mining Lease (M70/879).
Tuesday 1 May	OEPA	Meeting with OEPA to present Proposal. Discussion included the need for investigation into the relationship between the sand tails and native vegetation. Key environmental factors were identified including DRF and Priority flora, noise and dust in proximity to Eneabba townsite, protection of the town's water supply, fauna and rehabilitation of disturbed areas. Recommended Public Environmental Review (PER) level of assessment.	Investigations and surveys for identified key environmental factors.
Tuesday 1 May	DEC – Environmental Management Branch	Meeting with DEC to present the Proposal. Discussions included likely impact of the Proposal on fauna and flora of conservation significance and the management of *Phytophthora* Dieback. The DEC suggested the relocation of topsoil stockpiles to an area that was previously mined and under rehabilitation.	Topsoil stockpiles were relocated as suggested by the DEC. Investigations and surveys for the conservation significant species to be undertaken. Re-mapping of *Phytophthora* Dieback within the Proposal area to be undertaken.
Thursday 17th May	DEC – Industry Regulation	Meeting with the DEC – Industry Regulation to present the Proposal. Discussions included the need for investigations into the potential dust and noise emissions resulting from mining within close proximity to the Eneabba townsite. The DEC indicated that updates to the existing	Investigations for identified key environmental factors.

Date	Stakeholder	Discussion/key issues raised	Action
		DEC Licence conditions will be required to address the dust and noise emissions following the EPA environmental approvals process.	
Wednesday 2 May	DSD	Meeting with DSD to present the Proposal. Discussions included requirements under the *Mineral Sands (Eneabba) State Agreement Act 1975*. DSD indicated that Mining Lease M70/879 should be included in the mineral sands agreement tenement (AM70/267). DSD requested that Iluka present the Proposal and provide an update on the environmental approvals process at the next MSARCC meeting to be held in June 2012.	Iluka to prepare Proposal as required under the State Agreement Act. Iluka to present at the next MSARCC meeting.
Thursday 3 May	DoW	Meeting with the DoW to present the Proposal. Discussions included the likely impacts of the Proposal on the Water Reserve area and Well Head Protection Zones. DoW requested the shape files of the mine plan once the Referral is submitted to the EPA. DoW indicated that further consultation between Iluka and the department is required to address the likely impact, and protection of, the Water Reserve area.	Iluka to provide the DoW with mine plan shape files after submission of this Referral. Ongoing discussions with the DoW with regard to the protection of the town water supply. Hydrological studies to be undertaken to ensure there will be no impact on the town water supply during mining.
Thursday 3 May	Water Corporation	Meeting with Water Corporation to present the Proposal. Discussions included the likely impact of the Proposal on the existing production and observations bores and treatment plant facilities. Bore 2/75 has been decommissioned (capped & sealed) but infrastructure (including pipe work) is still in place and will require removal as it is in mine path. Bore 1/89 supplies 100% of the town supply. Water Corporation requested crib rooms, septic tanks, fuel storage, etc. to be located outside the Water Reserve and no mobile refuelling of equipment within the Water Reserve. Monitoring bore 1/75 is within the mine path and may need to be replaced under the Water Corporations groundwater licence.	Iluka to assess replacement infrastructure that will be disturbed by mining to ensure continuity in town water supply. No crib room facilities, septic tanks or hydrocarbon storage, will be located within the water reserve. There will be no refuelling of mobile equipment within the Water Reserve.

7.2.6 Consultation with Local Government and Eneabba community

Iluka has consulted with the Shire of Carnamah, Eneabba Progress Association and the Eneabba community regarding the Proposal. An information session was held at the Eneabba Recreation Centre on Monday, 14th May 2012 to discuss current and future mining at the Iluka Eneabba operations. In general, concerns raised included the increase of dust with regard to mining in the vicinity of the Eneabba townsite.

7.2.7 Ongoing consultation

Iluka is committed to maintaining open communication with the Eneabba community and other key stakeholders with regard to mining activities at Eneabba.

Stakeholders not consulted prior to the submission of this Proposal will be consulted during June and July 2012 (Table 7.1). Discussions with Verve Energy with regard to the gas pipeline and the requirements for mining in proximity will also be undertaken.

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Appendix A
Summary report of flora and vegetation studies

Appendix B
Carnaby's Black Cockatoo assessment