

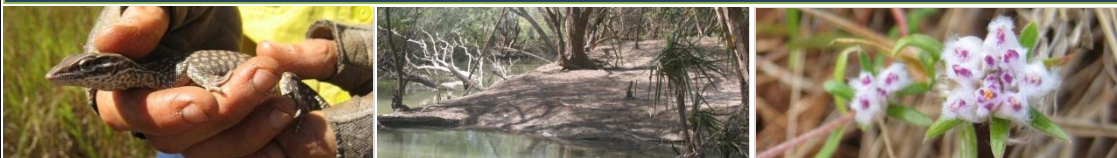


Appendix I - Weed Management Plan


Australian Ilmenite Resources Pty Ltd


SILL80 Project,

2012



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Executive Summary

Australian Ilmenite Resources Pty Ltd (AIR) SILL80 Project is a proposed open cut mine and processing facility to be constructed in the Roper River region of the Northern Territory. AIR intends to produce up to 300,000 tonnes of refined ilmenite at the mine per annum, with an expected mine life exceeding 20 years.

The Public Environmental Report (PER) is a formal assessment under the *NT Environmental Assessment Act 1982* at the request of the Northern Territory Minister for Natural Resources, Environment and Heritage (the Minister). The Weed Management Plan is one of many complimentary reports required to support the PER for the SILL80 Ilmenite Project.

In order to ensure successful revegetation of the mine site and surrounding pastoral lands the management of weeds is of high priority. Negative impacts that may occur as a result of the SILL80 project include:

- Large areas of exposed earth available for weed colonisation;
- Spread of existing weed infestations due to disturbance and vehicle traffic;
- Untidy and bare infrastructure areas; and
- Dead or weed infested revegetated areas.

The general objective of this Plan is to minimise the risk of mine operations facilitating the spread and establishment of weeds into MLA27422 and the greater Numul Numul Station area.

This Plan has been written with the view to achieving the following specific objectives:

- Ensure weeds are not introduced to MLA27422 on machinery and equipment brought onto the lease by AIR personnel or associated contracting companies. All vehicles will be required to undergo a thorough wash-down prior to entry to MLA27422.
- Avoid spread of weeds within MLA27422 through machinery and equipment hygiene - Vehicle access routes to MLA27422 will be developed to prevent risk of spreading weeds from nearby colonies. Weeds are to be actively managed as per controls detailed within this Weed Management Plan. Control will involve the spraying and/or manual removal of weed species including and additional to those listed in Appendix I1.
- Minimise areas of soil exposure to prevent the risk of colonisation from nearby weed infestations (via dispersal methods such as wind and animals) - This will be achieved by only clearing the area to be mined in the immediate future, and upon completion re-stabilise and rehabilitate as soon as practical (refer to Erosion Sediment Control Plan PER Appendix H).
- Ensure weeds are not introduced to the lease parcel via imported materials such as processing equipment, machinery and stores - All materials such as steel, plastics and plant equipment will be inspected for soil and seed presence. All equipment will be thoroughly cleaned prior to relocation to MLA27422.
- Monitor the success of the weed management strategies outlined within this Plan, and review strategies where necessary - The key to successful weed management is awareness, rapid detection, and response. Weed Identification Kits will be utilised to aid in identification of weeds and list preferred management options for all weeds that have the potential to occur within the lease (Appendix I2).
- Ensure ongoing rapid weed detection and respond to any emerging infestations.

Weed colonisation within MLA27422 will be controlled through prevention, monitoring and early eradication as follows:

- Minimising disturbance to areas with, or vulnerable to, weed infestation;

- Inspecting vehicles and machinery for soil and seeds upon entering the site and washing them in purpose built wash-bays as required;
- Inspecting disturbed and rehabilitated areas for weed presence (particularly after rainfall events) and consulting with NRETAS for treatment;
- Raising awareness of weed control within the workforce; and
- Progressive rehabilitation of disturbed areas to discourage weed establishment.

AIR has prepared an Erosion and Sediment Control Plan (see Appendix H of the PER) which includes measures that aim to minimise soil disturbance. For example:

- Stripping topsoil from mining areas and stockpiling at the nominated sites;
- Flattening and revegetating temporary earth structures and stockpiles immediately with sabi grass and stylo legumes (seca, verano); and
- Keeping all plant and equipment within the mining lease to prevent any damage to native vegetation outside MLA27422.

The mining lease and access tracks within which all plant, machinery, and vehicles must stay will be clearly flagged or fenced.

The commencement of weed monitoring will coincide with the commencement of clearing within the lease parcel. Weed monitoring will end once all disturbed areas within the lease parcel have been successfully stabilised, landscaped and rehabilitated to 80% total coverage. The aim of the monitoring is to confirm the success of all objectives specified within this Management Plan and as per agreements with land owners and current managers.

Manual and/or chemical control programs will be implemented wherever new weed species are identified within MLA27422 and the associated roads and pipeline corridor. Advice on the most effective control means for each weed species shall be sought from NRETAS. Detail concerning listed weed species can be found in Appendix I2 and Appendix I5.

Photographs of weed species known to be problematic in the area will be posted on noticeboards to assist employee identification of populations around their work areas.

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1 Introduction

1.1 Background

The SILL80 Project is a proposed open cut mine and processing facility to be constructed in the Roper River region of the Northern Territory. The main objective of the proposed facility is to extract and process ilmenite concentrate for sale to foreign markets.

Australian Ilmenite Resources Pty Ltd owns the SILL80 Project, which comprises MLA27422, totalling 1225 hectares. AIR intends to produce up to 300,000 tonnes of refined ilmenite at the mine, with an expected mine life exceeding 20 years.

1.2 Location

The SILL80 deposit is located 120 km east of Mataranka on the Roper Highway (Figure 1-1).

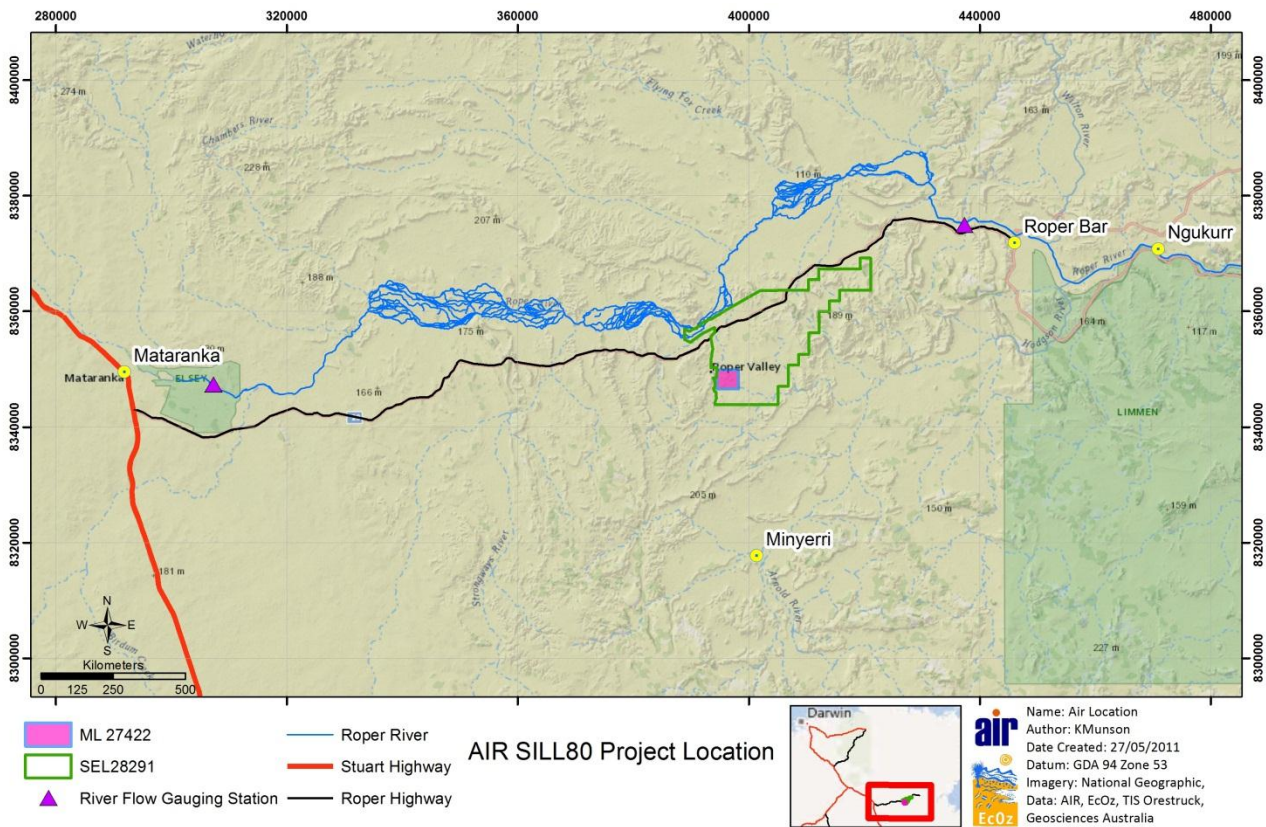


Figure 1-1 MLA27422 location with reference to surrounding communities

1.3 Potential Impacts

In order to ensure successful revegetation of the mine site and surrounding pastoral lands the management of weeds is of high priority.

Negative impacts that may occur on MLA27422 due to the operation of the mine include:

- Large areas of exposed earth available for weed colonisation;
- Spread of existing weed infestations due to disturbance and vehicle traffic;
- Untidy and bare infrastructure areas; and
- Dead or weed infested revegetated areas.

To minimise potential weed infestation or spread resulting from AIR's operations within MLA27422, the organisation will manage classified weeds in accordance with the *Weeds Management Act 2001* (NT).

1.4 Objectives

The general objective of this Plan is to minimise the risk of mine operations facilitating the spread and establishment of weeds into MLA27422 and the greater Numul Numul Station area.

This Plan has been written with the view to achieving the following specific objectives:

- Ensure weeds are not introduced to MLA27422 area on clearing and construction vehicles, machinery, and equipment brought into the lease;
- Avoid spread of weeds within MLA27422 and the greater Numul Numul Station area – particularly via clearing and construction vehicles, machinery, equipment, and personnel;
- Minimise areas of soil exposure and disturbance and thus the risk of colonisation from nearby weed infestations (via dispersal methods such as wind and animals);
- Ensure potential weeds are not introduced to the lease parcel via imported materials such as processing equipment, machinery and stores;
- Monitor the success of the weed management strategies outlined within this Plan, and review strategies where necessary; and
- Ensure ongoing rapid weed detection and response to any emerging infestations post construction.

Effectiveness of this plan will be monitored throughout the life of the project and for a period of time post mining through quarterly reporting and tri-annual auditing. Review of weed management procedures will be conducted annually through the Mining Management Plan review process.

1.5 Legislation

The relevant legislation to this Plan is the *NT Weeds Management Act 2001*, which states that the owner and occupier of land must:

- a) Take all reasonable measures to prevent the land being infested with a declared weed;
- b) Take all reasonable measures to prevent a declared weed or potential weed on the land spreading to other land; and
- c) Within 14 days after first becoming aware of a declared weed that has not previously been, or known to have been, present on the land, notify an officer of the presence of the declared weed.

2 Management Strategies

2.1 Ensure weeds are not introduced to the MLA27422 or greater area

There is potential for introduction of weeds through clearing and construction activities within MLA27422. Contracting companies engaged by AIR must be made well aware that all vehicles, materials, personnel and equipment entering the lease must be clean of weed seeds, soil, and debris. All vehicles will be required to undergo a thorough wash-down prior to entry to MLA27422.

2.2 Avoid spread of weeds within the MLA27422

Vehicle access routes to MLA27422 will be developed to prevent continued disturbance to vegetation outside of the lease, and to minimise the risk of spreading weeds from nearby colonies. Weeds are to be actively managed across the whole site prior to commencement of mining and also on an on-going basis as per controls detailed within this Weed Management Plan. Control will involve the spraying and/or manual removal of weed species including and additional to those listed in Appendix I1. Guidance and resources on methods of weed control can be obtained from the Weed Management Branch within the Department of Natural Resources, Environment, the Arts and Sport (NRETAS), and particularly their website: www.nt.gov.au/weeds. This includes the NT Weed Management Handbook and many other tools for weed identification and control. Spread of weeds will be minimised through the routine wash-down of all vehicles entering the site.

During clearing, all woody material will be mulched for use in mulch berms and rehabilitation practices as detailed in the Rehabilitation Management Plan (Appendix K), all non-woody material will be incinerated to prevent weed development and spread.

2.3 Minimise exposure of disturbed areas

As weeds readily colonise disturbed soils, disturbed areas must be minimised to prevent infestation. This can be achieved by only clearing the area to be mined in the immediate future, and upon completion of operations in each mining pit, aiming to re-stabilise and rehabilitate as soon as practical. Implementation of the Erosion and Sediment Control Plan (Appendix H of the PER) will assist in ensuring measures are in place to minimise disturbance of soil as well as detailing engineering controls to prevent off-site impacts from the mobilisation of sediment.

2.4 Ensure imported materials are weed free

All materials such as steel, plastics and plant equipment, especially those sourced from interstate and abroad will be inspected for soil and seed presence. All equipment will be thoroughly cleaned prior to relocation to MLA27422.

2.5 Ongoing Monitoring and Response

The key to successful weed management is awareness, rapid detection, and response. Land managers and on-site personnel must be able to identify weeds and respond to weed emergences in a timely manner. To assist in this, Weed Identikits should be produced for, and used by, on-site contractors and managers, and

formal training provided on the use of these kits. The Weed Identikits provide a brief description to aid in identification of weeds and list preferred management options for all weeds that have the potential to occur within the lease. With this tool, on-site staff can identify emerging weeds and eradicate them before infestations become established. Weed Identikits can easily be compiled using the Weed Management Branch website (a Weed Identification Kit is provided in Appendix I2).

It may be several years before weed seed accidentally transported to the lease parcel emerges as a visible weed infestation, thus the Weed Identikit and training for on-site staff is important to ensure that the lease parcel remains weed free into the future.

2.6 Responsibility

Table 2-1 lists the roles and responsibilities of the personnel responsible for the Weed Management Plan.

Table 2-1 – Weed Management Roles and Responsibilities

POSITION	RESPONSIBILITY
<p>General Manager - Production</p>	<ul style="list-style-type: none"> • Ensure that all declared noxious weeds are identified and eradicated as required by regulations • Ensure that this weed management plan is implemented • Provide access to training for Site Manager • Maintain wash-down log
<p>Field Manager</p>	<ul style="list-style-type: none"> • Ensure that all personnel are aware of and adhere to these procedures • Inspect vehicles for seed and soil when entering site • Implement wash-down procedures • Undertake continued training in weed identification • Maintain and act upon Weed Control Register • Perform regular surveys to identify noxious weeds and undertake any control programs as necessary
<p>Employees and Contractors</p>	<ul style="list-style-type: none"> • Report any occurrence of noxious weeds • Wash all vehicles and equipment before entering or leaving site

3 Weed Management

Weed colonisation within MLA27422 will be controlled through prevention, monitoring and early eradication as follows:

- Minimising disturbance to areas with, or vulnerable to, weed infestation;
- Inspecting vehicles and machinery for soil and seeds upon entering the site and washing them in purpose built wash-bays as required;
- Inspecting disturbed and rehabilitated areas for weed presence (particularly after rainfall events) and consulting with NRETAS for treatment;
- Raising awareness of weed control within the workforce; and
- Progressive rehabilitation of disturbed areas to discourage weed establishment.

3.1 Minimising Disturbance

Weeds readily colonise disturbed soils, thus the area cleared will be limited to the minimum required area to construct the excavation pit for immediate operations. As soon as practicable upon extraction of resource from the pit, the disturbed area must be stabilised, landscaped and revegetated.

AIR has prepared an Erosion and Sediment Control Plan (see Appendix H of the PER) which includes measures that aim to minimise soil disturbance. For example:

- Stripping topsoil from mining areas and stockpiling at the nominated sites;
- Flattening and revegetating temporary earth structures and stockpiles immediately with Sabi grass and stylo legumes (Seca, Verano); and
- Keeping all plant and equipment within the mining lease to prevent any damage to native vegetation outside MLA27422.

The mining lease and access tracks within which all plant, machinery, and vehicles must stay will be clearly flagged or fenced.

3.2 Vehicle Inspection and Wash-down

The most effective way of preventing the introduction and spread of weeds into an area is to ensure that all mobile equipment (particularly earthmoving equipment), regardless of size and design, is free of all plant and soil matter prior to arrival on site. All mobile equipment shall be washed down and cleaned of mud, earth and seeds prior to entry to site. It is the responsibility of the Field Manager to inform all earthworks contractors of the requirement to thoroughly wash their equipment prior to it entering site.

The Site Manager is responsible for ensuring all earth moving equipment is inspected prior to entering the site and thoroughly cleaned prior to the commencement of works.

A wash down area, with drainage water directed to a dedicated sump, will be located near the processing plant. All vehicles requiring entry to the site will be required to wash down before proceeding into the site. Sumps will be managed to ensure that they do not overflow during high rainfall events and discharge seed

stock and hydrocarbon contaminated material into the surrounding environment. Purpose built wash-down bay facilities will feature a silt trap/sump that can easily be cleaned out.

The transport fleet are dedicated vehicles that will not be used on other sites. They will remain on established roads and highways and are considered to pose minimal risk to the introduction of weeds. These vehicles will still require wash down at each return trip to the mine site, however this can be achieved through either routine inspection and disinfection on an as needs basis, or drive through automatic wash-down bays which apply high pressure water sprays to the underside of the vehicle, wheels and wheel arches.

3.3 Monitoring and Control

The commencement of weed monitoring will coincide with the commencement of clearing within the lease parcel. Weed monitoring will end once all disturbed areas within the lease parcel have been successfully stabilised, landscaped and rehabilitated to 80% pasture coverage. The aim of the monitoring is to confirm the success of all objectives specified within this Management Plan and as per agreements with land owners and current managers.

The Site Manager must be trained and capable of conducting regular inspections of the site for emerging weeds or introduced materials that may contain weeds or weed seed. A wash down log will be maintained of vehicles entering the lease (Appendix I3).

3.3.1 Invasive Species Register

The project area will be regularly inspected for invasive species. Locations of any populations shall be recorded in a designated Weed Control Register (Appendix I4). The following information will be recorded:

- Location (with MGA coordinates);
- Species type if known, or detailed description;
- The extent of the area affected;
- Description of processes likely to be causing weed infestation; and
- General topography of the affected area (i.e. drainage, disturbed areas etc.).

3.3.2 Manual and Chemical Control

Manual and/or chemical control programs will be implemented wherever new weed species are identified within MLA27422 and the associated roads and pipeline corridor. Advice on the most effective control means for each weed species shall be sought from NRETAS. Detail concerning listed weed species can be found in Appendix I2 and Appendix I5.

Identified infestations will be:

- Clearly marked to prevent entry by persons and equipment;
- Sprayed by a licensed contractor (control methods detailed in Appendix I5);
- The area will be photographed to monitor the success of the eradication program on a quarterly basis; and
- Follow-up eradication programs implemented as required.

The most likely location of introduced weed species will be within wash down bay and sediment sump and high use areas such as the processing shed. Routine spraying of these areas will be performed to prevent weed development within these areas.

3.4 Workplace Awareness

Photographs of weed species known to be problematic in the area will be posted on noticeboards such that all employees will be able to identify any populations around their work areas and report them. Weed identification aids have been developed specific to MLA27422 (Appendix I2) and made available to all staff members. The site induction will include information and photographs of a range of common weeds. This ensures all personnel on site are aware of weed species and their management.

3.5 Progressive Rehabilitation

AIR will implement an ongoing rehabilitation program to minimise colonisation opportunities for invasive species. The rehabilitation program will focus on instating pasture species; Sabi grass and stylo legumes (Seca, Verano) in disturbed areas post mining works. Pasture was identified as the desired revegetation method by traditional owners and land (refer to Rehabilitation Management Plan PER Appendix K).

4 Glossary / Acronyms

Glossary

Eradicate	To totally remove something
Infestation	Large numbers of a pest or parasite within an area
Weed	An unwanted plant that has become a nuisance or prevalent or is outcompeting plants that are more desirable

Acronyms

AIR	Australian Ilmenite Resources
NRETAS	Department of Natural Resources, Environment, The Arts and Sport
NT	Northern Territory

Appendix I1 - Classified Weed Species within MLA27422

Introduced Species		NT Status	National Status
Scientific Name	Common Name		
<i>Acanthospermum hispidum</i>	Starburr	B C	-
<i>Barleria prionitis</i>	Barleria	A C	ALERT
<i>Calotropis procera</i>	Rubber Bush	B C	-
<i>Cenchrus echinatus</i>	Mossman River Grass	B C	-
<i>Cryptostegia madagascariensis</i>	Madagascan Rubber Vine	A C	-
<i>Hyptis suaveolens</i>	Hyptis	B C	-
<i>Jatropha gossypifolia</i>	Bellyache Bush	B C	-
<i>Martynia annua</i>	Small Devil`s Claw	A C	-
<i>Parkinsonia aculeata</i>	Parkinsonia	B C	WONS
<i>Prosopis pallida</i>	Mesquite	A C	WONS
<i>Senna obtusifolia</i>	Sicklepod	B C	-
<i>Senna occidentalis</i>	Coffee Senna	B C	-
<i>Sida acuta</i>	Spiny-head Sida	B C	-
<i>Sida cordifolia</i>	Flannel Weed	B C	-
<i>Sida rhombifolia</i>	Paddy`s Lucerne	B C	-
<i>Themeda quadrivalvis</i>	Grader Grass	B C	-
<i>Tribulus terrestris</i>	Caltrop	B C	-

NATIONAL STATUS

WONS - Weeds of National Significance

ALERT - Alert List for Environmental Weeds

NT STATUS

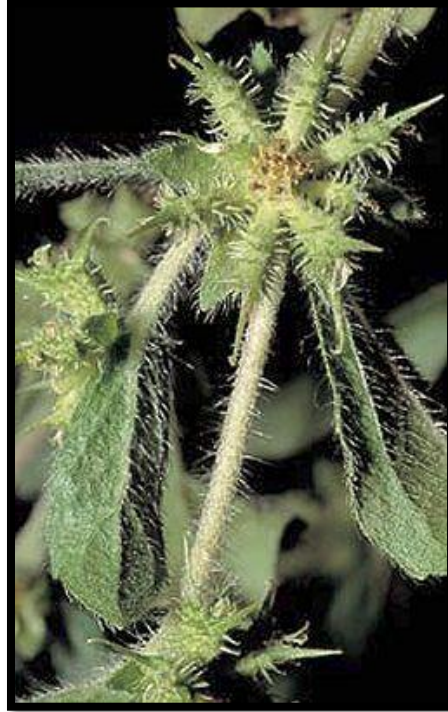
A – NT Class A Weed (to be eradicated)

B – NT Class B Weed (growth & spread to be controlled)

C – NT Class C Weed (not to be introduced)

Appendix I2 – Weed Identification Kit

Information below is summarised from NRETAS website <<http://www.nt.gov.au>>.



Native from Guatemala to northern Argentina and to Caribbean islands. Small flowers (florets) white to pale yellow in solitary heads in leaf axils and forks of stem, outer bracts around heads 3–5 mm long. Flowers summer and autumn.

Annual herb to 90 cm high. Distinguished by erect habit; Stems with multicelled stiff hairs. Leaves opposite, ovate to elliptic, hairy, leaf margins toothed or lobed to almost entire leaves mostly 2–12 cm long, 1–3 cm wide; leaf stalk absent. Fruiting heads a group of 5–10 'seeds' in a star-like burr, each 'seed' wedge-shaped, 4–7 mm long, hairless. 'Seeds' that have hooked spines and 2 longer divergent spines 3–4 mm long at the apex.

Hooked burrs are readily dispersed by animals and may also float long distances. Burrs are also a forage contaminant.

Barleria (*Barleria prionitis*)



Barleria is a declared Class A (to be eradicated) and Class C (not to be introduced to the Northern Territory) weed in accordance with the NT Weeds Management Act.

Barleria has the potential to form dense prickly thickets due to its persistence and extremely invasive nature in open woodlands. Barleria has a demonstrated ability to survive the dry season and thrive during the wet.

Barleria is unpalatable to stock, and can reduce the productivity of pastoral land. Infestations can restrict the movement of stock and access to water. Barleria readily competes with and displaces native vegetation.

Barleria reproduces by seed, with most seeds germinating close to the parent plant. The buoyancy of the seed also aids dispersal down watercourses.

Rubber Bush (*Calotropis procera*)



Rubber bush is declared a Class B (spread to be controlled – south of 16°30'S latitude) and Class C (not to be introduced to the Northern Territory) weed in accordance with the NT Weeds Management Act.

Rubber bush is native to tropical Africa and Asia. It was probably introduced to Australia as a garden plant, or in the packaging of camel saddles brought from India in the early 1900s. Rubber bush first became established in the Katherine area and then spread along the Roper River in the early 1950s. Rubber bush has now spread into Western Australia and through the Barkly Tablelands, and south to Tennant Creek.

Rubber bush poses a significant risk to valuable grazing land in the NT. It has the potential to colonise large parts of the Barkly Tablelands and Victoria River District, where it competes with native species.

Mossman River Grass (*Cenchrus echinatus*)



Cenchrus echinatus is a native of North and South America. Seed heads consists of a cylindrical spike of up to 50 burrs. Flowers most of the year in tropical areas. Clump-forming annual grass to 80 cm high. Leaves with or without hairs, to 12 mm wide. Distinguished by burrs 4–10 mm long with backwardly directed barbs and with a ring of smaller bristles around the base of the burr. Burrs are spread attached to animals, clothing and bags. Burrs also float and are moved by water. Germinates in spring and summer in temperate zones. Often grows on sandy soils especially along the coast; provides good grazing when young, but is a major weed if allowed to mature. Burrs reduce the value of wool and make shearing hazardous. Spines of burrs also penetrate hides lowering their value. This grass is a weed of many tropical and subtropical crops where the plant competes for moisture, nutrients and light. Burrs are also a problem in recreation areas.

Madagascan Rubber Vine (*Cryptostegia madagascariensis*)



Rubber vine is a poisonous, woody climbing plant that can reach up to 15 metres high. It invades rivers and creeks, strangles vegetation, is poisonous to livestock and can prevent animals accessing water. Its rampant growth inhibits and smothers native vegetation and ecosystems.

Its ability to spread and colonise quickly has led to it becoming a threat to many areas of Northern Australia and *Cryptostegia grandiflora* being listed as a Weed of National Significance and it is regarded as one of Australia's worst weeds.

The plant contains several toxic compounds and may be poisonous to humans and stock. Dense thickets of rubber bush can form on disturbed and degraded soils, inhibiting access to watering points, bores and dams.

Rubber vine occupies about 3.5 million ha in Queensland (an area about the size of Victoria) and is spreading to the Northern Territory at a rate of 1-3% per year. There have been isolated infestations in Western Australia. It has a potential distribution which could cover all of Northern Queensland, the Top End of the Northern Territory and Pilbara Region of Western Australia.

A rubber vine containment line was established between the Queensland and Northern Territory boarder in 1999 and all infestations outside this line are targets for eradication while inside the line integrated control to minimise impact is being carried out.

Rubber vine spreads quickly and is hard to control once established. Effective control of rubber vine can be achieved by adopting an integrated control program.

Hyptis or Horehound (*Hyptis suaveolens*)



Hyptis is native to South America; it was first recorded in the Northern Territory (NT) by the explorer Leichhardt in about 1845, indicating it may have been introduced prior to colonisation.

Hyptis is now widespread in the Darwin, Katherine, Gulf and Victoria River Districts. It favours disturbed areas such as roadsides and overgrazed areas. Hyptis will grow on most soil types, except those which become waterlogged. Hyptis can form dense thickets and compete with improved and native pastures, especially when these pastures are overgrazed. Hyptis is unpalatable to most types of livestock.

The small seeds are enclosed in the spined burr/capsule which can be easily caught and transported by livestock, native animals and human clothing. The capsules can float on water, facilitating waterborne spread. Hyptis can also spread as a contaminant in hay or pasture seed.

The aromatic oils in Hyptis make it unpalatable to stock. Care should be taken to stop cattle overgrazing areas with remnant palatable species, as this will provide an opportunity for further Hyptis establishment.

Bellyache Bush (*Jatropha gossypifolia*)



Bellyache bush can form dense, impenetrable thickets which can hinder mustering, obscure fence lines and restrict the growth of other native plants.

Regeneration occurs from seed and cuttings. The pods explode when ripe, spreading seed up to 13 metres from the parent plant. Ripe fruits are buoyant, allowing bellyache bush to disperse along water corridors and catchments. Meat ants are known to transport seed and assist germination by removing a tiny outgrowth on seed coats known as a caruncle. Pods and seeds may also be spread by vehicles, machinery, clothing, livestock and feral animals.

There are two distinct strains of bellyache bush present in the Northern Territory: the 'Darwin Purple' with predominantly purple/red foliage and the 'Katherine Green' with green foliage.

The seed sucking jewel bug *Agonosoma trilineatum* was identified as a promising biocontrol agent for bellyache bush. This beetle restricts the spread of bellyache bush by dissolving and then consuming the contents of the seed, making it unviable. Unfortunately, in Australian trials, there have been difficulties in sustaining jewel bug populations over prolonged time periods. Further investigation is required to determine the cause.

Devil's Claw (*Martynia annua*)



Devil's claw is native to Central and South America. It was first identified in the Northern Territory in the Pine Creek area during the early gold mining days. It was recognised as being present in Katherine after World War II, and subsequent spread has resulted in infestations occurring in the Katherine, Pine Creek and Victoria River Districts. Devil's claw prefers disturbed ground, and is often found in high-use areas such as around stockyards, buildings and along roadsides.

The large, bell-shaped flowers are white to pink in colour and about 5 cm long. The throat of the flower is red with yellow spots. When seed capsules form they are initially covered with a fleshy green skin and a curved beak which splits when mature exposing the "claws". The mature capsule is very hard, grey to black in colour and 3 to 4 cm long.

The spined seed capsules can injure and cause discomfort to livestock and native animals. The capsules can be spread by animals and by attaching to vehicles, clothing and machinery. Most seed will germinate within the first two years after forming, however some will remain preserved in the capsules for five years or more. In order to eradicate this species a control program spanning five to ten years is required.

Parkinsonia (*Parkinsonia aculeata*)



Parkinsonia is native to southern USA, the Caribbean, and Mexico. It is suggested that Parkinsonia was first introduced into Australia in the late nineteenth century as a shade tree for planting around water bores, dams and homesteads. It is now found in established thickets throughout semi-arid Australia with infestations in Western Australia, the NT, Queensland and northern New South Wales. Parkinsonia is now well established on the Barkly Tableland, Victoria River and Gulf regions and occurs in various densities across most of the NT.

Parkinsonia can form dense, impenetrable thickets, sometimes several kilometres across, making areas of land inaccessible to humans and animals. The thickets can impede mustering activity, restrict stock access to water, displace native plants and animals, alter stream flows and harbour feral animals, particularly pigs.

Mesquite (*Prosopis species*)



Mesquite was introduced to Australia more than 100 years ago, where it was widely planted as a shade tree throughout western Queensland and north-western Western Australia. It was also used as a soil stabiliser around mine sites in Queensland and New South Wales. Mesquite is now present in all mainland states.

Mesquite is a thorny tree which can grow to a height of 15 m. Mesquite trees can form dense, impenetrable thickets. Mesquite reduces environmental values such as biodiversity and ecological function through the invasion and replacement of native plant communities and habitat for wildlife.

The direct effects of mesquite on landholders include reduced pasture and loss of production. Thorns can also damage vehicles and machinery and injure stock. Severe infestations increase costs associated with mustering and land management.

In the Northern Territory mesquite occurs as scattered, isolated, low level infestations across multiple regions including Arnhem Land, the Victoria River District (VRD), the Barkly Tableland and the Alice Springs region.

On the Barkly Tableland low level infestations occur on at least 12 pastoral leases. These infestations are current management priorities as further spread and establishment into clean areas is a significant risk.

Sicklepod (*Senna obtusifolia*)



Sicklepod is an annual or perennial woody shrub that grows to about 2m in height. Its alternate leaves are divided into two or three opposite pairs of round-ended leaflets. These leaflets are 2 to 3cm long and 1.5 to 2cm wide. Flowers are small, yellow and have five petals. They are produced in pairs in the upper leaf joints. The seed pods are long, slender, round in cross section. They are approximately 12cm long and 4mm across, and there are slight indentations between the seeds.

Sicklepod is thought to be native to Tropical America, and has spread through Africa, Asia and Northern Australia.

In the Northern Territory it is widespread in the Darwin, Victoria River and Gulf regions. Sicklepod prefers well drained, fertile soils, but can invade pastures and other disturbed areas such as fence lines, roadsides, waste areas and drainage channels.

Sicklepod has the capacity to grow into dense, vigorous mono-specific stands and can smother most pasture species. Infestations can produce up to 10,000 seeds per square metre. Sicklepod has the ability to become a serious pest in both horticultural and grain crops. Sicklepod is unpalatable to livestock, but can be spread through animals consuming the seed and passing through their droppings.

Sicklepod is a difficult plant to control, especially when it becomes a large, dense infestation. Repeated slashing or cultivation, in conjunction with chemical application can control Sicklepod. Slashing alone will not be effective, as under most conditions, it will not kill the plant, rather it may encourage it to regenerate.

Coffee Senna (*Senna occidentalis*)



Coffee Senna can adversely impact native pastures, by successfully competing for moisture, light and nutrients and consequently lowering grazing capacities. Although there have been no documented cases, coffee Senna is thought to be toxic to cattle. Grain contaminated with the toxic seed should not be fed to livestock, including poultry.

Spinyhead Sida (*Sida acuta*)



Spinyhead Sida is an invasive unpalatable shrub that competes with and excludes native plants as well as pasture and crop species. Spinyhead Sida can infest areas where degraded, disturbed and improved soils occur. Prolific seeding has contributed to spinyhead Sida becoming a common weed of road verges, camp grounds, and other areas where soils have been disturbed and or degraded. Spinyhead Sida will also invade native and improved pastures as well as crops and domestic gardens.

The seeds adhere to fur, clothing and other fibrous materials making it easy to spread. Seeds also spread as impurities in agricultural produce such as hay and pasture seed, as well as on hooves, footwear and vehicles. Spinyhead Sida seeds are able to germinate even after being eaten by stock and passing through their digestive systems. Sida seeds can persist for elongated periods of time; seedlings may appear years after the successful removal of mature plants.

A native of Central America, spinyhead Sida has spread throughout the tropics and sub-tropics in the Pacific, Asia and Australia. In Australia, spinyhead Sida is widespread in the higher rainfall areas from Brisbane in Queensland to the Ord River region of Western Australia. In the Northern Territory (NT) it is common in the Darwin, Katherine, Gulf and Victoria River regions.

Spinyhead Sida is found on most soil types except some of those derived from limestone and seasonally flooded clays. In agricultural areas, infestations can become established in high traffic areas such as lane ways, around troughs and cattle yards.

Flannel Weed (*Sida cordifolia*)



Sida cordifolia is a perennial subshrub of the mallow family Malvaceae, native to India. It has naturalised throughout the world, and is considered an invasive weed in Africa, Australia, the southern United States, Hawaiian Islands, New Guinea, and French Polynesia. *S. cordifolia* is an erect perennial that reaches 50 to 200 cm (20 to 79 in) tall, with the entire plant covered with soft white felt-like hair that is responsible for one of its common names, "flannel weed". The stems are yellow-green, hairy, long, and slender.

The yellow-green leaves are oblong-ovate, covered with hairs and 3.5 to 7.5 cm (1.4 to 3.0 in) long by 2.5 to 6 cm (0.98 to 2.4 in) wide. The flowers are dark yellow, sometimes with a darker orange center, with a hairy 5-lobed calyx and 5-lobed corolla. As a weed, it invades cultivated and overgrazed fields, competing with more desired species and contaminating hay.

Paddy`s Lucerne (*Sida rhombifolia*)



An erect branched, slightly woody perennial herb to about 1m high, with small (2-5 cm), sparse, alternately arranged toothed leaves. Flowers are about 2 cm diameter, yellow and hibiscus-like in shape. Fruit is a ribbed capsule, which breaks up into 8-10 segments.

Usually confined to waste ground, such as roadsides and rocky areas, stock camps or rabbit warrens, but can be competitive in pasture, due to its unpalatability to livestock. The common name suggests that it has good feed value, but this is not the case.

May reduce stock carrying capacity of pasture, and could be an environmental weed of remnant grassy native vegetation in farming areas. Finely barbed seed is spread on animals or clothing, in hay, in water or in mud on machinery or vehicles. Control by chipping plants out. Spot spraying with selective or non-selective herbicides for young plants. Mature plants are quite resistant to herbicides. Slashing just before flowering will prevent seed production temporarily and produce new growth for spraying.

Grader grass (*Themeda quadrivalvis*)



Grader grass is native to India, and was first introduced to the NT in 1967-68 as a contaminant in pasture seed. Further introductions of this weed were probably made in the same way. Grader grass is now well established on several properties in the Katherine and Darwin regions and continues to spread.

Grader grass is an annual, tufted grass which can grow to a height of 2 metres. Tufts may range in stem numbers from a few stems to up to 10 or more, each with long branched seed heads. Seed heads are made up of globular or fan shaped clusters, interspersed by leaf-life bracts.

Mature grader grass stands can be golden orange or red in colour and is quite similar to the native, perennial kangaroo grass (*Themeda triandra*).

Grader grass is capable of invading both native and improved pastures, competing with pasture species in over-utilised or disturbed areas. Stock may graze young plants but find mature grader grass unpalatable. If grader grass becomes dominant in a pasture there is a loss of productivity, and increased fire risk.

Grader grass introduction and spread can be attributed mostly to contaminated pasture seed, and movement by wind and water.

Caltrop (*Tribulus terrestris*)



Caltrop tends to invade roadsides, recreational and agricultural areas along with other high use or disturbed areas. The seeds are well equipped for dispersal by attaching to animals, tyres and footwear. They are able to puncture bicycle tyres and cause discomfort to people and animals. Caltrop may also cause photosensitization and nitrate poisoning in livestock.

Appendix I3 – Wash-down Confirmation Form

WASH-DOWN CONFIRMATION FORM for vehicles and equipment

Date Required for Inspection	
Approximate Time of Required Inspection	
Park Entrance preferred for Inspection	
Contract Number	
Company Name	
Location of previous Vehicle / Equipment Operation	
Vehicle / Equipment ID number	
Roads proposed for travel to Inspection Station	
Proposed method of Wash-down	
Operator's Contact Number	
Operator's Signature	

Please note that this sheet must be faxed to AIR on the following fax number **one whole working day prior** to the required inspection time. Should faxes be received late, an inspector will not be available, and should you carry on, your vehicle and equipment will be turned away from the site.

Fax Number: (08) 89 41 34 98

Inspector's Signature	
<u>Office Use Only</u>	
Date Received	
Field Manager Signature	

Appendix I4 – Weed Control Register

Weed Control Register

Name of Person Lodging Report		
Date		
Description of Location		
Co-ordinates	Zone	
	Easting	
	Northing	
Species Type (if known) or Weed Description		
Area Affected (m²)		
Topography		
Control Method		
Follow-Up Required	YES	NO
	WHEN:	
Photo Taken	YES	NO
	FILE NUMBER:	
Signature		
<u>Office Use Only</u>		
Date Received		
Field Manager Signature		

Appendix I5 - Listed Weed Control Methods

Weed	Form	Management Goal	Optimum Treatment Times	Non-chemical applications	Chemical and Concentration	Rate	Situation, method and comments					
<i>Acanthospermum hispidum</i> Starburr	Herb	Class B/C Growth and spread to be controlled	Jan – Apr	Hand pulling and Slashing	2, 4-D (Amicide)	1%	Foliar Spray					
					1 : 1 mixture of 2, 4-D and Starane	1%						
					Banvel 200 (Dicamba)	1 : 100						
<i>Barleria prionitis</i> Barleria	Shrub	Class A/C To be eradicated	Nov – May	Hand pulling and burning	2,4-D amine 625g / L	320ml / 100L	Foliar Spray					
					Fluroxypyr 200g / L	500ml / 100L or 3L / Ha						
<i>Calotropis procera</i> Rubber Bush	Shrub	Class B/C Growth and spread to be controlled	May – Sept	Grubbing, then dry and burn material	Garlon DS	1 : 100	Foliar Spray					
					Arsenal	1 : 400						
					Brush-off	15g / 100L						
					Tordon 50D	1 : 75						
										Garlon 600	1 : 30	Basal Bark
										Arsenal	1 : 30	
										Tordon 75D mixed with diesel	1 : 50	
										Garlon mixed with diesel	1 : 30	Cut Stump
<i>Cenchrus echinatus</i> Mossman River Grass	Grass	Class B/C Growth and spread to be controlled	Nov - April	Cultivation, pulling by hand or burning before plants reach seed set	Glyphosate 360 g / L	10 ml / 1L	Foliar spray					

Weed	Form	Management Goal	Optimum Treatment Times	Non-chemical applications	Chemical and Concentration	Rate	Situation, method and comments
<i>Cryptosegia spp.</i> Rubber Vine	Vine	Class A/C To be eradicated	Dec – June ideal, although can be removed year round	Fire can destroy seeds, seedlings and adult plants provided there is sufficient fuel load. Blade or disc ploughing can be effective and will open up dense areas for access. Slashing reduces vigour but does not kill plant.	Triclopyr 300g / L and Picloram 100g / L	350-500ml / 100L or 3-5L / ha	Foliar Spray
					Triclopyr 240g / L and Picloram 120g / L or Triclopyr 600g / L	1L / 60L diesel	Basal Bark < 5cm stem diameter
					Triclopyr 240g / L and Picloram 120g / L or Triclopyr 600g / L	1L / 60L diesel	Cut Stump > 5cm stem diameter
<i>Hyptis suaveolens</i> Hyptis	Herb	Class B/C Growth and spread to be controlled	Dec - March ideal, April and Nov reasonable	Manually remove all plant material; slash to encourage competition from desirable species	2, 4-D amine 625 g / L	320 ml / 100L	Seedling or adult: Foliar spray
					Glyphosate 360 g / L	15 ml / 1L	Seedling or adult: Foliar spray
<i>Jatropha gossypifolia</i> Bellyache Bush	Shrub	Class B/C Growth and spread to be controlled	May until September (Dry Season) pulling October until April	Burning and grubbing is effective if new growth is followed up with chemical control	Glyphosate with diesel	1 : 1	Basal Bark / Cut Stump
					Banvel 200 with wetting agent	1 : 100	

Weed	Form	Management Goal	Optimum Treatment Times	Non-chemical applications	Chemical and Concentration	Rate	Situation, method and comments
			(Wet Season) Foliar spray		Brush Off with wetting agent	100g / 100L	
<i>Martynia annua</i> Devils Claw	Herb	Class A/C To be eradicated	January – April	Hand pulling, grubbing and slashing	Grazon DS	1 : 300	Foliar Spray
					Starane	1 : 200	
					2,4-D Amine	1 : 200	
					Dicamba 200 with wetting agent	1 : 100	
					Garlon 600 mixed with diesel	1 : 50	Basal Bark / Cut Stump
<i>Senna obtusifolia</i> Sickle Pod	Shrub	Class B/C Growth and spread to be controlled	January – April	Hand pulling or slashing	Starane	1 : 100	Foliar Spray
					Tordon 75-D	300ml / 100L	
					Garlon DS and wetting agent	200ml / 100L	
<i>Senna occidentalis</i> Coffee Senna	Shrub	Class B/C Growth and spread to be controlled	January – April	Hand pulling or slashing	Starane	1 : 100	Foliar Spray
					Tordon 75-D	300ml / 100L	
					Garlon DS and wetting agent	200ml / 100L	

Weed	Form	Management Goal	Optimum Treatment Times	Non-chemical applications	Chemical and Concentration	Rate	Situation, method and comments
<i>Parkinsonia aculeate</i> Parkinsonia	Shrub	Class B/C Growth and spread to be controlled	March to May preferable, control effective year round	Blade ploughing, stick raking, bulldozing and chaining can be effective if roots removed. Revegetation after mechanical control will prevent re-sprouting and seedling establishment. Fire destroys seed in soil surface and can be used as follow up to remove seedlings after other control efforts. Fire may be used to manage mature trees.	Triclopyr 300g / L and Picloram 100g / L	350ml / 100L or 3L / ha	Foliar Spray
					Triclopyr 240g / L and Picloram 120g / L mixed with diesel	1L / 60L	Basal Bark (< 5cm stem diameter)
					Triclopyr 240g / L and Picloram 120g / L mixed with diesel	1L / 60L	Cut Stump (> 5cm stem diameter)
<i>Prosopis pallida</i> Mesquite	Legume	Class A/C To be eradicated	March to May preferable, control effective year round	Hand grubbing, blade ploughing or mechanical control aimed at root removal.	Triclopyr 300g / L and Picloram 100g / L	350ml / 100L or 3L / ha	Foliar Spray
					Triclopyr 240g / L and Picloram 120g / L mixed with diesel	1L / 60L	Basal Bark (< 5cm stem diameter)
					Triclopyr 240g / L and Picloram 120g / L mixed with diesel	1L / 60L	Cut Stump (> 5cm stem diameter)

Weed	Form	Management Goal	Optimum Treatment Times	Non-chemical applications	Chemical and Concentration	Rate	Situation, method and comments
<i>Sida acuta</i> Spinyhead sida	Shrub	Class B/C Growth and spread to be controlled	Dec - March ideal, April and Nov reasonable	Repeated slashing and cultivation, vigorous pasture competition	2, 4-D amine 625 g / L	320 ml / 100L	Seedling or adult: Foliar spray
					Metsulfuron-methyl 600 g / L	10 g / 100L	Seedling or adult: Foliar spray, need wetting agent
<i>Sida cordifolia</i> Flannel Weed	Shrub	Class B/C Growth and spread to be controlled	Dec - March ideal, April and Nov reasonable	Repeated slashing and cultivation, vigorous pasture competition	2, 4-D amine 625 g / L	320 ml / 100L	Seedling or adult: Foliar spray
					Glyphosate 360 g / L	15 ml / 1L	Seedling or adult: Foliar spray
					Metsulfuron-methyl 600 g / L	10 g / 100L	Seedling or adult: Foliar spray, need wetting agent
<i>Sida rhombifolia</i> Paddy's Lucerne	Shrub	Class B/C Growth and spread to be controlled	Dec - March ideal, April and Nov reasonable	Grub plants out. Slashing before flowering will prevent seed production temporarily and produce new growth for spraying	2, 4-D amine 625 g / L	320 ml / 100L	Seedling or adult: Foliar spray
					Glyphosate 360 g / L	15 ml / 1L	Seedling or adult: Foliar spray
					Metsulfuron-methyl 600 g / L	10 g / 100L	Seedling or adult: Foliar spray, need wetting agent

Weed	Form	Management Goal	Optimum Treatment Times	Non-chemical applications	Chemical and Concentration	Rate	Situation, method and comments
<i>Themeda quadrivalvis</i> Grader Grass	Grass	Class B/C Growth and spread to be controlled	November – April	Burning, before seeding. If seed present, burn inside a drum to generate sufficient heat to kill seeds.	Glyphosate 360g / L	15ml / 1L	Foliar Spray
<i>Tribulus spp.</i> Caltrop spp.	Vine	Class B/C Growth and spread to be controlled	Throughout the year	Hand pulling and grubbing	Glyphosate 360g / L	1 : 100	Foliar Spray (on mats of seedlings and young plants. Less effective on mature plants)

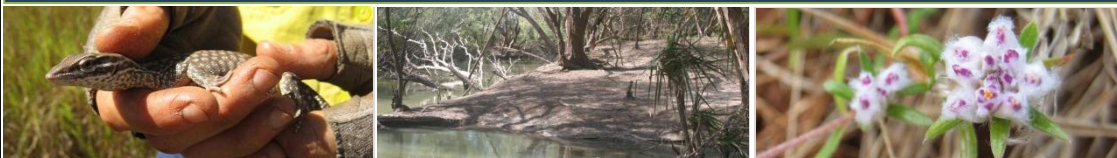


Appendix J - Biting Insect Management Plan


Australian Ilmenite Resources Pty Ltd


SILL80 Project,

2012



Document Control Record

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1 Context

Australian Ilmenite Resources (AIR) proposes to develop an ilmenite mine within ML27422 – in the Roper River region. Through the development of the Public Environmental Report (PER) it was requested that a Biting Insect Management Plan be developed for AIR's ilmenite project. The Biting Insect Management Plan has been developed with reference to the *Guidelines for Preventing Mosquito Breeding Sites Associated with Mining Sites 2005* by the Northern Territory Government – Department of Health and Families.

This initial Biting Insect Management Plan is intended to minimise potential impacts or issues concerning biting insects as a result of works associated with AIR's SILL80 Project. Potential issues identified include;

- Local transmission of mosquito borne diseases
- Increase in adult mosquito populations
- Increase in mosquito breeding sites

Mine site infrastructure will be managed to minimise the potential to create new mosquito breeding sites or increase yields at existing sites. Potential breeding areas can be created in or around construction works, water storage facilities, sediment traps, pit dewatering, waste water disposal, mine waste dumps, site clearing burrow pits and storage of artificial receptacles. Any equipment sourced from North Queensland that is capable of holding even a small amount of water can potentially harbour the eggs of the dengue mosquito *Aedes aegypti*. Mitigation measures will be put in place to prevent the introduction of this species.

2 Management and Monitoring

AIR is committed to ensuring the health and safety of its workforce. Biting Insect Management on-site will be performed in accordance with the *Guidelines for Preventing Mosquito Breeding Sites Associated with Mining Sites 2005* by the Northern Territory Government – Department of Health and Families. Key management objectives will be to prevent mosquito breeding opportunities on-site, reduce the potential for contact between personnel and mosquitoes and detail monitoring and response strategies to severe outbreaks or incidence of disease.

These actions are:

1. Prevent the potential of increasing mosquito populations through appropriate water storage:
 - Infrastructure will be designed to minimise potential mosquito breeding sites;
 - Periodic cleaning of vegetation and silt from around sediment dams and water impoundments;
 - Maintenance of septic systems to prevent mosquito breeding opportunities;
 - Periodic removal of potential artificial breeding sites; and
 - Clean all equipment sourced from North Queensland with 10% chlorine.
2. Reduce the potential for contact between personnel and mosquitoes:
 - Screening of all residential, eating and recreational areas;
 - Installation of thick curtains inside buildings and yellow lights outside buildings to minimise mosquito attraction to light sources;
 - Incorporate awareness of disease risk and prevention into the site induction to increase personnel awareness and responsibility to avoid contact with mosquitoes; and
 - Reinforce awareness during breeding season through periodic reminders of risk and prevention.
3. Monitor for mosquito outbreaks and respond to severe outbreaks or incidence of disease:
 - Trapping of adult mosquitoes once a month for the initial 12 months of mine operation to develop a baseline mosquito monitoring program;
 - Inspection of potential breeding sites during peak breeding times;
 - Application of a suitable barrier insecticide such as bifenthrin should mosquito problems arise;
 - Isolation of personnel suspected of having the malaria virus to prevent contact with mosquitoes; and
 - Ensure incidences of notifiable disease are reported to the National Notifiable Disease Surveillance System.

2.1 Biting Insect Management (Construction)

Table 1: AIR's Biting Insect Management for Construction

OBJECTIVES	Prevent the occurrence of mosquito breeding sites and the presence of adult mosquitos
TARGETS	No mosquito breeding sites generated during construction operations
ACTIONS	<p>Any depressions generated with the potential to hold water will be drained to prevent ponding</p> <p>Storage containers capable of holding water will either be discarded after use or stored in a manner to prevent water ponding</p> <p>Ponds, dams, drains, sediment traps, bunded areas and onsite excavations will be periodically inspected for the presence of mosquito larvae at a frequency to be recommended by NT Department of Health. Detected populations will be managed under recommendations from the Medical Entomology Branch NT.</p> <p>Erosion and wash-down management infrastructure will be controlled to prevent standing water bodies adjacent to site.</p> <p>All spoon drains/drainage channels will have sufficient grade where possible to prevent ponding, and be maintained free of sediment and vegetation.</p> <p>Ponds, dams and other water holding structures will be designed appropriately and maintained to minimise the potential for mosquito breeding.</p> <p>Runoff sediment ponds will be emptied immediately post storm events to prevent standing water, or be designed as deep (>1m), steep sided (1V:2H) ponds.</p> <p>All construction workers will be educated of the risk of mosquito borne disease through onsite inductions. This will include a description of peak abundance periods and personal protective measures including long sleeve shirts and trousers, regular application of repellents and avoidance of outdoor operations at sundown. Outdoor lanterns or portable gas powered insecticide vaporisers could be used in outdoor areas at night when required, as well as permethrin impregnated work clothing.</p> <p>Workers will be educated about the early symptoms associated with exposure to mosquito borne arbovirus and will be instructed of the need to report any observed symptoms.</p> <p>All construction accommodation will be screened and external lighting will utilise yellow bulbs to discourage attracting insects. Barrier insecticide treatment of accommodation and work buildings will control adult mosquitoes around these areas.</p>
MONITORING	AIR will monitor mosquito activity in construction accommodation and work areas to identify if mitigation measures are not successful and to determine whether control measures should be implemented.
REPORTING	Significant mosquito activity will be reported to AIR's General Manager as well as the Medical Entomology Branch NT.

2.2 Biting Insect Management (Operations)

Table 2: AIR’s Biting Insect Management for Operations

OBJECTIVES	Prevent the occurrence of mosquito breeding sites and the presence of adult mosquitos
TARGETS	No mosquito breeding sites generated during operation activities
ACTIONS	<p>Any depressions generated with the potential to hold water will be drained to prevent ponding</p> <p>Storage containers capable of holding water will either be discarded after use or stored in a manner to prevent water ponding</p> <p>Ponds, dams, drains, sediment traps, bunded areas and onsite excavations will be periodically inspected for the presence of mosquito larvae at a frequency to be recommended by NT Department of Health. Detected populations will be managed under recommendations from the Medical Entomology Branch NT.</p> <p>Erosion and wash-down management infrastructure will be controlled to prevent standing water bodies adjacent to site.</p> <p>All spoon drains/drainage channels will have sufficient grade where possible to prevent ponding, and be maintained free of sediment and vegetation.</p> <p>Ponds, dams and other water holding structures will be designed appropriately and maintained to minimise the potential for mosquito breeding.</p> <p>Runoff sediment ponds will be emptied immediately post storm events to prevent standing water, or be designed as deep (>1m), steep sided (1V:2H) ponds.</p> <p>All operation workers will be educated of the risk of mosquito borne disease through onsite inductions. This will include a description of peak abundance periods and personal protective measures including long sleeve shirts and trousers, regular application of insecticide and avoidance of outdoor operations at sundown. Outdoor lanterns or portable gas powered insecticide vaporisers could be used in outdoor areas at night when required, as well as permethrin impregnated work clothing.</p> <p>Workers will be educated about the early symptoms associated with exposure to mosquito borne arbovirus and will be instructed of the need to report any observed symptoms.</p> <p>All construction accommodation will be screened and external lighting will utilise yellow bulbs to discourage attracting insects. Barrier insecticide treatment of accommodation and work buildings will control adult mosquitoes around these areas.</p>
MONITORING	AIR will monitor mosquito activity in on-site accommodation and work areas to identify if mitigation measures are not successful and to determine whether eradication measures should be implemented.
REPORTING	Significant mosquito activity will be reported to AIR’s General Manager as well as the Medical Entomology Branch NT.

3 Preventing Breeding Sites

This chapter identifies the key structures proposed by AIR for their SILL80 Project that have the potential to become breeding sites for biting insects. These areas will be constructed in accordance with recommendations outlined in the *Guidelines for Preventing Mosquito Breeding Sites Associated with Mining Sites 2005* by the Northern Territory Government – Department of Health and Families.

3.1 Camp

- Potable Water Storage Tanks
- Septic Systems
- Storm Water Containment Bunds
- Stormwater drains and sediment traps
- Cleared areas
- Borrow pits for roads/building pad construction
- Waste Dump Area
- Any additional potential water pooling receptacles associated with this area

3.2 Mine Site

- Storm water drains, storm water collection ponds, sediment traps, discharge sites
- Excavation Pits
- Any additional potential water pooling receptacles associated with this area
- Water dams and water tanks
- Process water/wash down water
- Borrow pits for roads/building pad construction

3.3 Access Road

The Access Road will be constructed to minimise any potential for constricting flow to mitigate flooding potential. As a result, pooling water will also be avoided. Borrow pits will be rehabilitated to be free draining.

4 Decommissioning and Rehabilitation

A decommissioning and rehabilitation plan will be in place for all mining operations to ensure no actual or potential mosquito breeding sites remain after cessation of mining operations. All disturbed areas should be rehabilitated to be free draining where practical.

Aspects to consider when decommissioning and rehabilitating a mine site include;

- Removing and contouring all sediment ponds,
- Removing all bund walls created for the development,
- Removing infrastructure and artificial receptacles that could pond water,
- Removing water dams and reinstating existing flow paths where practical, otherwise leaving dams and pit voids and deep, steep sided water features
- Rehabilitating borrow pits,
- Removing wetland filters, sediment traps, and other facilities that could pond water and breed mosquitoes.

5 References

Whelan, P and Warchott, A, 2005 *Guidelines for the preventing mosquito breeding sites associated with mining sites*, November 2005, Department of Health and Families, Northern Territory Government, Darwin, Australia.



Appendix K - Rehabilitation Management Plan


Australian Ilmenite Resources Pty Ltd


SILL80 Project

2012



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Executive Summary

Australian Ilmenite Resources Pty Ltd (AIR) SILL80 Project is a proposed open cut mine and processing facility to be constructed in the Roper River region of the Northern Territory. AIR intends to produce 200,000 tonnes of refined ilmenite at the mine per annum, with an expected mine life exceeding 20 years.

To stabilise mined land and mitigate potential erosion and sedimentation issues, progressive rehabilitation to pastoral production will occur. Pastoral production is the preferred end land use that has been nominated by the land owners. Specifically, the land will be rehabilitated to a healthy perennial grass rangeland with a diverse mix of plants, both native and introduced (i.e. non-declared species).

The objectives of the rehabilitation work are to:

- Achieve stable landforms;
- Reduce incidence of weed infestation and spread;
- Reduce risk of erosion and sedimentation;
- Progressively rehabilitate over the life of mining;
- Prevent non-essential access to rehabilitation areas;
- Maintain natural drainage and hydrology of land as much as is practicable;
- Rehabilitate the access tracks and roads that are not required post-construction and mining;
- Comply with all regulatory requirements, approvals and any other applicable legislation; and
- Implement monitoring and performance evaluation measures that are practical and measurable.

Mined areas will be rehabilitated in a co-ordinated program between AIR staff and station managers, in order to develop the area as a perennial grass rangeland for cattle grazing. Processed spoil will be returned to mined pits, which will then be broadcast with perennial grass seeds and covered with weed free pasture hay. Cattle will be introduced to the area for a short and controlled period to initiate sowing of seeds and stimulate ground preparation. As a perennial grass rangeland develops, the area will be grazed systematically, for a short duration (6-12 hours) every six or more months, as determined by a Grazing Plan, to promote growth. Native grasses, forbs, small shrubs and trees will also be encouraged.

Photo monitoring will also be conducted within the rehabilitation areas, with permanent reference points established.

Success or failure will be determined through the use of photo monitoring, weeds occurring at equivalent or lower densities than surrounding areas, and presence/absence of erosion and sedimentation. In general terms, it is expected that 80% desired groundcover (as determined by the Station Manager) will be achievable and will indicate success. In addition, retention of moisture in the soil, displayed by 'healthy' pasture, particularly towards the end of the dry season, will also be an indicator of success.

Annual reporting on rehabilitation methods and monitoring will be presented in the Annual Environmental Review, required as part of the Environmental Management Plan and reported to the Department of Mines.

A mine closure plan will be developed once the major mine expansions have been finalised in accordance with industry best-practice guidelines and the NT Department of Resources *Mine Close Out Objectives* (DoR 2008).

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We would like to thank Moira Lanzarin, Numul Numul Station Manager, for her valuable input and time. Moira's knowledge and experience in grazing management and appropriate pastoral management for the Northern Territory was invaluable in development of this Rehabilitation Management Plan, including review of drafts and supply of images for the plan.

We would also like to thank Traditional owners of the region for their support in development of the Rehabilitation Management Plan.

1 Introduction

1.1 Background

The SILL80 Project is a proposed open cut mine and processing facility to be constructed in the Roper River Region of the Northern Territory. The main objective of the proposed facility is to extract and process ilmenite concentrate for sale to foreign markets.

Australian Ilmenite Resources Pty Ltd owns the SILL80 Project, which comprises ML27422 and MLA29042, totalling 1247 hectares. AIR intends to produce 200,000 tonnes of refined ilmenite at the mine per year, with an expected mine life exceeding 20 years.

1.2 Location

The SILL80 deposit is located 120km east of Mataranka on the Roper Highway (Figure 1-1). The proposed mine site is approximately 10km south of the Roper River, 4km south-east of the Kewulyi Aboriginal Community Outstation (old Roper Valley Homestead) and 3km south-west of Numul Numul homestead.

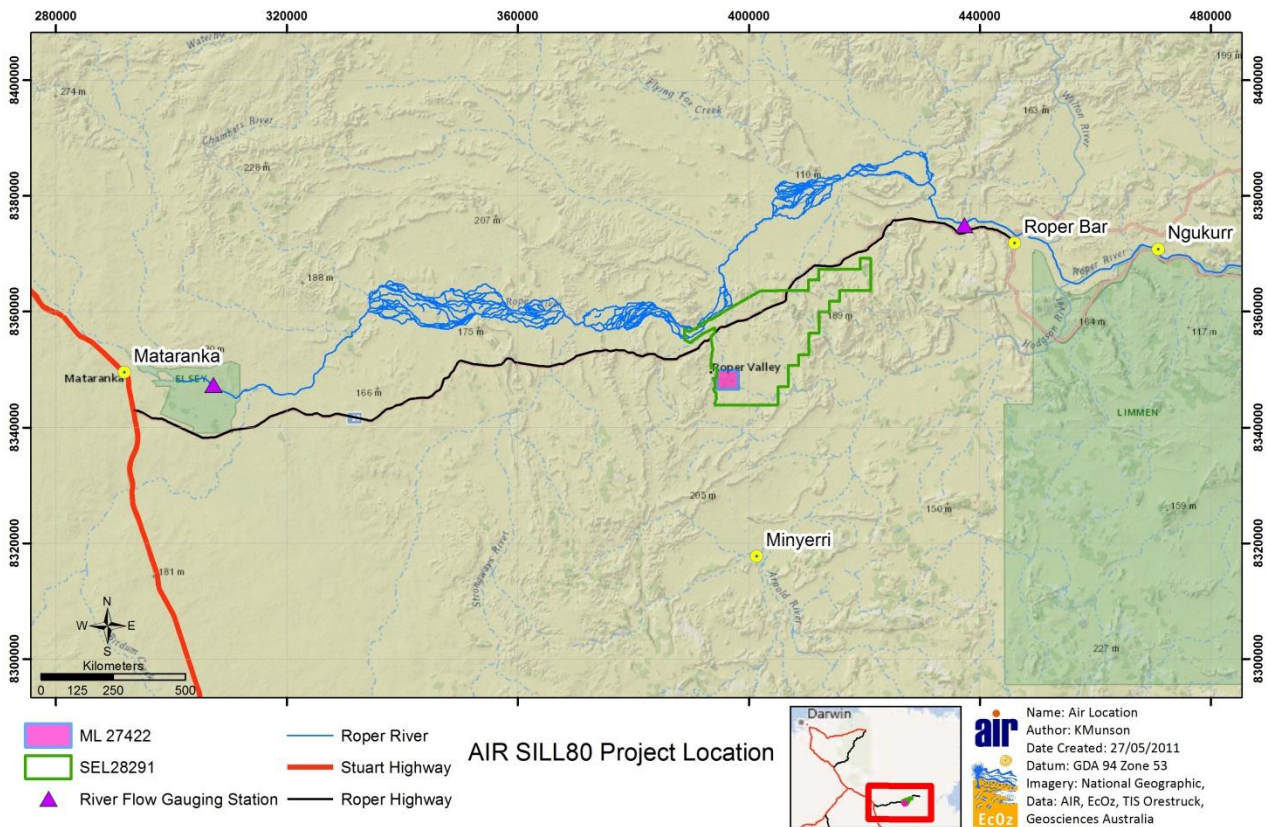


Figure 1-1. Project location with reference to surrounding communities

1.3 Potential Impacts

Negative impacts that may occur on ML27422 and MLA29042 due to the operation of the mine include:

- Large areas of exposed earth available for weed colonisation and/or erosion and sedimentation;
- Spread of existing weed infestations due to disturbance and vehicle traffic;
- Unstable landscape post mining;
- Reduced quality of surrounding water resources;
- Gradual decline in landscape function;
- Untidy and bare infrastructure areas;
- Altered drainage and hydrology; and
- Impact on potential for future pastoral land use if contaminants (e.g. heavy metals) and other potential hazards are not properly identified or managed.

In order to ensure successful rehabilitation of the mine site and surrounding pastoral lands, the management of weeds is of the highest priority.

To minimise potential weed infestation or spread resulting from AIR's operations within ML27422, the company will manage classified weeds in accordance with the *Northern Territory of Australia, Weeds Management Act 2001*. Further information on weed management can be found in the Weed Management Plan (PER Appendix I).

1.4 Consultation

Early consultation was carried out to identify the various options available for post mining land use and rehabilitation. Progressive rehabilitation is preferable to enable stabilisation of the land to protect it from potential issues associated with erosion and sedimentation. Progressively rehabilitating the land will also allow for adaptation of rehabilitation objectives, should they require revision in response to monitoring results and/or changes in stakeholder expectations.

Consultation with current sub-lease holders (Coodardie Pty Ltd: the O'Brien family - Numul Numul Pastoral Lease) and Traditional Owners (Namul-Namul Aboriginal Corporation) resulted in agreement to progressively convert the land to improved pasture, using both native and exotic grasses combined with reintroduction of plants currently found in the area.

AIR will implement an ongoing rehabilitation program to minimise colonisation opportunities for weed species. The rehabilitation program will focus on establishing the pasture species 'sabi grass' (*Urochloa mosambicensis*) and 'stylo' legumes (i.e. *Stylosanthes hamata* and *Stylosanthes scabra*) in disturbed areas post-mining works. Further detail on preferred species and methods of rehabilitation were obtained from consultation with the managers of the Numul Numul Pastoral Lease, specifically Moira Lanzarin (nee O'Brien).

2 Objectives and Targets

2.1 Existing Land Use and Condition

As the area encompassing ML27422 and MLA29042 is currently a pastoral station, existing land disturbance through cattle stocking is evident (e.g. pugging and soil compaction). Weed species (e.g. *Hyptis suaveolens* and *Sida acuta*) are present throughout the property and laneways and tracks have been developed for mustering and maintenance purposes. The laneways and tracks are maintained annually through post wet season grading. Extensive fencing for stock management and multiple stock dams exist within the lease area.

The Roper River Region is sparsely populated. Only 3,500 people live in the catchment, of which 70% are Indigenous. The largest population centres are Mataranka (600), Ngukurr (1589), and Minyerri (340) (Northern Territory Government 2007), respectively located about 105 km east, 80 km west, and 65 km south of the Project area. People of the Jawoyn, Mangarayi, Ngalkan, Ngandi, Nunggubuyu, Mara, Alawa and Yangman language groups live in the region (AIATSIS 2000). English is not the first language for the majority of the Indigenous population and Kriol is commonly spoken.

In such a remote region, which experiences wet/dry seasons and has a sparse population, industrial and economic options can be limited. Pastoralism, mining, conservation and indigenous tourism-based industries are the main areas of activity within the Region.

There is a 67% indigenous population within the Mataranka Basin (Stoeckl et al. 2007), therefore traditional practices and connections to land and water are high.

2.2 Post-Mining Land Use

It is proposed that the post mining land use will be a combination of native and introduced pastoral species in a healthy and productive state. Rehabilitation will avoid a blanket monoculture of introduced species.

As the quality and composition of the grasses increase, so too will the production capacity. This will make the land more economically viable than it is currently and is supported by both the Namul-Namul Aboriginal Corporation (Traditional Owners) and sub-lease holders, the O'Brien family, who currently manage the property as a cattle station.

2.3 Objectives

Performance and management of rehabilitation will be the obligation of AIR. As such, it will be AIR's responsibility to demonstrate successful rehabilitation before return of the security bond from the Department of Resources on completion of mining. It is envisaged that AIR will most likely engage local land holders, managers and contractors to help achieve successful rehabilitation.

The objective of the rehabilitation work is to utilise grazing to establish the desired future land use of a diverse and healthy perennial grass rangeland system, with well covered soil that has effective water absorption and nutrient cycling.

In general terms, the objectives of the rehabilitation work are to:

- Achieve stable landforms;

- Reduce incidence of weed infestation and spread;
- Reduce risk of erosion and sedimentation;
- Progressively rehabilitate over the life of mining;
- Prevent non-essential access to rehabilitation areas;
- Maintain natural drainage and hydrology of land as much as practicable;
- Rehabilitate access tracks and roads that are not required post construction and mining;
- Improve economic viability of the land;
- Establish and maintain a healthy and productive state of vegetation;
- Comply with all regulatory requirements, approvals and any other legislation; and
- Undertake monitoring and performance evaluation measures that are practical and measurable.

2.4 Targets

- Increase in the economic viability of the land;
- No new channels will be created and no evidence of significant erosion, either within the mining area or in surrounding environment (resulting from mining activities);
- Occurrence and density of declared or undesirable weeds within post mining areas, tracks or roads no greater than surrounding areas;
- No negative impact on nearby waterways;
- 80% total groundcover is achieved, assessment made at the end of the wet season, determined through the use of photo monitoring and aerial photography and other monitoring tools (e.g. caged exclusion plots); and
- Lease relinquishment conditions are met within 24 months of cessation of mining.

3 Rehabilitation Plan

The purpose of this plan is to outline a method for rehabilitation that will be subject to regular review, detailed monitoring and reporting and, most importantly, modification as required. The plan will follow the basic adaptive management framework of Plan – Monitor – Control – Replan (Figure 3-1). It is expected that as knowledge increases through experience and experimentation with planting and stocking rates, timing and recovery period, that the plan will evolve and shift to something which can be used as a guide, not only for Numul-Numul Station, but for other areas within the Northern Territory and similar climates.

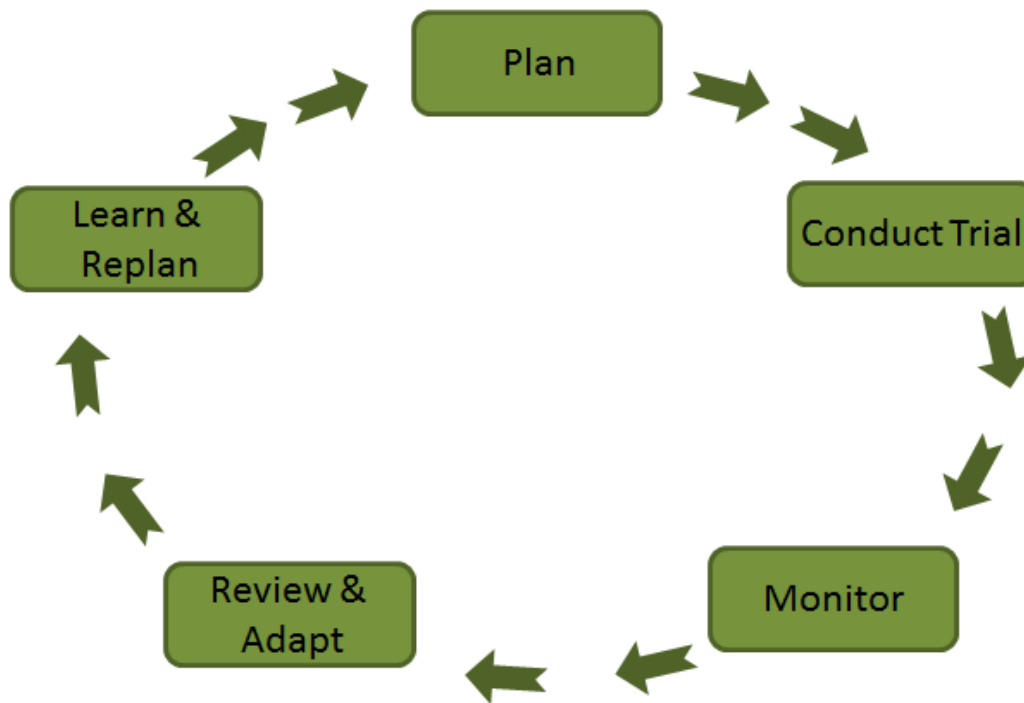


Figure 3-1. Adaptive Management Framework.

3.1 Mining method

Ilmenite recovery will require strip mining using excavators to remove the regolith to an average depth of 1.2m (maximum 4m), in order to recover 200,000 tonnes of ilmenite concentrate per annum, at a grade of between 10% and 25%. Between 400,000 and 1 million tonnes of regolith will be excavated per year.

Excavations will progress along strips up to 300m long and 200m wide. After the initial strip is mined, the ore is processed and the residual material (about 75 – 90% of the original material) is stockpiled, dewatered, and placed back into the pit as excavations move to the next strip. This will allow areas to be rehabilitated in a progressive manner. Where topsoil is available, it will be stockpiled for later use in spreading over filled pit areas and managed to prevent infestation with weeds. However, very little top soil is expected, as the ilmenite mineralisation generally extends to the surface with minimal overburden.

To assist in the development of top soil and reintroduction of local native plants, the timber cleared from the site will be stockpiled, put through a mulcher, re-stockpiled and distributed over the site post mining.

Prior to excavations, the vegetation will be cleared and soil ripped to a depth of approximately 1m for ease of ore removal by a single CAT325DL excavator or similar.

3.2 Topography

The project area lies mainly within the physiographic province of the Gulf Fall, a dissected terrain from which almost all of the old Tertiary land surfaces have been eroded. This terrain is characterised by broad alluvial valleys between low rubbly hills and prominent strike ridges of resistant Roper Group strata. The flat-floored ridges form part of the vast Roper River floodplain and its associated tributaries (Wilton, Maiwok, Flying Fox and Jalboi Rivers) and are largely developed on incompetent shales, fine-grained sediments, and volcanics and carbonate rocks. Local relief is variable ranging from 20 to 120 metres.

3.3 Drainage and hydrology

The Roper River catchment is one of the largest in the Northern Territory with an area of 81,794 km² (Faulks 2001). It is fed by nine rivers (Phelp, Hodgson, Arnold, Wilton, Mainoru, Jalboi, Strangways, Chambers and Waterhouse), and three major creeks (Maiwok, Flying Fox and Elsey).

The region is generally considered poor in groundwater (Zaar, 2009). Groundwater resources in the area of the SILL80 Project are typical for the catchment, comprising fractured and weathered rocks with bores yielding less than 1 L/s.

The extremely high evaporation rate (mean annual rate about 2400 mm), greatly exceeds annual rainfall, even in the wettest years. Conversely, during the wet season flooding in the lower lying areas of the Roper catchment can be extensive, and flooding can occur in the area of the proposed mine.

Open cut mining involves topsoil stripping, overburden removal, handling, and stockpiling, resulting in potential erosion and sedimentation issues not only within the mining area but also into the surrounding environment. The slope of the mining lease is 0.98%, and while relatively flat there would still be a degree of runoff and sedimentation potential. Velocity of water from rainfall events is expected to be 0.4ms⁻¹.

3.4 Erosion Control

The effectiveness of erosion and sediment controls during the operational and rehabilitation stages can be optimised through effective mine planning and design. Suitable strategies include:

1. Designing any drainage systems operating for the life of the mine so that they do not cause erosion. This will involve the construction of a level spreader at the point of discharge into intact vegetation;
2. Diverting runoff around the mine site where possible, to minimise water flowing from upstream catchments to operational areas;
3. Designing the final mine geometry to create a landform that allows free drainage of surface runoff while minimising erosion;
4. Staging open cut mining during the dry season so pit areas are either, open and capturing water during the wet season or rehabilitated to greatly minimise the erosive potential of the refilled pit surface.;
5. Capturing stormwater infiltrating into pits for reuse as part of the overall water-management strategy for the site to avoid or reduce discharge of polluted water. There are commonly a range of non-

potable water uses on a mine site such as dust suppression and irrigation of revegetation areas. This may be more cost effective than treatment of polluted runoff and will also reduce consumption from other water sources.

Operational Phase Strategies:

Activities will vary throughout the life of the mine, and it is expected that erosion and sediment control measures and activities will evolve over time. Erosion control strategies for mines should normally comprise the following:

1. Minimisation of extent and duration of disturbed areas draining to waterways, and prompt revegetation of non-operational disturbed areas;
2. Ensuring both temporary earthworks and permanent land-shaping provide a landform which minimises erosion hazard;
3. Prompt stabilisation of land following land reshaping (both temporary and permanent); and
4. Design of temporary surface-water collection, conveyance and disposal systems in a manner which minimises erosion.

Where possible, stormwater should be diverted around any active or rehabilitated mine areas. This will minimise both the flow rate and volume of runoff reducing erosion and sediment transport from these areas and maintain local hydrology within surrounding areas.

The following sediment and erosion control devices and stormwater management controls will be implemented on the site;

- Construction Entry/Exit Shake Down – Used to prevent the tracking of sediment from tyres of vehicles to public roads;
- Catch drain – Used to convey clean water flows toward a level spreader for discharge into intact vegetation and flows from disturbed areas to sediment basins and water storage pits;
- Diversion banks – Used to convey clean water flows toward a level spreader for discharge to intact vegetation
- Sediment Basin – Used to trap and retain sediment via settlement of suspended particles;
- Mulch Bund (Batter) – Used to reduce the velocity of treated water discharged from the sediment basins in addition to providing a further degree of treatment; and
- Silt fences.

More information is provided in the Erosion and Sediment Control Plan in PER Appendix H.

3.5 Topsoil Management

Where available, topsoil and vegetation will be retained and spread back over the re-contoured areas progressively upon completion of mining. Topsoil will be stockpiled, for use in rehabilitation, in an area not subject to flooding or sheet flow, which will ensure that the topsoil is not lost or subjected to damage from erosion. Topsoil stockpiles will be constructed no more than 2m in height to maintain soil health. The seed bank in the topsoil will be sufficient to supplement additional grass/pasture seed to be introduced in the rehabilitation areas. Topsoil will be monitored for weeds and actively maintained, particular care will be taken to avoid introduction of declared weeds (refer to the Weed Management Plan, PER Appendix I). Cleared vegetation will be mulched and made available for revegetation to help create the post mining topsoil.

3.6 Species Selection

3.6.1 Desirable Introduced Species

The following species are recommended (Partridge 2004) for intensive grazing in the tropical and sub-tropical regions of the NT. Descriptions are taken from *Better Pastures for the Tropics and Subtropics* by Ian Partridge (2004).

Sabi Grass – Urochloa mosambicensis

A perennial grass, either tufted or creeping with short stolons and low growth habit. Ideal for areas receiving 500 – 1,200 mm annual rainfall with a strong dry season. It grows quickly after rains, but, although drought-resistant, it hays off quickly once soil moisture runs out. It does not tolerate poorly drained soils subject to flooding. Sabi grass combines well with legumes, especially stylos (Seca and Verano). A small amount of Sabi seed sown with the legume seed may gradually increase with time to provide a more stable pasture.

Verano – Stylosanthes hamata

This plant grows well in the tropics with 600 – 1,700 mm rainfall. It is adapted to a wide range of infertile, sandy-surfaced and well-drained soils. Verano can grow up to 75 cm, but develops a flat crown under heavy grazing. If allowed to seed without grazing, it tends to behave as an annual, but 30 – 40% of plants will behave as a perennial under grazing, and continue to grow into the dry season after flowering. However, it generally behaves as a weak biennial, regenerating well from the reserves of seed in the soil in the next wet season, and can therefore survive fire which kill the parent plant.

Seca – Stylosanthes scabra

The shrubby stylos are extremely hardy plants ideal for extensive grazing. They establish easily, keeping green leaf into autumn, and persist through drought due to their deep tap roots.

Shrubby stylos are ideal for growth in tropical climates where they receive 600 – 1600 mm of rainfall. They will grow in a range of soils but do not tolerate waterlogging or heavy cracking clays. They will grow into small erect shrubs of 2 m high if ungrazed, but under grazing conditions they will remain at 30 – 40 cm high with a closely eaten crown on a single stem.

The feeding value of the leaf and flowering heads is high, and is well maintained into the dry season. Seca regenerates well after fire, resprouting from the base or regenerating from seed in the ground.

3.6.2 Desirable Native Species

The following species were identified by Numul Numul Station Managers as desirable native pasture species to be included in the mix of pastoral species introduced for rehabilitation.

- Perennial Sorghum - *Sorghum x almum* Parodi, *Sorghum* spp. hybrids
- Bull Mitchell - *Astrebla squarrosa*; and
- Flinders Grass - *Iseilema membraceum*.

3.7 Rehabilitation

The annual area of disturbance at the SILL80 project is proposed to be between 15 and 25 hectares, and will vary with ore depth and production output. Excavations will be dug along approximately 300 x 200m wide strips to maximum depth of 4m where Ilmenite-bearing soils occur.

Consultations with the Traditional Owners and Pastoral Lease owners sought input as to what their rehabilitation desires would be, and the proposed rehabilitation plan is based on this.

Mined areas will be rehabilitated in consultation with station managers in order to develop the area as a diverse and healthy perennial grass rangeland system. Processed spoil will be returned to the pit, which will then be broadcast with perennial grass seeds and covered with weed free pasture hay. Cattle will then be introduced to the area, at high density (Figure 3-2), for a short and controlled period to initiate sowing of seeds and stimulate ground preparation. As a perennial grass rangeland develops, the area will be grazed systematically, for a short duration (6-12 hours) every six or more months, to promote growth. Specific management will be determined through a Grazing Plan to be prepared by Numul Numul Station Managers.



Figure 3-2. High Density Stocking.

Very little top soil is present and the vegetation is sparse in areas (Figure 3-3) providing little brush cover available for protection of seedlings and soil. Effective rehabilitation may require a higher density of plantings to ensure long-term survival of individual plants and effective soil erosion prevention. Native grasses will also be encouraged and it is expected that some small shrubs and trees will also establish.



Figure 3-3. Sparse Vegetation within ML27422.

A permanent fence (3 barbwire) grid, determined by AIR and the pastoral lease holders, will be put into place to facilitate the effective and safe management of the site.

Rehabilitation will generally follow the below steps:

- Excavations will be progressively backfilled with the residual material left over from ore processing (about 75 – 90% of the original material).
- Residual material will be dewatered prior to being placed back into the pit.
- Top soil (where available) will be stockpiled for later use in spreading over filled pit areas. However, very little top soil is expected, as the Ilmenite mineralisation extends to the surface with very little overburden.
- Additional soil may be sourced from other areas within the Mining Lease, as required.
- Perennial grass seeds will be broadcast over rehabilitation areas – to develop a perennial grass rangeland.
- Hay or silage will be introduced to the paddock to provide additional fodder and mulch, along with mulch sourced from stockpiled cleared material.
- Cattle will be selectively introduced to the paddock for a short amount of time (possibly only 6 to 12 hours). This will be done at high density with electric tape or portable panels used to create the desired density. The cattle will mix the mulch through hoof action and add natural fertiliser in the form of faeces and urine. This will create “new” topsoil.
- If enough native residual seed does not germinate in the area a cross-selection of perennial grass species will be introduced at a later date.
- Re-introduction of cattle will be carried out at various times (for short periods and of varying density), carefully managed to promote growth of pasture without negatively impacting the environment and to promote the desired future landscape.
- Regular monitoring will occur to determine if the rehabilitation activities are achieving the desired result or if methodologies need to be modified.
- Access roads not wanted by landowners will be ripped and allowed to revegetate naturally.
- Prior to the completion of mining operations, consultation with landowners will be undertaken to determine the fate of all mining infrastructure, including the processing plant, concrete pad, sheds, office, roads and any other infrastructure in place.

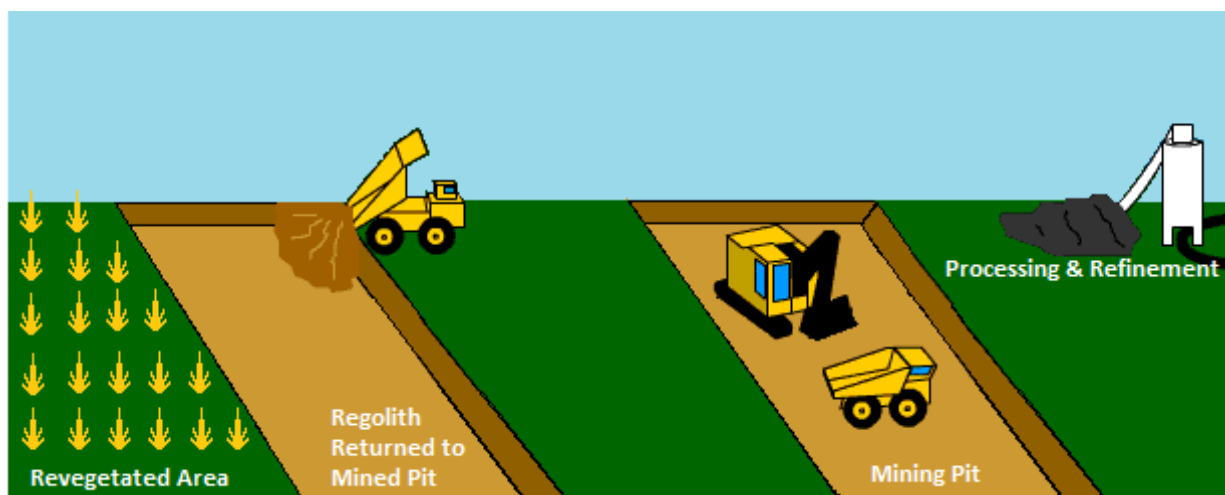


Figure 3-4. Schematic Representation of the Process of Mining and Rehabilitation.

Mining will progress in the first twelve months over an area not exceeding 25 hectares. In year two, mining will move to a second resource area and rehabilitation can commence over the year one mining area (Figure 3-4). Initially hay and/or silage will be spread over the ground along with topsoil, mulch and desired perennial seed.

Photo and cage monitoring (also known as exclusion plots) will be used to help determine success rate through per cent ground cover; this is discussed in more detail in Section 4.

Timber stacks resulting from vegetation clearing will be used for producing mulch. This will have the added benefit of introducing seed naturally during the rehabilitation process.

Success of rehabilitation will be determined through the use of baseline data (e.g. photograph prior to mining), monitoring and the use of control sites (discussed further in section 4).

Water and Fertiliser

Stock will most likely be watered using a trailer trough, with water sourced from a hydrant at the AIR processing plant and taken to the cattle occupied paddock for the duration of grazing.

The pasture will not require addition of water, although there may be the need for supplementary fertiliser and advice will be obtained from the Northern Territory Agriculture Association.

Timing

Timing of grazing will vary but in general, the paddocks will be used for weaners (May – July) and sale bulls (prior to May). Further detail will be provided in the Grazing Plan, which will outline the timing and type of livestock used and the most effective strategy to achieve the desired goals. During the non-growing period (late dry season) the paddocks will be able to tolerate high stocking. The cattle will knock down and re-mulch old plants to assist in creation of an additional mulch layer. Improved pasture has a much faster recovery rate (approximately 30 days) than native pasture, although it may be necessary to protect slower growing plants, which could be achieved with the use of cages. Cages can also be used for monitoring and is discussed further in section 4.

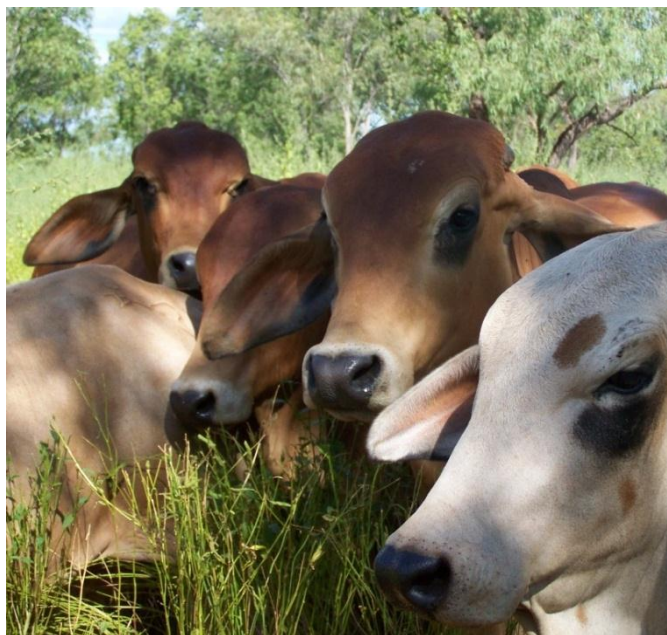


Figure 3-5. Cattle Grazing on Improved Pasture

It is anticipated that the growing season will extend in each subsequent season as management is refined. There will not be a set rotation, as this will have to be determined based on growth rate and recovery period required, weather and other variables. Cattle rotation will be driven by vegetation growth rates, but this can be variable over weeks and months and will need to be closely monitored and managed by the station managers and as per the Grazing Plan to be developed for the site.

Weeds

Weeds will be managed in accordance with the AIR Weed Management Plan (PER Appendix I). If weeds are an issue within a paddock, stock is one tool which can be utilised to help control them through introduction of cattle at a time when the weeds are vulnerable, breaking them down, eating and trampling on them. Perennial grasses, given adequate time to recover between grazing, will generally out-compete weeds and again the timing of grazing will be critical for management (M Lanzarin 2011, pers. comm., 29 November). Other tools, such as mechanical and/or chemical, will also be considered and the technique most appropriate for the given circumstances will be used.

Wildlife

Wildlife corridors will be encouraged within the rehabilitation areas, with larger shrubs and trees encouraged in areas where they may assist in formation of mosaic or checkerboard wildlife corridors.

Stock movement

Stock movement will be carried out using “low stress” stock handling techniques.

3.7.1 Roads and Tracks

When the mine is nearing closure, consultation will be undertaken to determine what infrastructure is removed and rehabilitated or will remain for the benefit to ongoing management of the cattle station. The areas that are not required will be ripped and revegetated to bush or pasture depending on location/needs. If a given area is to be added to pasture areas, it will be treated in the same way as the paddocks. If natural bush is favoured, then they will be ripped and allowed to naturally revegetate whilst maintaining weed control.

Indications from consultation carried out to date are that access tracks will be kept due to their value in assisting running the cattle station.

3.7.2 Timeframes

Initial rehabilitation will not take place until after the completion of the first year of mining. It is expected that between 15 and 25 hectares of land will be mined in the first year. This is an ideal area for the techniques outlined in section 3.7. Each year, a paddock of approximately the same size will be made available for rehabilitation. At the end of mining there will be approximately 15 perennial pasture paddocks, including paddocks used to grow hay or silage which will be used to support the intensive grazing plan.

3.7.3 Training/Site Induction

The general site induction will include detail on the rehabilitation strategy being employed to assist employees in understanding the importance of maintaining fencing integrity, access requirements during both grazing and non-grazing periods, weed management/control, and movement of stock within the mining lease.

3.7.4 Fire control

Fire should not be required to aid in the rehabilitation, and measures will be taken to ensure that unwanted fire does not occur in these areas. Fire tolerant pasture species are not favoured by pastoralists, and it is

likely that fire would promote the growth of undesirable weeds. Fire breaks will be established around the mining lease to ensure protection of mining infrastructure and rehabilitation areas.

3.7.5 Carbon Sequestration

The clearing of vegetation for mining activities will result in the removal of approximately 800 ha of existing woodland. This comprises the processing and general work area, open cut pits and access roads. Land clearing contributes to Greenhouse Emissions via the use of machinery to remove vegetation but importantly, it is recognised that removal of vegetation generally contributes to a loss of a carbon sink. The rehabilitation proposed should improve the overall ability of the land to sequester carbon. Recent studies (e.g. Chan et al. 2009 & Tyrchniewicz Consulting 2006) indicate that improved pasture and grazing management can lead to increased Soil Organic Carbon (SOC) sequestration potential and reduction in greenhouse gas emissions (when compared to traditional grazing practices and unmanaged grazing).

Methods for measuring carbon sequestration are being developed (M Lanzarin 2012, pers. comm., 10 Jan.) and will enable estimates to be made of the effectiveness of this type of rehabilitation in creating an offset for mining. It will also enable comparisons to be made between the different rehabilitation strategies to determine the most effective. A “control” area will be established to provide baseline data on the current land practice and its ability to sequester carbon for later comparison to various rehabilitated sites.

3.7.6 Fodder Conservation

A paddock will be set aside as a fodder conservation area, although the location and timing of this will be determined based on the best available technology and local expertise. The paddock will be planted specifically for the purpose of growing a fodder/silage crop to be used to support the proposed rehabilitation and ongoing management of the lease.

3.7.7 Mine Closure

Mine closure planning will be conducted in consultation with land owners and other stakeholders to ensure that the final stages of rehabilitation and mine closure objectives incorporate their requirements (e.g. retention of certain infrastructure or a specific alternate land use).

The mine closure plan will be developed according to the following objectives developed from the NT Department of Resources *Mine Close Out Objectives* (DoR 2008):

- Protect human health and safety;
- Reduce the need for long term monitoring and maintenance through design of and construction of landforms that are geotechnically and geochemically stable;
- Develop landforms that are consistent with the surrounding landscape;
- Develop an environmental monitoring and reporting program which is focused towards demonstrating the achievement of closure outcomes;
- Undertake progressive rehabilitation of the site during operations;
- Ensure that the full cost of decommissioning and rehabilitation is understood and that a mechanism for funding exists; and
- Ensure that residual risks and liabilities are identified and controlled to an acceptable level.

Following demolition of infrastructure and site clean-up, the remaining disturbed sites will be regraded to re-establish existing drainage lines.

4 Monitoring and Maintenance

4.1 Operation Phase Monitoring and Maintenance

Prior to commencement of mining, a series of photographs will be taken, which will establish a baseline condition for the land and will be the minimum acceptable end condition for the rehabilitation. This will also assist in providing a reference for current weed species/infestations so that new species or problems can be identified and remedied quickly.

Photo monitoring will also be conducted within the rehabilitation areas, with reference points set up and flagged. Photos will be taken periodically (minimum quarterly) over the same area of rehabilitation to determine success/failure. Photo point locations may be demarked in such a way as to ensure no damage by cattle (Figure 4-1).



Figure 4-1. Marker embedded into the ground to prevent damage by cattle.

The following guidelines will be utilised when undertaking photo monitoring:

- Photos should be taken from the same location and in the same direction, preferably with a reference point visible in the photo. This might be a star picket which is painted or has a number or unique identifier on it. It should be robust enough to ensure cattle do not damage or knock it over;
- Photos should be taken on cloudy but bright days, if this is possible, to avoid the creation of too many shadows which can make it difficult to distinguish between plant species and skew perception of ground cover;
- Photos should be taken quarterly in line with mid dry season, end of dry season, mid wet season and end of wet season;
- The photo point should be easy to find and therefore easy to replicate in subsequent years;
- Photo data sheets should also be used to record date and any other features that may not be obvious in the photos, such as species type and density, what stocking rate has or will be used, amount of time cattle have or will be present etc.; and

- Close up photos can be taken in the same location using caged quadrats, one of which should be protected from damage by cattle (to allow comparison of “natural” regeneration compared to regeneration after cattle) and at least one other used to inspect annual/perennial composition/density, ground cover, soil and animal activity.

It is expected that interpretation of monitoring will take place through continued discussion with Government officials, experienced holistic managers and other relevant parties.

The use of paddock grass cages is useful to check and determine grass recovery times and changes in fast/slow growth. The increase in sugar reading on a Brix Meter against the control will be another possible monitoring tool used to check progress and drive changes in strategy.

Sample grid or point data will be used annually to determine ground cover and plant composition. All results will be compared to a “control” area which will be nominated prior to the commencement of mining. This area will remain in similar condition to the current land condition and will be ideal for measuring (and establishing baseline) carbon sequestration.

If changes within the paddock are rapid, it may be necessary to take more frequent photos at specific times. In particular, it may be beneficial, in this case, to take photos prior to introduction of cattle, immediately post removal of cattle (likely to be the same day as previous photo) and then monthly or quarterly depending of rapidity of change.

Initially, each paddock may be treated slightly differently from the last to help determine the most successful rate of stocking, species selection, and depth of mulch, type of mulch (hay/weed/pasture/silage and ratios used) and length of recovery permitted before re-introduction of cattle. Comparison can be made between the paddocks and monitoring and management adapted accordingly. The Grazing Plan may be updated periodically to reflect any changes in management based on results of monitoring. The Grazing Plan is the responsibility of Numul Numul Station Managers (Figure 4-2).



Figure 4-2. Preparing a Grazing Plan.

It will be important to establish early indicators of failure. This could be infestations of undesirable plants, soil compaction, or slow growth. Strategies will be developed over time to identify and remedy these indicators through changes in management and careful documentation of success.

Weeds are a critical factor which will need to be closely monitored and controlled. Reference should be made to the AIR Weed Management Plan (PER Appendix I).

Fencing will be established post mining and prior to the rehabilitation work. Fencing will be regularly checked and maintained to ensure integrity; any damage will be fixed as quickly as possible. As cattle are likely to intensively graze for only very short periods of time, station managers will be present; this will have the added benefit of ensuring that no damage is sustained by the fence and can be fixed quickly.

Management of stock will be closely monitored and adapted by Numul Numul Station Managers as required.

4.2 Reporting, Review and Recommendations

This type of rehabilitation has not been trialled extensively in the Northern Territory, therefore it is expected that strategies will change over time, adaptation dependent on success and failure. As discussed above, several strategies will be trialled over subsequent rehabilitation areas, using higher or lower density of stock, longer or shorter periods within the rehabilitation area and changes to species selection and protection/encouragement of alternative species (including some shrub and trees). The success of the earlier trials will drive which strategies are used in the longer term.

However, it should be noted that similar techniques have been trialled in other areas (e.g. Daggett 2005, Donovan n.d., Coodardie 2011 & Henggler et al 2012), most notably by the O'Brien family on Coodardie station, and have shown that this type of rehabilitation is very successful when managed appropriately.

Adaptive management will be pursued (see Figure 3-1). Should initial trials prove less than successful, further strategies will be explored, such as different site preparation and planting methods e.g. manual seeding and the use of machinery, changes to species composition, timing of stock introduction etc.

Success and failure will be determined through the use of photo monitoring, the presence/absence of weeds, and presence/absence of erosion and sedimentation. In general terms, it is expected that more than 80% total groundcover of diverse and healthy perennial grasses along with well covered soil and effective water absorption and cycling, will indicate success.

Annual reporting on rehabilitation methods will be presented in the Annual Environmental Review required as part of the Mining Management Plan and reported to the Department of Resources.

5 Definitions

Dewatered	To remove water
Kriol	Kriol is an English-based creole language spoken by many Aborigines in Australia
Monoculture	The cultivation of a single crop
Overburden	Rock or soil overlying a mineral deposit
Perennial	An enduring plant that lasts longer than two years, sometimes dying in the off season and regrowing in the on season
Progressive Rehabilitation	Rehabilitation that takes place on areas as they become available rather than waiting for the end of mining before rehabilitating
Regolith	The layer of unconsolidated solid material covering the bedrock of a planet
Silage	Green fodder compacted and stored in airtight conditions, typically in a silo, without being dried, used as animal feed in the winter
Topsoil	The upper part of the soil, which generally contains the seed bank

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Appendix L - Environmental Management Plan


Australian Ilmenite Resources Pty Ltd


SILL80 Project

2012



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Executive Summary

Australian Ilmenite Resources (AIR) is developing an Ilmenite mine and processing facility within Numul Numul Station in the Roper River Region of the Northern Territory. As part of the approvals process for this development the Northern Territory Government (NTG) has requested a suite of planning documents including the development of an Environmental Management Plan (EMP) that describes a framework for the environmental management of the proposal and associated land.

The NTG has requested that the EMP include:

- The proposed management structure of the operation and its relationship to the environmental management of the site;
- Management targets and objectives for relevant environmental factors;
- The proposed measures to minimise adverse impacts and maximise opportunities, including environmental protection outcomes;
- Performance indicators by which all anticipated and potential impacts can be measured;
- Proposed monitoring programs to allow early detection of adverse impacts;
- Information on how the land will be managed if it is taken out of production;
- A summary table listing the undertakings and commitments made in the PER, including clear timelines for key commitments and performance indicators, with cross-references to the text of the PER; and
- Provision for the periodic review of the EMP itself.

This EMP uses the environmental risk analysis of the Public Environmental Review (PER) document as an outline of the potential environmental risks of this development. From this, 12 themes of environmental issues were defined:

- Water;
- Flora and fauna;
- Vegetation clearing and rehabilitation;
- Mine decommissioning and closure;
- Erosion and sedimentation;
- Noise and vibration;
- Air quality;
- Culture and heritage;
- Waste management;
- Handling, storage and disposal of dangerous goods;
- Health and safety (including biting insects and fire); and
- Community.

Each of these themes were placed into a planning framework of environmental management that describes the objectives and targets, actions to fulfil these objectives and targets, monitoring required to ensure that the actions are being effective, reporting and auditing of environmental activities, and any corrective actions required to fulfil the stated objectives.

Effectiveness of the EMP is only possible if there is the capacity to improve management responses as dictated by monitoring outcomes. This EMP will be explicitly aligned with other monitoring, auditing and reporting procedures including a Mining Management Plan and Mine Closure Plan.

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1 Introduction

Australian Ilmenite Resources (AIR) is developing an Ilmenite mine and processing facility within Numul Numul Station in the Roper River Region of the Northern Territory (Figure 1-1) known as the SILL80 Project. Engagement with stakeholders, to identify their concerns, was an integral part of early scoping for this development. Major concerns identified were management of environmental issues including ensuring stakeholder confidence in AIR's remediation of potential environmental impacts.

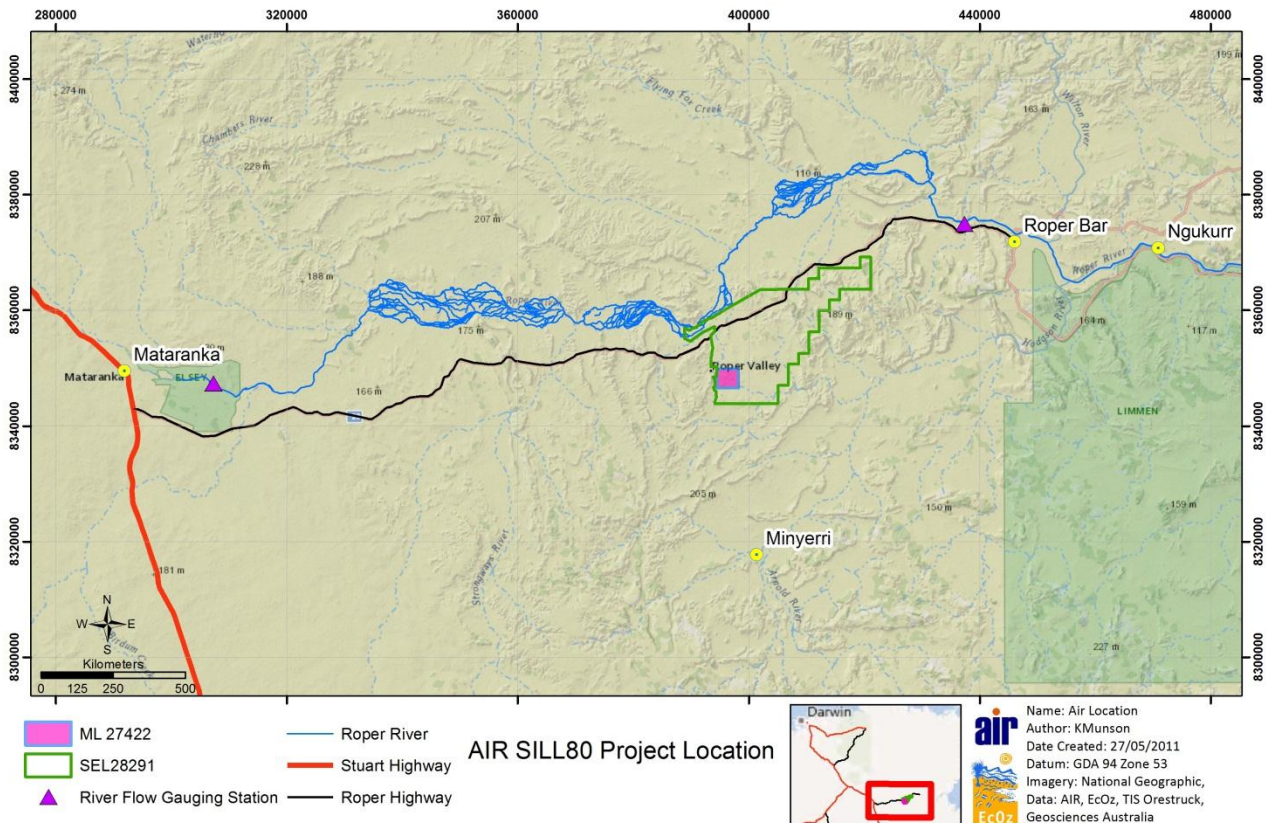


Figure 1-1. Location of Proposal.

This document describes the framework for environmental management employed by AIR; including safeguards and controls developed to ensure Environmental Impacts are minimised and promptly remedied. This report also outlines commitments for monitoring and long-term management of the site and surrounding environment.

1.1 Purpose and Scope

This Environmental Management Plan (EMP) has been prepared to cover all construction and operational activities associated with the AIR Operations on ML27422 and MLA29042. This plan has been developed to ensure implementation of commitments stated in the Public Environmental Report (EcOz Environmental Services 2012).

This EMP document covers both construction and operational phases of mining as AIR plans progressive construction works concurrent with operational works, potentially throughout the life of the mine.

The objectives of this EMP are as follows:

- To define the statutory obligations that must be fulfilled;
- To present a range of specific environmental management actions necessary to meet the requirements of the environmental assessment process;
- To provide a clear framework for effective environmental management during construction and operational activities on the project;
- To assign clear and appropriate responsibilities for the implementation of specific environmental undertakings;
- To specify monitoring regimes to enable assessment of environmental performance; and
- To facilitate self-assessment to ensure that mitigation measures are implemented.

The EMP will be reviewed and amended annually to maintain relevance to all aspects of the SILL80 project. Any updates to the EMP will be included in the Mining Management Plan (MMP) annual review.

The EMP will be used by:

- **Managers** to assist in the planning and resourcing of functions and to allow for assessment of required skills, competencies and training;
- **Geological Supervisor** to assist in the selection of workforce and equipment and to identify specific training, competencies and resources for the Project;
- **Site Supervisor (foreman)** to allow them to clearly understand specific requirements for specific tasks at specific locations;
- **Site Field Crew** to avoid spread of potential weeds, undertake appropriate water management, and minimise impact to threatened species and habitats;
- **Contractors** to avoid spread of potential weeds and minimise the risk of impact to threatened species and habitats; and
- **Auditors** to easily understand the general performance requirements of the Project and to enable each of these requirements to be checked and reviewed appropriately.

1.2 Legislative Requirements

The main Territory and Commonwealth legislation associated with this proposal are listed below:

Northern Territory Legislation

- *Aboriginal Sacred Sites Act 1989;*
- *Bushfires Act 1980;*
- *Control of Roads Act 1979;*
- *Dangerous Goods Act 1998;*
- *Environmental Assessment Act 1994 (and Environmental Assessment Administrative Procedures 2003);*
- *Local Government Act 1993;*
- *Mineral Titles Act 2010;*
- *Mining Management Act 2001;*
- *Planning Act 1999;*
- *Soil Conservation and Land Utilisation Act 1978;*
- *Territory Parks and Wildlife Conservation Act 1978;*
 - *Territory Parks and Wildlife Conservation Act Amendment Act 2005;*
- *Traffic Act 1949;*
- *Waste Management and Pollution Control Act 1998;*
- *Water Act 1992;*
- *Weeds Management Act 2001; and*
- *Noxious Weeds Act 2000.*

Commonwealth Legislation

- *Aboriginal and Torres Strait Islander Heritage Protection Act 1984;*
- *Aboriginal Land Rights (NT) Act 1976;*
- *Australian Heritage Council Act 2003;*
- *Environmental Protection and Biodiversity Conservation Act 1999;*
- *Industrial Chemicals (Notification and Assessment) Act 1989; and*
- *Native Title Act 1993.*

2 Management Framework

2.1 Definition of Terms

The following information is provided to define the terms used within this EMP, and more specifically, those terms used in Section 5.

- Objectives** Objectives help determine what level of environmental management should be achieved and the general intent of the EMP.
- Targets** Targets specify indicators to assist in determining if the objectives of the EMP are being met. They define the goal to which actions can be set.
- Actions** Specific actions undertaken to aid implementation of the EMP.
- Corrective Actions** Management strategies that are to be actioned should it be identified that targets and objectives are not being achieved.

2.2 Standards, Codes of Practice and Guidelines

The design and construction of the project will conform to relevant standards, codes and guidelines as appropriate.

Table 2-1. Relevant Standards, Codes and Guidelines.

Standards
AS/NZS 1269: Occupational Noise Management Set
AS 1678: Road Transport of Dangerous Goods
AS 1851: Maintenance of Fire Protection Systems and Equipment
AS/NZS 1940: The Storage and Handling of Flammable and Combustible Liquids
AS 2436: Guide to Noise Control on Construction, Maintenance and Demolition Sites
AS 2931: Selection and Use of Emergency Procedure Guides for the Transport of Dangerous Goods
AS/NZS 14004: Environmental management systems - General guidelines on principles, systems and support
AS/NZS 31000:2009: Risk Management
AS/NZS 14015: Environmental management - Environmental assessment of sites and organizations
Codes of Practice
National Code of Practice for the Storage and Handling of Workplace Dangerous Goods;
NT Code of Practice for Induction for Construction Work;
National Code of Practice for Manual Handling; and
National Code of Practice for the Labelling of Workplace Substances.
Guidelines
Storm water and wash down water pollution from building sites and Commercial/Industrial premises
Vehicle/plant or equipment wash down facilities
Noise guidelines for development sites
Australian and New Zealand Environment and Conservation Council (ANZECC) Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2000

2.3 Responsibilities

AIR is responsible for implementation of, and compliance with, this EMP. AIR may engage construction contractors to carry out activities such as process plant construction, haul road upgrades or pit excavations at the mine.

AIR will be responsible for ensuring that contractors comply with this EMP and for regularly monitoring the performance of the contractors. AIR will also be responsible for approval of quality management procedures and systems prepared in association with the contractors and in accordance with this EMP.

Amongst other obligations, the contractors shall be responsible for:

- Development of Systems, Procedures and Reporting mechanisms which will ensure and demonstrate in a tangible way, compliance with the EMP;
- Development and implementation of appropriate training to all staff and contractors on the requirements of this EMP. This shall range from detailed training for supervisors, through to inclusion of environmental matters in project induction for other workers; and
- Participating in audits and reviews and undertaking corrective actions and system improvements when audit and review results deem necessary.

All AIR personnel are responsible for the environmental performance of their activities and for complying with the laws of the Northern Territory (NT). Specific environmental roles and responsibilities are detailed in the following sections.

2.3.1 Managing Directors – AIR

The Managing Directors are responsible for the standard of all management, including environmental management. To assist in fulfilling this responsibility, the Managing Directors are supported by a series of specialist personnel (refer to hierarchy in Figure 2-1).

2.3.2 General Manager – Production – AIR

The General Manager - Production is responsible for actioning all required surveys, monitoring, consultations, reporting requirements and community support as committed to within this EMP. Local contractors and employees will be sourced through the General Manager - Production. The General Manager - Production will receive feedback from the Field Manager regarding on-ground achievements and conditions, and will liaise directly with the Managing Directors and Financial Director for financial guidance and company direction.

2.3.3 Field Manager – AIR

The Field Manager is responsible for ensuring that onsite environmental safeguards, surveys and monitoring, inspections and remediation are all carried out as committed to within this EMP and as directed by the General Manager - Production. The Field Manager will report back directly to the General Manager - Production with outcomes and on-ground suggestions.

2.3.4 Environmental Contractors

Externally contracted environmental consultancy staff will conduct or supervise required audits and surveys. Environmental consultants will provide reports on this work, including recommendations on environmental management backed by extensive environmental training and experience. Communications regarding logistics will be directed to the Field Manager, and management recommendations will be directed to the General Manager - Production for consideration. Environmental consultants will also work closely with the

General Manager - Production with respect to annual EMP reviews and annual submission of the Mining Management Plan.

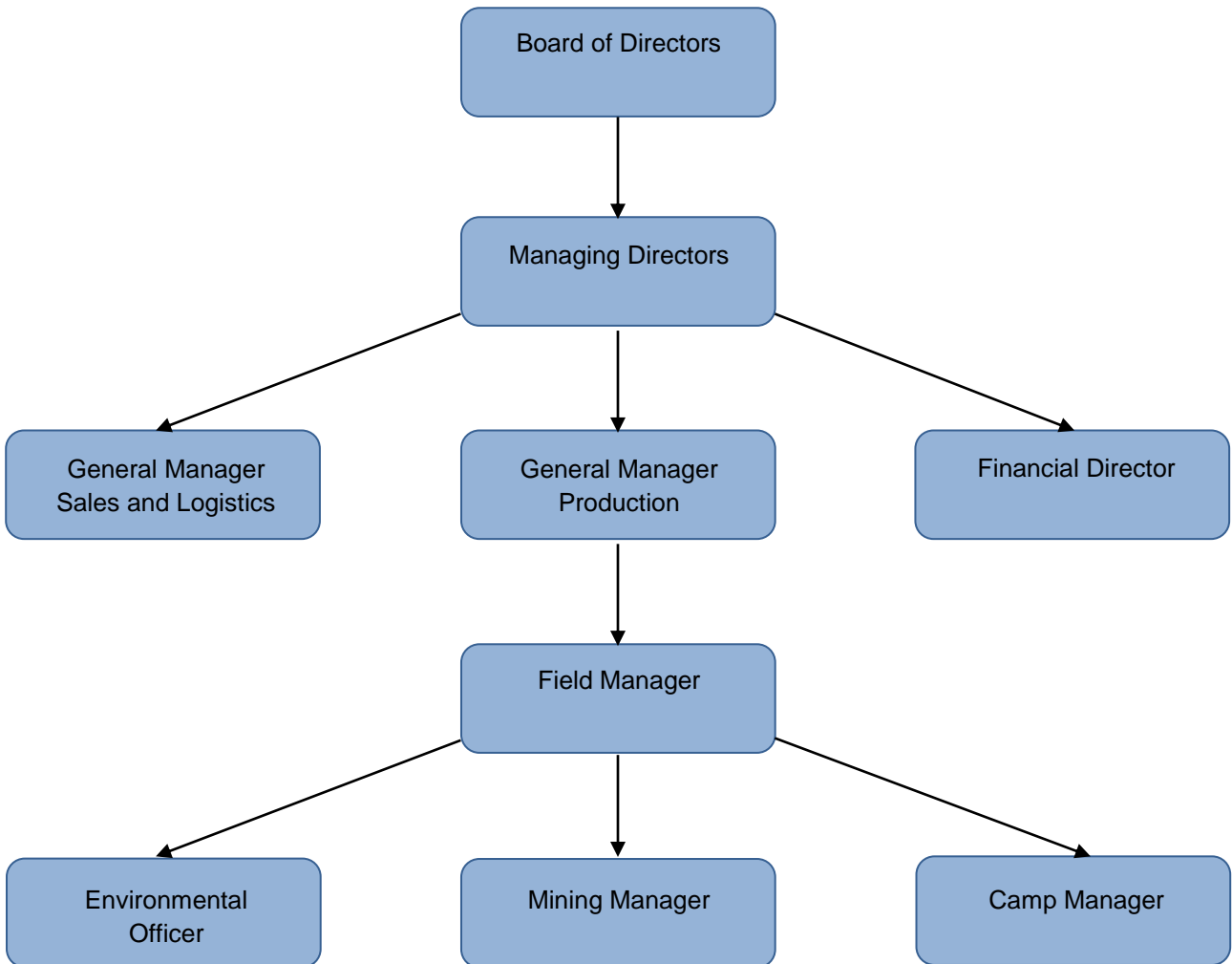


Figure 2-1. AIR Personnel Hierarchy

3 Goals and Strategies

3.1 Goals

The main aim of environmental management for this project is to ensure that the design, construction activities, rehabilitation and future operation of the mine are conducted in a manner so that, as much as possible:

- There is no unnecessary environmental degradation of the development site and adjacent areas;
- There is minimal adverse impact on the natural, social, economic and cultural values of the land and local area; and
- Where adverse impacts are unavoidable, they are contained in magnitude, time and area.

3.2 Strategic Pathways

The key strategic pathways for achievement of the goals above are:

- Avoid negative impacts through appropriate setting and design of infrastructure to minimise impacts on the surrounding environment;
- Where impacts are unavoidable, ensure strategies for management and mitigation are in place and adhered to; and
- Ensure the rapid and effective response to any identified environmental impacts.

3.3 Production Interruption

The AIR proposal occurs on land which has been used as a pastoral station for many years. Rehabilitation is aimed at re-instating a combination of native and introduced pastoral species in a healthy and productive state to increase the economic viability of the land. Should the land for any reason be taken out of production, then it is expected that it will continue to be used as a pastoral station until such time as mining is able to recommence.

4 Key Risk Summary and Management

The environmental approvals process requires, amongst other things, that the responsible government agency (NRETAS) provide guidelines identifying the key risks of the proposed development on the environment. In this instance, four key risks were identified in the Guidelines:

- (i) Extraction of water from the Roper River used for processing ore

Outcome: The proponent will demonstrate that water extraction from the Roper River will not significantly impact the aquatic environment or affect water supply to other downstream users.

- (ii) Effectiveness of the proposed rehabilitation over large areas.

Outcome: The proponent will demonstrate that impact caused by strip mining and disturbance to riparian habitats can be mitigated through effective and timely rehabilitation with appropriate species, erosion and sediment control, and weed management.

- (iii) Potential impacts to threatened species.

Outcome: Impacts to threatened species are avoided or mitigated with effective rehabilitation.

- (iv) Land use risks

Outcome: risks to current land use are identified and mitigated.

Later (Section 5), these risks, as well as subsidiary and more minor risks, are placed in an EMP framework identifying specific objectives and targets and the actions required to fulfil these targets. Monitoring programs to measure progress, reporting requirements and corrective actions are also developed.

4.1 Water

AIR will access water for processing Ilmenite from the Roper River at the waterhole currently used for extraction by Flying Fox station. Water flowing in the Roper River at the proposed point of extraction is fed by groundwater flows from the Tindal Limestone aquifer at Mataranka during the dry season and from combined rainfall, surface water flows and groundwater flows during the wet season. Groundwater in the source Tindal Limestone aquifer will be allocated under the Mataranka Water Allocation Plan to approximately 19,365 ML/year.

Water for the AIR project will be pumped via a pipeline 12 km south to the processing site. Current data indicates that the Roper River, on average, ceases to flow at Red Rock gauging station (60 km downstream of the proposed extraction point) approximately 18 days of the year, and with full allocation of groundwater entitlements from the Tindal Limestone Aquifer this would increase to 73 days per year at Red Rock (Knapton 2009). There is a subsequent future risk to environmental values and also the AIR project if ground water entitlements are fully allocated. Appendix G gives further detail about the hydrology of the Roper River.

The community of Ngukurr rely on water from the Roper River to supplement the town's groundwater supplies. Communities and cattle stations adjacent to the Roper River utilise the stream for reliable water supply. Cattle stations nearby to ML27422 have reported dams drying up late in the dry season due to extended periods of minimal to no rain and high evaporation rates. Historically, Numul Numul and Flying Fox stations have drawn water from permanent water holes in the Roper River to supplement dam and groundwater infrastructure during dry periods.

The Ngukurr community downstream of the Roper Bar divert water from the Roper River for drinking; approximately 80% of the community's water comes from the river with another 20% sourced from groundwater. Power and Water (P&W) are currently exploring options for an alternate water supply and have identified three bores, two of which are not suitable (due to presence of Barium and/or low potential extractions); a third bore closer to the river is now being examined further.

The Australian Drinking Water Guidelines recommend that communities with >1000 people (for example Ngukurr) have water quality monitoring based on a risk assessment; the outcomes of the risk assessment for the Ngukurr region is that there is bacteriological monitoring weekly and physical chemicals monitored quarterly. These are reported annually (see http://www.powerwater.com.au/news_and_publications/reports/water_quality_reports).

The diversion point for the Ngukurr community is located below Roper Bar, in the tidal section of the Roper River, therefore in an area susceptible to migration of the salt water interface during low flow conditions. Continued freshwater inflow across Roper Bar can assist in slowing salt water incursion upstream. Predicting the impact of increased water diversion on salinity within the Roper River is complicated as the geology, groundwater interaction, rainfall and water residence times all affect salinity within the system.

The primary risks to achieving environmental objectives are over-extraction leading to:

- (i) Decrease in flow and/or an increase in cease-to-flow events of the Roper River having consequences on:
 - a. Water quality at Ngukurr
 - b. In-stream ecology including threatened species.

Because of the interaction between water quality and quantity they are treated together.

Surface Water

There are concerns that extraction of water for this development may lead to deleterious changes in the hydrology of the Roper River affecting the river's integrity having a deleterious impact on threatened species and also water quality at Ngukurr.

Unrestrained extraction of water from the Roper River may lead to realisation of these concerns and, in addition, may cause an increase in the number of cease to flow events and allow the salt water interface to migrate upstream. Determining the inherent risk ranking for this development requires some restraint in that the proposed water extraction is not very large. The inherent ranking incorporates the modelling results (Appendix G) but no other specified mitigation procedures; the model concluded that:

- A 24-hour pumping schedule will have a much lower impact on minimum observed instantaneous flows at Judy Crossing and probably Red Rock.
- Evapo-transpirational (ET) losses along the section from Judy Crossing to Red Rock are approximately $0.6 \text{ m}^3/\text{s} \pm 0.1$. It would be expected that these losses would show a diurnal response, although the observed record at Red Rock shows no such daily variation. It is suggested that there is considerable buffering due to pool storage and the ET losses are observed as an averaged response. Based on this assumption it would be expected that the 12-hour pumping regime would create a similar averaged response at Red Rock and flows to the pool downstream of Roper Bar.
- Based on observed and simulated flows at Judy Crossing under recent climatic conditions (1970-2008) the maximum pumping rate should be no more than $480 \text{ m}^3/\text{hr}$ (instantaneous extraction of $0.133 \text{ m}^3/\text{s}$ or 133 L/s). This means that an upstream cut-off of $0.67 \text{ m}^3/\text{s}$ should be applied.
- Based on the 1970-2008 historic exceedances, a cut-off of $0.67 \text{ m}^3/\text{s}$ (or 670 L/s) will result in extraction being stopped for less than 1% of the time.

- Based on the historic exceedances, a cut-off of $0.67\text{m}^3/\text{s}$ (or $670\text{L}/\text{s}$) will result in extraction being stopped for 5% of the time (i.e. 18 days).

Thus it seems that abstraction at a rate of $133\text{L}/\text{s}$ will not increase cease to flow events and/or impact on water quality at Ngukurr.

Surface Water Quality Mitigation

Taking cognisance that the SILL80 Project requires only $64\text{L}/\text{s}$, the following controls are committed to:

- Maintaining the 50ML storage dam at full capacity.
- Limit abstraction to less than $100\text{L}/\text{s}$ over 24 hours.
- Observing the measuring plate at the abstraction point daily during low flows and cease abstraction when flows reach $0.90\text{m}^3/\text{s}$ or $900\text{L}/\text{s}$ (in excess of the recommended cut-off of $0.67\text{m}^3/\text{s}$ to ensure that downstream water qualities are maintained).

Should abstraction be required at a flow of $900\text{L}/\text{s}$ or less, AIR will initiate a water quality monitoring program at Ngukurr to ascertain the impact of abstracting water and permanently cease abstraction if any deterioration in water quality is observed. A monitoring program is being established to ensure that water quality and aquatic biodiversity objectives are met. Section 8.1.4 of the PER describes the aquatic monitoring program; the water quality program is outlined in PER Appendix G.

Groundwater

The groundwater level at the open pits is at approximately 35m below ground level whilst the pits will only extend to 4m below surface. Thus mining will not intersect groundwater. Groundwater will not be exploited but the geotechnical work (PER Appendix N) identified potential concerns surrounding leaching of heavy metals from the placement of tailings into the mined out open pits.

The site is underlain by a dolerite sill which is weathered at the top (about 10m deep) with hard rock dolerite beneath. The weathered strata are relatively impermeable and dry. Ground water occurs at depth in confined fractured hard rock.

Groundwater Quality Mitigation

Contingency planning and mitigation measures pertain to monitoring the impacts of migrating leachates from the rehabilitated open pits. Should these leachates migrate further than current predictions and/or contain concentrations of heavy metals in excess of trigger levels, then further investigations and assessments are to be undertaken which may employ compaction of the floors of the open pits and/or the addition of bentonite clay to the floors of the open pits to manage and mitigate the potential impacts on groundwater resources.

If the floors of the open pits are compacted and/or amended by the addition of bentonite, the risk will be reduced.

For further information refer to the AIR Water Management Plan (PER Appendix G).

4.2 Terrestrial and Aquatic Flora and Fauna

One of the studies done specifically for this development was a field and desktop study of the regional species assemblage. This work was done, in part, to identify the species that are known to or may occur within the development envelope or could be impacted by the development.

There were no listed vegetation communities in the area; nor any threatened flora found or expected. Few of the regional threatened fauna species in the area were deemed likely to be on the mine area; those that were (for example the Australia Bustard) are considered wide ranging species that would not be affected by

this development. There is the possibility of Merten's Water Monitor occurring at or nearby the extraction point. But it is thought that this development will not affect this species.

The nature of impact of this development on terrestrial and wading species of conservation significance is considered very small for two reasons. Firstly, for those species that may use the river from where water is being extracted, there is very little chance that these species will be affected as the volume of water extracted is comparatively small. Furthermore, the Water Management Plan (Appendix G of the PER) precludes any extraction beyond the sustainable limit of 20% of inflows. Secondly, for all other species the footprint of the development is relatively small compared to the distribution and habitat requirements of these species. However, it is noted that noise and dust may extend beyond the cleared area, but is not considered to be significant. It is therefore concluded that this development poses no substantial threat to any of these species.

4.3 Rehabilitation

The draft Rehabilitation Management Plan (RMP) is presented as Appendix K in the AIR PER. The rehabilitation of mine pits for this project aims to return the land back to pastoral production. The RMP outlines the process and procedures to achieve a stable soil surface (thereby partially mitigating erosion and sedimentation issues) and progressive rehabilitation. Pastoral production is the preferred end land use that has been nominated by the land owners. Specifically, the land will be rehabilitated to a healthy perennial grass rangeland with a diverse mix of plants, both native and introduced (i.e. non-declared species).

The Guidelines specifically identify riparian vegetation impacts; there is not expected to be any riparian vegetation impacts from this development.

Rehabilitation Inherent Risk Profile

There are three aspects around a failure of the rehabilitation program:

- (i) It will leave soil surface exposed giving the potential for erosion and possibly sedimentation into waterways.
- (ii) Can allow for the establishment and spread of weeds. This may also have financial implications for the land manager.
- (iii) As one of the intents of the rehabilitation program is the return of mined land to grazing land any failure will mean land will be taken out of pastoral production indefinitely potentially imposing economic implications on land managers.

Rehabilitation Mitigation

The RMP outlines the strategy to return the mined pits back to grazing land; this strategy has been developed by the land managers. The RMP also specifically outlines timeframes, objectives and a monitoring strategy to ensure effectiveness of rehabilitation.

The RMP is also supported by a Weed Management Plan; PER Appendix I. The Weed Management Plan aims to limit the introduction of new weeds to the area, the spread of weeds across the site and the establishment of weeds throughout the operations area.

An Erosion and Sedimentation Control Plan (ESCP) is presented in Appendix H. The ESCP outlines the strategy and associated commitments for managing erosion in and around the mine site and associated infrastructure.

4.4 Current Land Use

Numul Numul Station is a working pastoral lease and there are concerns that the mining operation may interfere with the pastoral operation. There are three aspects to these concerns:

- (i) Social, specifically interference from mine operations on pastoral operations such as changes to fencing and vehicle movement; this aspect also includes amenity such as noise and visual at the land manager's residence.
- (ii) Environmental, specifically changes in land and water leading to changes in pastoral productivity as well as weed invasion and disposal of wastes.
- (iii) Economic, lost production due to mine activities including land being taken out of pastoral production for the mining process and not returned due to failure of the rehabilitation program; this may also include lost pastoral productivity due to changes in hydrology.

Land Use-Social Risks and Mitigation

AIR's Mining Lease overlaps the existing Perpetual Pastoral Lease 1161, which is sub-leased from Traditional Owners through the Namul Namul Aboriginal Corporation. The SILL80 project is located within close vicinity to the Numul Numul Station homestead and its cattle management infrastructure. This includes holistic management paddocks, stockyards and laneways. Aspects of the SILL80 project may interfere with the current land use operations. For this reason a formal agreement is being developed between AIR and the current managers of Numul Numul Station – further to the lease agreement brokered with the lands traditional owners. The agreement with the land managers of both Numul Numul Station and Flying Fox Station will contain detail concerning:

- Protocol of Entry;
- Contracted Work;
- Agreement to ensure operation of pastoral lease will be maintained despite AIR's operations;
- Shared infrastructure, agreement of use and communication methods and procedures; and
- Annual Compensation.

There have been recent meetings between the parties with proposed terms and conditions being developed into a draft agreement, good faith negotiations are continuing.

Without this agreement there would be substantial potential for interference with pastoral activity. The agreement will formalise the relationship structures and on-going dialogue between these stakeholders.

The environmental risks here relate to those issues that deleteriously affect pastoral productivity and hence the economy of the pastoral lease such as weeds, altered hydrology, clearing and waste materials. These issues are dealt with in other areas within the risks section including rehabilitation, water, erosion and sediment control, and wastes.

In a strictly economic sense the land manager agreement outlines the annual compensation which is partly dependent on rehabilitation success; it is thought that this agreement should mitigate any economic loss due to mining activities.

5 Environmental Management

5.1 Water

Management of Water	
Objectives and Targets	<ul style="list-style-type: none"> • Withdrawal of water from the Roper River will not impact detrimentally on downstream users including wildlife. <p>Specifically:</p> <ul style="list-style-type: none"> – No increase in the number of cease-to-flow events; and – No negative impact on water quality. <ul style="list-style-type: none"> • Surface water resources at the mine site are not impacted. • Ground water resources at the mine site are not impacted • For the SILL 80 Project it is a stated objective to abstract less than 20% of instantaneous flow. <p>A Water Management Plan has been developed and aims to:</p> <ul style="list-style-type: none"> • Develop abstraction practices to mitigate any potential negative impacts for downstream users including wildlife. • Provide a framework for monitoring and reporting abstraction of water to the Northern Territory Government. <p>Other objectives include:</p> <ul style="list-style-type: none"> • To define the statutory obligations that must be met. • To present a range of specific management actions necessary to meet the primary objectives. • To provide a clear framework for effective water management during construction and operational activities. • To assign clear and appropriate responsibilities for the implementation of the Water Management Plan. • To specify monitoring regimes to enable assessment and ensure performance. • To facilitate self-assessment to ensure that mitigation measures are implemented.
Actions	<ul style="list-style-type: none"> • Enter a Service Level Agreement with NRETAS to receive flow rate alarm from the Red Rock gauging station as per the Water Management Plan. • Install a measuring plate at the abstraction point, calibrated against flows at the upstream (Mataranka) and downstream (Red Rock) gauging stations. • Ensure that no more than 1649ML/a is extracted from the Roper River • Development of a detailed Water Balance for the SILL80 Project (see the Water

Management of Water

	<p>Management Plan)</p> <ul style="list-style-type: none"> Obtain water quality monitoring data at Ngukurr from PowerWater’s ongoing Water Quality monitoring program (Annual Drinking Water Quality Reports) and incorporate in the annual assessment of abstraction. <p>The measures to manage and mitigate the potential impacts to surface water are:</p> <ul style="list-style-type: none"> Maintaining the 50ML storage dam at full capacity. Limit abstraction to less than 100L/s over 24 hours. Observing the measuring plate at the abstraction point daily during low flows and cease abstraction when flows reach 0.90m³/s or 900L/s (the recommended cut-off of 0.67m³/s plus an allowance to ensure that objectives and targets are exceeded). <p>Groundwater contingency planning and mitigation measures pertain to the addition of bentonite clay to the floors of the open pits to manage and mitigate the potential impacts on groundwater resources.</p> <p>Development of a monitoring program designed to:</p> <ul style="list-style-type: none"> Demonstrate that abstraction limits and monitoring will show that natural river flow is not reduced by more than 100L/s over 24 hours at any time. Detect and mitigate potential impacts from process waters seeping from the tailings placed in mined out open pits; and Confirm that abstraction at 100L/s or less (the maximum project water requirement is 64L/s) is adequate to prevent unacceptable impacts on downstream users including water supplies to the community at Ngukurr. <p>In addition, the following general actions will be observed:</p> <ul style="list-style-type: none"> As part of mine site induction, ensure that all staff are informed about obligations, including annual auditing. Devise a spill contingency plan on which to base an emergency response in case of a spill or accident involving chemicals. Use best practice road and drainage construction. Produce an annual Water Report detailing all water monitoring results from the procedures outlined in the WMP. This report will be submitted with the annual MMP update.
<p>Monitoring</p>	<p>Surface Water</p> <p>Monitor abstraction and flow in the Roper River:</p> <p><i>Location:</i> Monitoring to be undertaken at the abstraction point.</p> <p><i>Parameters:</i></p> <ul style="list-style-type: none"> Rainfall. Abstraction rates and volumes with an inline flow meter at the abstraction point.

Management of Water

- River flow height on measuring/gauging plate.
- Monitor remotely (NRETAS Website) and obtain data for the gauging stations at Mataranka Homestead (G9030176) and Red Rock (G9030250).
- Obtain water quality data for Ngukurr from Power and Water.

Frequency: Weekly

Methodology:

- Limit abstraction by installing a submersible pump with a rating of less than 100L/s and fit with an in-line flow meter.
- Install a measuring/gauging plate at the abstraction point.
- Calibrate the measuring/gauging plate using flow data from the gauging stations at Mataranka Homestead (G9030176) and Red Rock (G9030250) using flow data and surveyed cross sections upstream, at and downstream of the abstraction point.
- Set level at which measuring frequencies will become daily.
- Set level at which abstraction will cease.

Auditing:

An engineer/scientist will audit all monitoring data to ensure compliance with objectives, targets and performance criteria.

Groundwater

Location: As per groundwater monitoring bore shown in Figure 6.1 of the Water Management Plan

Parameters:

- Rainfall.
- Depth to ground water level.

Analytical Parameters

Analyte	Assessment or Trigger Value (mg/L where applicable)
pH Value	6.5 – 8.5
EC, TDS, TA and Major Cations and Anions	no more than 15% above ambient level
Leachable Metals	ADWG 2011 level below or no more than 15% above ambient concentration where the latter exceeds the ADWG
Aluminium	0.200
Arsenic	0.007
Cadmium	0.002
Chromium	-
Cobalt	-
Copper	2.000

Management of Water

Iron	0.300
Lead	0.010
Manganese	0.500
Selenium	0.010
Zinc	3.000
Molybdenum	0.050

Frequency:

- Daily: rainfall
- Monthly: ground water levels.
- Quarterly: water quality.

Auditing:

An engineer/scientist will audit all monitoring data to ensure compliance with objectives, targets and performance criteria

Reporting

Surface Water

An engineer/scientist and the Site Manager shall record all monitoring results of which a record will be kept on site for inspection and review by DoR and/or NRETAS. Tabulations and graphs will be compiled with brief notes on exceptions. These will be included in any site audits to be undertaken.

Records and reports, including a final summary, are to be submitted annually.

Where a potential non-conformance event with potential environmental impacts has occurred, the Site Manager shall immediately notify DoR and NRETAS (by telephone to be followed by e-mail within 24 hours) of the nature of the event, the measures implemented to prevent recurrence and any outcomes

Groundwater

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Records and reports, including a final summary, are to be submitted annually.

Where a potential non-conformance event with potential environmental impacts has occurred, the Site Manager shall immediately notify DoR and NRETAS (by telephone to be followed by e-mail within 24 hours) of the nature of the event, the measures implemented to prevent recurrence and any outcomes.

Corrective Actions

Surface Water

Should any environmental non-conformances, incident and/or impact occur as a direct result of the abstraction of water from the Roper, abstraction will be curtailed until suitable

Management of Water

	<p>and appropriate mitigating/corrective measures have been implemented. These are to be agreed with DoR and NRETAS</p> <p><i>Contingency Plan:</i></p> <p>Limit and/or cease abstraction.</p> <p>Groundwater</p> <p>Should any environmental non-conformances, incident and/or impact occur due to the disposal of tailings, mitigating/corrective measures will be implemented.</p> <p>Corrective actions will be implemented where an identified action or situation has the potential to impact on the environment.</p> <p><i>Contingency Plan</i></p> <p>Line open pits with a mixture of bentonite and soil to inhibit seepage of tailings water.</p>
<p>Relevant legislation, Standards and Plans</p>	<p>Legislation</p> <ul style="list-style-type: none"> • <i>Dangerous Goods Act (NT)</i> • <i>Water Act (NT)</i> • <i>Waste Management and Pollution Control Act (NT)</i> • <i>Mining Management Act</i> <p>Standards</p> <ul style="list-style-type: none"> • AS 1940 • SAA/SNZ HB76 <i>Dangerous Goods – Initial Emergency Response Guide</i> <p>Guidelines</p> <ul style="list-style-type: none"> • NRETAS <i>Erosion and Sediment Control Plan Content</i>

5.2 Flora and Fauna

Management of Flora and Fauna	
Objectives and Targets	<ul style="list-style-type: none"> • To minimise the impacts of construction activities on flora and fauna. • To minimise the potential for weed and pest introduction or spread. • No clearing of vegetation or land disturbance outside of the construction, operational and infrastructure areas, including access roads. • No incidents of significant fauna kill. • Ensure that flow downstream of the extraction point is not diminished to the extent that barriers to fish migration are exposed earlier in the dry season, or delay them being passable early in the wet season (e.g. Roper Bar).
Actions	<ul style="list-style-type: none"> • Confine clearing of vegetation to the minimum required for construction and operation of the mine and associated infrastructure such as roads. • Further and continuous monitoring to be completed to determine the presence/absence of weeds, with particular focus on Weeds of National Significance (WONS). • Clearly mark the areas to be cleared prior to land clearing. • Parking areas and turning points for plant and equipment is to be within site boundaries to minimise vegetation disturbance. • Implement a weed and pest management program to prevent weeds and pests leaving or entering the site. • Machines are to arrive on site 'clean' of weed seeds (including mud) and are to be inspected and recorded. • Ensure machinery hygiene by establishing a wash down area. • Inspect vehicles for weeds, seeds and soil prior to leaving and entering the site. • Monitoring of weeds will be conducted during construction and treatment will take place if they become visible, and weed information to be reported within the Mining Management Plan. • Maintain clean and tidy work areas to ensure native fauna are not attracted to the site, including provision of covered bins, e.g., dispose of leftover food from construction workers appropriately. • Large trees with hollows and hollow logs on the ground should be left in situ where possible, to provide nesting opportunities for native species. • As part of inductions instruct personnel to only use existing tracks and avoid off-road driving; • In inductions, educate personnel on the importance of protecting stands of native vegetation, and on measures to prevent the spread of weeds, and weed identification and reporting; • Develop reporting and action framework for any weed invasions.

Management of Flora and Fauna

	<ul style="list-style-type: none"> • Mulch all woody material cleared for use in mulch berms and rehabilitation practices as detailed in the Rehabilitation Management Plan (Appendix K) • Burn all non-woody material from clearing practices to prevent weed development and spread. • Erect fences to exclude stock and other large animals, from hazardous areas such as the processing area, mine pit and internal roads • Declared weeds (including WONS) to be managed according to the <i>Weeds Management Act</i>. Undesirable species to be managed at Land Manager and AIR discretion pending the development of improved pasture as per the Rehabilitation Management Plan.
Monitoring	<ul style="list-style-type: none"> • Monitor construction activities to ensure that land disturbance does not extend beyond the construction area. • Inspect construction site and adjacent areas for fauna deaths and for plant stress and detail information in the environmental review required as part of the Mining Management Plan. • Conduct ongoing weed monitoring during the construction and operation of the mine, especially in areas disturbed by ongoing construction activities. • Use photo monitoring points to help determine success/failure of rehabilitation.
Reporting	<ul style="list-style-type: none"> • Reporting of incidents in accordance with relevant legislation (e.g. Section 29 of <i>Mining Management Act</i>). • Internally report any fauna kills (including fish and birds at extraction point). • Internally report any evidence of plant stress as a result of construction activities. • Internally report any occurrence of additional, excessive or unapproved vegetation clearing. • Internal reports to be collated and information included in the updated Mining Management Plan. • Report any occurrence of listed weed species in the Mining Management Plan.
Corrective Actions	<ul style="list-style-type: none"> • Revise/review environmental safeguards as necessary to ensure they remain effective and applicable.
Relevant legislation, Standards and Plans	<p>Legislation</p> <ul style="list-style-type: none"> • <i>Mining Management Act</i> • <i>Endangered Species Protection Act</i> (Cth) • <i>Environmental Protection Biodiversity Conservation Act</i> (Cth) • <i>Fisheries Act</i> (NT) • <i>Weed Management Act</i> (NT) • <i>Plant Diseases Control Act</i> (NT)

Management of Flora and Fauna

- *Territory Parks and Wildlife Conservation Act (NT)*
- *Planning Act (NT)*

Guidelines

- *NRETAS Land Clearing Guidelines 2010*
- *NRETAS Land Clearing Guidelines: Riparian Vegetation*
- *NT Planning Scheme*

5.3 Vegetation Clearing and Rehabilitation

Management of Vegetation Clearing and Rehabilitation	
Objectives and Targets	<ul style="list-style-type: none"> • To minimise the impact of site clearing and disturbance to vegetation communities, and to optimise the use of cleared vegetation to encourage regeneration of cleared areas. • Minimise disturbance to native flora and fauna in accordance with approved clearing boundaries. • Minimise weed spread during clearing. • Minimise soil (particularly topsoil) degradation and loss. • To develop the land, post mining, to a combination of native and introduced species in a healthy and productive state.
Actions	<ul style="list-style-type: none"> • All clearing boundaries and approved access will be clearly shown on Project drawings and maps. • The minimum safe area only shall be cleared for pits, access road and infrastructure areas. • Cleared vegetation or soil is not to be pushed up against trunks of live trees. • Revegetate bare earth as soon as practicable to slow water run-off and improve infiltration. • Should previously disturbed areas no longer be necessary for mining activities, rehabilitation will commence in accordance with the Rehabilitation Management Plan (Appendix K). • Mulch all woody material cleared for use in mulch berms and rehabilitation practices as detailed in the Rehabilitation Management Plan (Appendix K) • Permanent fencing (3 barbwire) to be established and maintained post mining and prior to rehabilitation work
Monitoring	<ul style="list-style-type: none"> • Clearing works will be supervised closely by the Site Supervisor or the elected environmental representative to ensure that clearing is only conducted within approved boundaries. • Non Compliance and Incident Reporting will be reported to, and regulated by, senior management to ensure prompt rectification and management changes as required.
Reporting	<ul style="list-style-type: none"> • Any clearing proposed/undertaken will be reported within the Mining Management Plan. • Report progress made with progressive rehabilitation within the Mining Management Plan, including any changes to be employed in the following twelve months. • Reporting of incidents in accordance with relevant legislation (e.g. Section 29 of <i>Mining Management Act</i>). • Report any occurrences of listed weed species within the Mining Management Plan. • Report area cleared each year, and predictions for the coming year, in the annual

Management of Vegetation Clearing and Rehabilitation	
	update of the MMP
Corrective Actions	<ul style="list-style-type: none"> Rehabilitation shall be undertaken in such a way that it will be modified over time depending on results from monitoring, as per the Rehabilitation Management Plan.
Relevant legislation, Standards and Plans	<p>Legislation</p> <ul style="list-style-type: none"> <i>Mining Management Act.</i> <i>Environmental Protection and Biodiversity Conservation Act 1999.</i> <i>Territory Parks and Wildlife Conservation Act 2000.</i> <i>Heritage Conservation Act (NT) 1991.</i> <i>Aboriginal Sacred Sites Act (NT) 1989.</i> <i>Soil Conservation and Land Utilization Act 1980.</i> <i>Weeds Management Act 2001.</i> <i>Environmental Assessment Act 1982.</i> <i>Native Title Act 1993.</i> <i>Bushfires Act (NT Amendments) 2004.</i> <i>Pastoral Lands Act 1992.</i> <p>Plans and Guidelines</p> <ul style="list-style-type: none"> NT Draft <i>Land Clearing Guidelines 2009.</i> Rehabilitation Management Plan. Weed Management Plan. Erosion and Sediment Control Plan.

5.4 Mine Decommissioning and Closure

Management of Mine Decommissioning and Closure	
Objectives and Targets	<ul style="list-style-type: none"> • To rehabilitate the mine site to prevent continued degradation post mining disturbance. • To establish realistic and achievable closure criteria, in consultation with key stakeholders, within the first two years of the mine life. • To monitor progress towards and continually consider closure criteria with respect to mining operations. • Achievement of closure criteria. • Compliance with applicable legislation.
Actions	<ul style="list-style-type: none"> • Develop an appropriate environmental monitoring program to determine progress towards closure criteria and timelines to completion. • Clean-up of all contaminated areas. • Ongoing consultations with the land owner and native title holders will include assessment of planned and existing infrastructure that may be of value to others; particularly the sheds and access roads. • General landform will be rehabilitated according to the best practice and end use requirements. • A Closure Plan, with clear, achievable closure actions, will be developed once the major mine expansions have been finalised and at least two years prior to planned closure. • Upon mine closure, all disturbed areas to be rehabilitated to be free draining where practical, and septic tanks and other artificial receptacles to be removed. • Upon mine closure, AIR to engage a suitably qualified botanist to perform a weed survey of the mining area with recommendations on measures for any identified weeds prior to closure.
Monitoring	<ul style="list-style-type: none"> • Closure Audits will be conducted to ensure that the closure actions have been successful and closure objectives have been met.
Reporting	<ul style="list-style-type: none"> • Non Compliance and Incident Reporting will be reported to, and regulated by, senior management to ensure prompt rectification and management changes as required.
Corrective Actions	<ul style="list-style-type: none"> • Continuous consultation will occur throughout the life of mining to establish requirements for closure so that ample planning can be made well before closure.
Relevant legislation, Standards and Plans	<p>Legislation</p> <ul style="list-style-type: none"> • <i>Mining Management Act 2001.</i> • Mining Regulations 1998. • <i>Mineral Titles Act 2010.</i>

Management of Mine Decommissioning and Closure

- *Native Title Act 1993.*

Guidelines and Plans

- AIR Mining Management Plan & Rehabilitation Management Plan
- Department of Resources Mine Close Out Objectives (February 2008)
- ANZMEC/MCA (2000), *Strategic Framework for Mine Closure*. Australian and New Zealand Minerals and Energy Council and Minerals Council of Australia. Canberra, Australian Capital Territory
- Association of Mining and Exploration Companies *Mine Closure Guidelines* (AMEC, 2000)
- Australian Mining Industry Council (1989), *Mine Rehabilitation Handbook*
- Commonwealth Guidelines for Mine Closure and Completion (March 2009)
- Commonwealth Guidelines for Mine Rehabilitation (October 2006)

5.5 Erosion and Sedimentation

Management of Erosion and Sedimentation	
Objective and Targets	<ul style="list-style-type: none"> • Control soil erosion and sediment generation from areas disturbed by construction and mining activities; and • Minimise potential project related activities resulting in decreased water quality (particularly suspended solids) in the receiving environment. • Minimise the extent and duration of soil disturbance; • Maintain all erosion and sediment control measures in proper working order, at all times; • Monitor the site and adjust erosion and sediment control practices to maintain the required performance standard; • Control water flow from the top of and through the project area by diverting up-slope 'clean' water away from disturbed areas and ensuring that concentrated flows are below erosive levels and sediment is retained from disturbed areas; • Conserve topsoil for later site rehabilitation or regeneration (in a stabilised stockpile that is appropriately managed for weeds); • Rehabilitate disturbed lands quickly; • Ensure stormwater is managed to protect the receiving environment; • No obvious accumulation of sediment within natural watercourses or drainage lines outside of the construction area; • No unnecessary disturbance of earth or vegetation outside areas to be cleared or disturbed; • All batters or embankments with slopes greater than 1:4; and • Conformance to the AIR Erosion and Sediment Control Plan (ESCP).
Actions	<ul style="list-style-type: none"> • Design any drainage systems operating for the life of the mine so that they do not cause erosion. This will involve the construction of a level spreader at the point of discharge into intact vegetation; • Divert runoff around the mine site where possible, to minimise water flowing from upstream catchments to operational areas; • Design the final mine geometry to create a landform that allows free drainage of surface runoff while minimising erosion; • Stage open cut mining during the dry season so pit areas are either open and capturing water during the wet season or rehabilitated to greatly minimise the erosive potential of the refilled pit surface; • Capture stormwater infiltrating into pits for reuse as part of the overall water-management strategy for the site to avoid or reduce discharge of polluted water. • Ensure both temporary earthworks and permanent land-shaping provide a landform

Management of Erosion and Sedimentation

	<p>which minimises erosion hazard.</p> <ul style="list-style-type: none"> • Design temporary surface-water collection, conveyance and disposal systems in a manner which minimises erosion. • Where possible, stormwater should be diverted around any active or rehabilitated mine areas. This will minimise both the flow rate and volume of runoff reducing erosion and sediment transport from these areas and maintain local hydrology within surrounding areas. • All road design to follow the general principles and procedures outlined in the ESCP. • Erosion and sediment monitoring to be conducted over established roads in the project area in line with the Erosion and Sediment Control Plan. <p>The following sediment and erosion control devices and stormwater management controls will be implemented on the site (see PER Appendix H for more information);</p> <ul style="list-style-type: none"> • Construction Entry/Exit Shake Down – Used to prevent the tracking of sediment from tyres of vehicles to public roads; • Catch drain – Used to convey clean water flows toward a level spreader for discharge into intact vegetation and flows from disturbed areas to sediment basins and water storage pits; • Diversion banks – Used to convey clean water flows toward a level spreader for discharge to intact vegetation • Sediment Basin – Used to trap and retain sediment via settlement of suspended particles; • Mulch Bund (Batter) – Used to reduce the velocity of treated water discharged from the sediment basins in addition to providing a further degree of treatment; and • Silt fences.
<p>Monitoring</p>	<p>Construction</p> <p>Undertake a series of data collection exercises to define the existing stormwater quality. This will comprise the collection of water samples after the following rainfall events:</p> <ul style="list-style-type: none"> • 3 storm events of greater than 25 mm; and • 3 smaller rainfall events. <p>Analysed samples for total suspended solids (TSS), pH, dissolved oxygen (DO) and hydrocarbons with the results being used as water quality indicators for construction phase monitoring.</p> <p>Operations</p> <p>The site is to be monitored for the following:</p> <ul style="list-style-type: none"> • Visible evidence of deterioration of water quality of downstream watercourses that is directly attributable to the site (e.g. high turbidity); • Visible significant erosion; and/or

Management of Erosion and Sedimentation	
	<ul style="list-style-type: none"> • Failure of control measures.
Reporting	<ul style="list-style-type: none"> • Monitoring reports will be compiled as part of the annually reviewed Mining Management Plan. • Reporting of incidents in accordance with relevant legislation (e.g. Section 29 of <i>Mining Management Act</i>).
Corrective Actions	<ul style="list-style-type: none"> • Locate source of water quality deterioration; • Prevent continuing deterioration with temporary controls; • Repair existing controls, construct additional controls or modify procedures to prevent future deterioration in water quality; and • During the operational phase of the development, if there is a significant deterioration in water quality, the management plan and strategies will be reviewed.
Relevant Legislation, Standards and Plans	<p>Legislation</p> <ul style="list-style-type: none"> • <i>Mining Management Act</i> (NT) • <i>Water Act</i> (NT) • <i>Waste Management and Pollution Control Act</i> (NT) • <i>Soil Conservation and Land Utilisation Act</i> (NT) <p>Guidelines and Plans</p> <ul style="list-style-type: none"> • NRETAS Erosion and Sediment Control Plan Content (2006) • The guidelines put forth by the International Erosion Control Association (IECA 2008). • Department of Health and Families <i>Guidelines for preventing mosquito breeding sites associated with mining sites, NT</i> (2005) • IEAust. <i>Soil Erosion and Sediment Control Engineering Guidelines for Queensland Construction Sites</i> (June, 1996)

5.6 Noise and Vibration

Management of Noise and Vibration	
Objective and Targets	<ul style="list-style-type: none"> • Ensure that noise from the proposed construction works comply with the requirements of the <i>Waste Management and Pollution Control (Administration) Regulations</i>. • Minimise complaints due to noise and vibration.
Actions	<ul style="list-style-type: none"> • Implement noise minimising practices as per section 6 of AS2436: <ul style="list-style-type: none"> – Utilise best practice equipment to minimise noise where reasonably practicable; – Use plant in accordance with the manufacturer's instructions; – Site noisy equipment away from noise-sensitive areas (e.g. Numul Numul Homestead); – Carry out loading and unloading operations away from noise-sensitive areas; – Orientate plant known to emit noise strongly in one direction, so that the noise is directed away from noise-sensitive areas where possible; – Shut down or throttle down machines that are used intermittently during intervening periods between works; – Ensure engine covers fitted to machines are closed when the machine is in use; – Regularly maintain stationary and mobile equipment including off-site vehicles to keep noise levels near to that of new machinery; – Maintain all machinery such that mufflers are replaced appropriately; – Equipment used on the construction site is to be the quietest reasonably available; and – Vehicle, plant and machinery emissions will be minimised by regular inspections to ensure equipment are well maintained and in good working order.
Monitoring	<ul style="list-style-type: none"> • Conduct internal, informal monthly audits on site of work practices and condition of equipment and report identified issues, and mitigation employed, within the Mining Management Plan. • Maintain up to date records on site of all noise and vibration complaints and incidents in a community complaint register and report within the Mining Management Plan.
Reporting	<ul style="list-style-type: none"> • Reporting of incidents in accordance with relevant legislation (e.g. Section 29 of <i>Mining Management Act</i>).
Corrective Actions	<ul style="list-style-type: none"> • Identify the source of any noise complaint and appropriate mitigation measures, such as making adjustments to work practices and/or maintaining or replacing equipment as required.
Relevant Legislation and Standards	<p>Legislation</p> <ul style="list-style-type: none"> • <i>Mining Management Act</i> (NT) • <i>Waste Management and Pollution Control Act</i> (NT) • <i>Waste Management and Pollution Control (Administration) Regulations</i> (NT) • <i>Workplace Health and Safety Act</i> (NT) • <i>Work Health (Occupational Health and Safety) Regulations</i> (NT) <p>Standards</p> <ul style="list-style-type: none"> • AS 1055 Description and measurement of environmental noise

Management of Noise and Vibration

- AS 2012 Measurement of airborne noise emitted by earth-moving machinery and agricultural tractors
- AS 2221 Methods for measurement of airborne sound emitted by compressor units including prime movers and by pneumatic tools and machines
- AS 2436 Guide to noise control on construction, maintenance and demolition sites
- AS 2659 Guide to the use of sound-measuring equipment

5.7 Air Quality

Management of Air Quality	
Objective and Targets	<ul style="list-style-type: none"> • Ensure that air emissions from construction and operation of the mine are minimised. • No complaints regarding dust or other air quality issues resulting from construction activities.
Actions	<ul style="list-style-type: none"> • Rehabilitation to stabilise any areas exposed or disturbed to minimise dust generation. • Suppress dust on haul roads, unsealed roads and work areas using water trucks as required. • Dampen earth stockpiles to minimise wind erosion, or provide grass/vegetative cover on any longer term stockpiles. • Provide adequate water supply for the above activities. • Whenever possible, avoid conducting dust generating activities during high wind speed conditions. • Cover haul trucks to reduce spillage and dust generation. • Burning activities are not allowed on site at any time except for that specified in section 5.2. • Undertake regular maintenance of all construction machinery and vehicles. • Direct exhaust emissions from mobile plant away from the ground. • Limit vehicle, plant and machinery speeds when not driving on sealed surfaces. • Spraying of paint and other materials that have potential to become air borne particulates will not be undertaken during windy or rainy conditions. • Complaints received will be recorded and attended to promptly. On receiving a complaint, works will be reviewed to determine whether issues relating to the complaint could be avoided or minimised. Feedback will be provided to the complainant explaining what outcomes resulted.
Monitoring	<ul style="list-style-type: none"> • Conduct internal, informal monthly audits of site work practices and condition of equipment. Formally audit work practices and condition of equipment annually and report in the Mining Management Plan, with particular focus on issues and mitigation measures. • Maintain up to date records on site of all air quality complaints (internal or external).
Reporting	<ul style="list-style-type: none"> • Reporting of incidents in accordance with relevant legislation (e.g. Section 29 of the <i>Mining Management Act</i>).
Corrective Actions	<ul style="list-style-type: none"> • Identify the source of any air quality complaints and implement appropriate mitigation measures e.g. adjusting work practices and/or maintaining or replacing equipment as required.
Relevant Legislation and	Legislation

Management of Air Quality

Standards

- *Mining Management Act (NT)*
- *Fire and Emergency Act (NT)*
- *Waste Management and Pollution Control Act (NT)*
- *Workplace Health and Safety Act (NT)*

Standards

- *AS 2724.3 Ambient air Particulate matter – Determination of total suspended particulates (TSP) – High volume sampler gravimetric method*
- *AS 3580 Methods of sampling and analysis of ambient air*

5.8 Culture and Heritage

Management of Culture and Heritage	
Objective and Targets	<ul style="list-style-type: none"> • Developing an understanding of specific stakeholder interests and implications from the project on individual groups; • Working closely with all interested parties to seek mutually beneficial outcomes; • Ensuring transparency internally and externally regarding plans, decisions and changes; • Incorporating, where possible, the knowledge, skills and experience of stakeholders; • To preserve and protect Aboriginal and non-indigenous heritage sites of significance from damage or desecration and comply with statutory requirements. • No known or suspected archaeological places or objects to be disturbed except with the express permission of the relevant authority following an assessment of the feature and its significance and implementation of an appropriate management strategy.
Actions	<ul style="list-style-type: none"> • Ensure that all works are completed in accordance and with regard to any Aboriginal Areas Protection Authority (AAPA) conditions. • AIR will follow a strict protocol of contractor induction covering all topics related to culture and heritage, for example, management and awareness of cultural assets within the lease area. • No disturbance to known archaeological, historical or cultural features, this may be through limiting access (fencing) and / or educational programs and campaigns to raise awareness, including but not limited to signage. • Immediate cessation of works if historical or cultural material found or suspected. • Immediate assessment of any new archaeological, historic or cultural discoveries during works. • Site Induction including ‘cease work’ protocols and access limitations. • Maintenance of landowner property access at all times, where fences are breached temporary stock proof gates will be provided. • Minimise disruption to landowners and third parties where possible. • Regular communication with TO's to ensure access is not an issue. • Installing a speed limit of <40 km per hour on all access roads. • Promoting training to allow stakeholders/community members to undertake specific management tasks such as surveying or rehabilitation. • Engaging stakeholders/community members as contractors to undertake specific tasks. • Clearly delineate “Restricted Work Areas” as determined by the AAPA certificate.
Monitoring	<ul style="list-style-type: none"> • Monitor contractors/employees compliance with all actions.

Management of Culture and Heritage	
	<ul style="list-style-type: none"> • Monitor procedures developed and implemented to protect heritage places and items to ensure they are providing adequate protection. • Monitor throughout earthwork activities for evidence of archaeological material.
Reporting	<ul style="list-style-type: none"> • Regular internal and external audits. • Non-compliance and incident reporting, in accordance with relevant legislation.
Corrective Actions	<ul style="list-style-type: none"> • If heritage items/places are damaged in any way as a result of construction activities, notify the Mining Manager and await advice on the implementation of remedial action.
Relevant Legislation	<p>Legislation</p> <ul style="list-style-type: none"> • <i>Aboriginal and Torres Strait Islander Heritage Protection Act (Cth)</i> • <i>Aboriginal Land Rights (Northern Territory) Act (Cth)</i> • <i>Australian Heritage Council Act (Cth)</i> • <i>Native Title Act (Cth)</i> • <i>Aboriginal Land Act (NT)</i> • <i>Aboriginal Sacred Sites Act (NT)</i> • <i>Heritage Conservation Act (NT)</i>

5.9 Waste Management

Waste Management	
Objective and Targets	<ul style="list-style-type: none"> • Minimise the production of waste wherever possible. • Minimise wastes and pollution entering the surrounding environment. • To manage and control the disposal of all unavoidable wastes. • Appropriate disposal of wastes generated from construction activities and the ongoing operation of the Mine. • Waste handlers and receiving facilities are appropriately licensed.
Actions	<ul style="list-style-type: none"> • Permanent and temporary storage facilities for any fuels or chemicals to be designed as per Australian Standards or relevant guidelines. • Assessment of impact from high rainfall events, water holding capacity of soils and design of recycled and storm water storage basins to prevent any discharges. • Undertake induction and training of construction workforce to ensure awareness of waste management responsibilities. • All products and wastes stored on site must be kept in accordance with Australian Standards (and MSDS, where appropriate) and in a clean and tidy condition. • Waste and containers not able to be recycled will be disposed of at the landfill. • Segregation of wastes including inert building and construction material. • Consider principles to avoid, reduce, reuse and recycle where possible. • Ensure any regulated wastes generated on site are transported and disposed of by an appropriately licensed contractor. • Waste oil will be sent to approved recyclers where appropriate. • During construction provide putrescible waste bins for storage of domestic wastes (e.g., food, paper, and wrappers) prior to removal to the landfill. Putrescible waste bins are to be covered at all times.
Monitoring	<ul style="list-style-type: none"> • Monitor the effectiveness of waste management and review procedures and submit within the Mining Management Plan.
Reporting	<ul style="list-style-type: none"> • Reporting of incidents in accordance with relevant legislation (e.g. Section 29 of <i>Mining Management Act 2001</i> and Section 14 of the <i>Waste Management and Pollution Control Act 1998</i>).
Corrective Actions	<ul style="list-style-type: none"> • Undertake remedial action as necessary for the management of waste. • Amend procedures relating to waste management if found to be inadequate after monitoring.
Relevant Legislation and Standards	<p>Legislation</p> <ul style="list-style-type: none"> • <i>Mining Management Act</i> (NT) • <i>Dangerous Goods Act</i> (NT)

Waste Management

- *Public Health Act (NT)*
- *Waste Management and Pollution Control Act (NT)*
- *Water Act (NT)*

5.10 Handling, Storage and Disposal of Dangerous Goods

Handling, Storage and Disposal of Dangerous Goods	
Objectives and Targets	<ul style="list-style-type: none"> • To ensure that transport, storage and handling of dangerous goods on-site does not cause environmental harm or harm to persons. • To minimize potential for land contamination. • Nil human health issues from the use of Dangerous Goods.
Actions	<ul style="list-style-type: none"> • An Emergency Response Plan will be in place and employees inducted in its application. • Hydrocarbons will be stored in appropriately bunded areas according to Australian standards (e.g. AS1940:1993). • Any licences required for storage will be obtained. • Bunding will be inspected for damage regularly and repaired as soon as is practicable if any damage is detected. • Hazardous substances will be stored on site in accordance with the relevant legislative requirements and guidelines. • Storage facilities will be inspected regularly. • All personnel will be trained in the appropriate handling of the various chemicals to be stored on site. • All trucks carrying potentially dangerous goods in or out of the mine will be covered. • A qualified person will be appointed as Site Safety Adviser and will have on-site a set of the relevant MSDS for hazardous and dangerous materials. • Personnel working with dangerous goods will be aware of handling, storage and disposal requirements and as appropriate, have received relevant training. • Waste dangerous goods which cannot be recycled will be transported to a designated disposal site as approved by Local Government. • Spills of dangerous goods will be rendered harmless and collected for treatment and disposal at a designated site, including cleaning materials, absorbents and contaminated soils. • Spill kits to be strategically placed around the site with particular attention to high risk areas i.e. fuel storage and transfer areas. All staff to be appropriately trained in spill response procedures and in the use of spill kits. • Absorbent and containment material (e.g. absorbent matting) and neutralising material will be available where hazardous materials are used and stored and personnel trained in correct use. • Protective clothing, appropriate to the materials in use, will be provided. • Refuelling on site shall utilise auto shut off valves and refuelling shall not be done within 100 metres of a watercourse, water hole, lake or swamp.

Handling, Storage and Disposal of Dangerous Goods	
Monitoring	<ul style="list-style-type: none"> Regular monitoring (at least quarterly) shall be undertaken to ensure compliance with actions. Regular audits and reviews in accordance with this EMP will be undertaken, and recommendations and corrective actions shall be implemented. Audits shall include inspection of storage facilities and records for hazardous goods.
Reporting	<ul style="list-style-type: none"> Non-Compliance and Incident Reporting will be reported to, and regulated by, senior management to ensure prompt rectification and management changes as required. Reporting in accordance with relevant legislation (e.g. Section 29 of <i>Mining Management Act 2001</i> and Section 14 of the <i>Waste Management and Pollution Control Act 1998</i>). Any non-compliance / incident will be reported annually in the Mining Management Plan.
Corrective Actions	<ul style="list-style-type: none"> If there is any contamination of the environment by hazardous goods, this will be investigated and appropriate remedial actions taken to avoid recurrence. Storage and handling procedures will be reviewed as appropriate. Should any evidence of ground contamination be found the flow path to drains and watercourses will be cut off by sand bags or earthen bunds.
Relevant Legislation and Standards	<p>Legislation</p> <ul style="list-style-type: none"> <i>Mining Management Act</i> <i>Waste Management and Pollution Control Act (NT) 1998.</i> <i>Public Health Act (NT) 1997.</i> <i>Dangerous Goods (Road and Rail Transport) Act 2001.</i> Dangerous Goods (Road and Rail Transport) Regulations 2004. Petroleum (OHS) Regulations <i>Water Act 1992.</i> <i>Waste Management and Pollution Control Act 1998.</i> <i>Work Health Act and Regulations 2004.</i> <p>Standards and Plans</p> <ul style="list-style-type: none"> Environmental Health Information Bulletin No. 6 Requirements for Mining, Construction & Bush Camps, NT DHCS 2006. <i>AS/NZS 1940:1993 The storage and handling of flammable and combustible liquids.</i> <i>National Standards for the Storage and Handling of Dangerous Goods [NOHSC:1015(2001)].</i>

Handling, Storage and Disposal of Dangerous Goods

- *National Code of Practice for the Storage and Handling of Workplace Dangerous Goods [NOHSC:2017(2001)].*

5.11 Health & Safety (Incl. Biting Insects & Fire)

Management of Health & Safety (Incl. Biting Insects & Fire)	
Objective and Targets	<ul style="list-style-type: none"> • Prevent the potential of increasing mosquito populations through appropriate water storage. • Reduce the potential for contact between personnel and mosquitoes. • To ensure all personnel are aware of environmental obligations relating to construction and future operation of the mine to minimise the risk of an environmental incident. • To protect life and property within the mine during construction and operations. • No new biting insect breeding habitats created and no increase in mosquito numbers due to construction and operational activities.
Actions	<ul style="list-style-type: none"> • Once mining and processing begins, AIR is to conduct a radiological survey over the stockpile and processing area (see Radiation Assessment Report PER Appendix F). • Transport of Ilmenite to Port of Darwin to be in covered trailers • Sediment traps that cannot be free draining within 5 days must be steep sided and have a sloping bottom base to one end, with erosion protection (e.g. reno mattress) at the inflow and overflow facility. • Sediment traps should be maintained by silt and vegetation removal on a bi-annual basis, prior to and immediately following the wet season. There should be a designated access path for silt removal. • Sediment traps with dry season low flows should be sampled for mosquito larvae periodically in the dry season by AIR personnel and appropriate mosquito control programs arranged as required. • Natural drainage patterns should be maintained where possible. Access roads across drainage lines may need to be fitted with culverts of sufficient size to prevent upstream flooding for periods that will enable mosquito breeding. Culverts should be installed flush with the upstream surface level. Erosion prevention structures will need to be constructed on the downstream side of any culvert, and erosion prevention structures may also be required at the headwalls of any culvert. • Any structures that have disrupted surface drainage should be removed at the end of the mining operations. • Rainwater tanks must be adequately screened to prevent entry by mosquitoes. • Any container capable of holding water e.g. machinery tyres, drums, disused tyres, tanks, pots etc. should be stored under cover, be provided with drainage holes, emptied on a weekly basis, treated with appropriate insecticide on an appropriate schedule, or disposed of in an appropriate dump site to prevent the formation of mosquito breeding sites. • No used tyres, machinery or other containers that have previously held rain water should be brought to the NT from Queensland unless the containers or machinery has been thoroughly treated with chlorine or an appropriate insecticide to remove the possibility of the introduction of drought resistant eggs of exotic <i>Aedes</i> mosquito

Management of Health & Safety (Incl. Biting Insects & Fire)

	<p>species.</p> <ul style="list-style-type: none"> • Any drainage line directed into a dam must be fitted with a sediment trap or erosion prevention structures just upstream from the dam. • Any overflow areas from dams should have erosion protection measures to prevent the creation of plunge pools. • Infrastructure will be designed to minimise potential mosquito breeding sites. • Periodic cleaning of vegetation and silt from around sediment dams and water impoundments. • Maintenance of septic systems to prevent mosquito breeding opportunities. • Periodic removal of potential artificial breeding sites. • Clean all equipment sourced from North Queensland with 10% chlorine. • Screening of all residential, eating and recreational areas. • Installation of thick curtains inside buildings and yellow lights outside buildings to minimise mosquito attraction to light sources. • Incorporate awareness of disease risk and prevention into the site induction to increase personnel awareness and responsibility to avoid contact with mosquitoes. • Reinforce awareness during breeding season through periodic reminders of risk and prevention. • Maintain a record of events including, but not limited to the following: <ol style="list-style-type: none"> 1. The location of the emergency or incident; 2. The details (name and telephone number) of the person reporting the incident; 3. The estimated time of the release; 4. The environmental harm and/or environmental nuisance caused, threatened, or potentially caused by the release; and 5. Action taken to prevent further release and to mitigate any environmental harm and/or environmental nuisance caused by the release. • Ensure dangerous objects or articles, such as sharp or toxic materials and hazardous waste (solid and liquid), are securely fixed in vehicles to prevent injury to personnel. • Ensure that there is no burning on the site except that specified in section 5.2. • Ensure fire breaks are maintained on site and in adjacent bushland to protect both the development and nearby associated environment.
<p>Monitoring</p>	<ul style="list-style-type: none"> • Trapping of adult mosquitoes once a month for the initial 12 months of mine operation to develop a baseline mosquito monitoring program. • Inspection of potential breeding sites during peak breeding times. • Isolation of personnel suspected of having the malaria virus to prevent contact with mosquitoes;

Management of Health & Safety (Incl. Biting Insects & Fire)	
	<ul style="list-style-type: none"> • Monitor and record all construction-related pollution occurrences. • Monitor and record all construction-related fire occurrences on the construction site and adjacent properties. • Inspect emergency response procedures monthly. • Inspect all fuel and chemical storage facilities monthly to ensure integrity of tanks, bunding and any associated infrastructure.
Reporting	<ul style="list-style-type: none"> • Notify the Mine Manager of any environmental or safety incidents and, where required, the relevant authority. • Report all construction-related pollution occurrences. • Report any fires as soon as possible. • Report any biting insect outbreaks as soon as possible. • Report any pollution occurrences or biting insect outbreaks to the appropriate authority. • Report any occurrence of mosquito borne disease. • All of the above are to be included within the Mining Management Plan and reported on annually. Information should include what incidents occurred, where they occurred, what action was taken and what changes have been made to reduce likelihood of recurrence.
Corrective Actions	<ul style="list-style-type: none"> • Amend procedures relating to incident and safety management if found to be inadequate. • Undertake remedial action as necessary to mitigate any pollution, fire or biting insect incidents/disease. • Application of a suitable barrier insecticide such as bifenthrin should mosquito problems arise.
Relevant Legislation, Standards and Guidelines	<p>Legislation</p> <ul style="list-style-type: none"> • <i>Bushfires Act</i> (NT) • <i>Dangerous Goods Act</i> (NT) • <i>Disasters Act</i> (NT) • <i>Fire Services Act</i> (NT) • <i>Public Health Act</i> and Regulations (NT) • <i>Workplace Health and Safety Act</i> (NT) <p>Guidelines</p> <ul style="list-style-type: none"> • Department of Health and Families <i>Guidelines for preventing mosquito breeding associated with construction practice near tidal areas in the NT 2005</i> • Medical Entomology Guidelines:

Management of Health & Safety (Incl. Biting Insects & Fire)

- Mosquito breeding and sewage pond treatment in the Northern Territory
- Constructed wetlands in the Northern Territory – Guidelines to prevent mosquito breeding

5.12 Community

Community	
Objective and Targets	<ul style="list-style-type: none"> • Building long term relationships which can develop and adapt over the life of the project. • Developing an understanding of who is involved and how each group may be affected by decisions. • Working closely with all interested parties to seek mutually beneficial outcomes. • Ensuring transparency internally and externally regarding plans, decisions and changes. • Incorporating, where possible, the knowledge, skills and experience of stakeholders. • Being flexible in how information is sourced and provided and being adaptable to change. • Employ a minimum of 3 indigenous people from local communities equating to a 12% indigenous employment commitment • To minimise negative social and economic impacts on the surrounding area during construction and the ongoing operation of the mine.
Actions	<ul style="list-style-type: none"> • AIR will follow a strict protocol of contractor induction covering the following topics as a minimum: <ul style="list-style-type: none"> - General health and safety; - Environmental management and awareness; - Management and awareness of cultural assets within the lease and surrounding area; and - Identification of 'cease work' protocols and access limitations; - Waste management. • No disturbance to known archaeological, historical or cultural features, this may be through limiting access (fencing) and / or educational programs and campaigns to raise awareness, including but not limited to signage. • Immediate assessment of any new archaeological, historic or cultural discoveries during works. • Immediate cessation of works if historical or cultural material found or suspected. • Maintenance of landowner property access at all times, where fences are breached temporary stock proof gates will be provided. • Minimise disruption to landowners and third parties where possible. • Regular communication with TO's to ensure access is not an issue. • Consultation meetings held as required. • Grading and maintenance work carried out regularly to access tracks particularly following the wet season.

Community	
	<ul style="list-style-type: none"> • Speed limit of <40 km per hour on all access roads. • Promoting training to allow stakeholders/community members to undertake specific management tasks such as surveying or rehabilitation. • Engaging stakeholders/community members as contractors to undertake specific tasks. • Provide a list of local businesses and individuals with relevant skills and services to all contractors to promote local economic growth; Display list within the camp for employee use and update annually. • Develop a standard operating procedure (SOP) aimed at limiting accidents particularly on the Roper Highway.
Monitoring	<ul style="list-style-type: none"> • Monitoring river levels over time to gauge the impact and compare to historic data. • Metering of overall abstraction from the river. • Regular monitoring of cultural/historical sites to determine any impacts. • Routine dust monitoring. • Monitoring of rehabilitated land to ensure end function is being achieved. • A continuous review process will be followed to incorporate any changes in circumstances, along with regular internal and external auditing. • Regular monitoring and review of potential and realised issues is essential in determining success and the need for adaptive management. Monitoring will be carried out through continued consultation with stakeholders and members of the local community including pastoralists and Traditional Owners. Key aspects of monitoring will be: <ul style="list-style-type: none"> - Consultation feedback; - Internal and external auditing; - Feedback received ad hoc, both positive and negative; and - Assessment of level and type of support and services provided to local communities. • Moves will also be made to work collaboratively with other mine operators in the region to determine whether social impacts are being felt at a regional level and whether a strategy should be developed collectively over a wider area. • Results and findings from monitoring will be fed back into management plans and strategies to allow for continual improvements and adaptive management. • Regular inspection of work areas conducted to assess effectiveness of protection measures. • Non-compliance and incident reporting. • Regular inspections (at least quarterly) will be conducted to assess effectiveness of archaeological/historical site management.

Community	
Reporting	<ul style="list-style-type: none"> • Maintain community complaint register. • Notify Mine Manager of any complaints or controversial issues that may arise.
Corrective Actions	<ul style="list-style-type: none"> • Implement ameliorative actions as necessary that arise from community liaison. Implement measures to prevent recurrence. • If any damage is found to be occurring to areas important to the community (tourism, cultural, historic), then immediate action must be taken to report and repair the problem, and the appropriate authorities notified, as required.
Relevant Legislation and Standards	<ul style="list-style-type: none"> • <i>Aboriginal Land Rights (Northern Territory) Act 1976</i> • <i>Native Title Act 1993</i> • <i>Pastoral Land Act 1992</i> • <i>Northern Territory Aboriginal Sacred Sites Act 1989</i> • <i>Environmental Offences and Penalties Act.</i> • <i>Heritage Conservation Act.</i> • <i>Miscellaneous Acts Amendment (Aboriginal Community Living Areas) Act.</i> • <i>Planning Act.</i>

6 Performance Review and Auditing

6.1 Environmental Induction, Training and Awareness

All Managers (including the General Manager - Production, Field Manager, and Mining Manager) are responsible for identifying training and competency requirements for personnel under their control, and for ensuring that personnel have the requisite competencies, skills and training to carry out their assigned tasks. Managers are also responsible for ensuring training records are maintained. Training may include, but not be limited to, inductions and Toolbox Meetings.

6.1.1 Induction

All staff, contractors, and consultants will complete a comprehensive Site Induction. The induction will include safety requirements, site behaviour rules, access protocols and restrictions, cultural requirements and commitments, and a comprehensive review of environmental risks, requirements and standards. All project managers will have an additional training session on the use and implementation of the EMP.

It is the responsibility of the Managers to ensure records of the training of relevant personnel are maintained.

6.1.2 Toolbox Talks

The Field Manager will hold regular toolbox talks with staff and crews to discuss issues associated with the scheduled work. The toolbox talks will involve highlighting and discussing relevant environmental and safety issues and monitoring results. Toolbox Talk Agendas, attendance and outcomes will be recorded and maintained, as they will form the main stream of communication between the upper management and on-site staff.

6.1.3 In-House Training

Regular in house training activities can be identified through forums such as inductions and toolbox meetings.

6.2 Monitoring Requirements

Monitoring requirements have been listed for each category of management in order to establish whether there have been any impacts from the project, and to determine the effectiveness of mitigation measures. Following the recommended monitoring strategy, it will also be determine whether the environmental strategies are being complied with, and whether any environmental incidents have occurred. Monitoring results will feed back into the management plan review, planned annually with the submission of the Mining Management Plan (MMP).

6.3 Reporting Requirements

It is important that records and reports are maintained to ensure that the objectives of the EMP are being achieved. The Field Manager will be required to record daily and weekly activities on pre-prepared checklists addressing relevant EMP requirements.

All reports, reviews, and audits will be maintained by the General Manager - Production, copied to the Managing Directors, and made available to appropriate staff (Mining Manager, Environmental Officer and Field Manager) and, when relevant, the Regulatory Authorities. Audit results will be used to review

management practices, and the EMP will be updated yearly to accommodate changes in management practices.

6.3.1 Mining Management Plan and Environmental Management Plan

The AIR MMP is to be submitted annually and will include an annually revised version of this EMP.

The EMP is a live document and as such will be updated annually to ensure commitments remain effective and applicable.

DoR will be notified of any significant changes to approved mining activities by amending the MMP, this may occur at any time, outside of the above commitment.

6.3.2 Maintenance Log

AIR will develop and utilise a routine maintenance log including but not limited to; monitoring and maintenance of sediment dams, daily vehicle pre-start inspections, maintenance of waste and hazardous substance storage and bunding, and mosquito controls.

6.3.3 Audits

Annual audits of EMP compliance will be conducted and reported as part of the annual MMP review and renewal process.

In order to best assess the effectiveness of erosion and sediment control measures, AIR will conduct the annual environmental audits during, or shortly after the wet season, access permitting.

AIR's operations will be annually audited against this EMP and the results provided to the Department of Resources (DoR), who may also audit the site at any time.

Any reasonable environmental practices, procedures or standards recommended after an environmental audit or assessment will be implemented at the first available opportunity. AIR understands the importance of high environmental standards and is committed to achieving this.

Closure audits will be conducted upon finalisation of closure commitments, and yearly following closure until relinquishment, to evaluate effectiveness of revegetation, erosion and soil stability management. Timing of audits will be dependent on weather conditions and accessibility. Issues identified during audits will be recorded and corrective action implemented.

6.3.4 Incident Reporting and Non-Conformance

Incident reporting will be implemented to record any safety or environmental non-conformances or incidents. These shall be recorded on an incident report form and forwarded to the Field Manager and General Manager – Production. Reporting of incidents externally will be undertaken in accordance with relevant legislation (e.g. Section 29 of the *Mining Management Act*). Incidents will be investigated and followed up and, where relevant, corrective actions nominated and implemented. The Field Manager is responsible for ensuring all incidents are thoroughly investigated and managed accordingly.

6.3.5 Complaints Register

The Field Manager will be required to report and record any complaints from the public or specific Project stakeholders to the General Manager - Production. The General Manager - Production will record any complaints received from the Field Manager and enter these on the AIR Complaints Register in accordance with the Complaints Management Procedure. The General Manager - Production shall review each complaint upon receipt and agree with the Field Manager on how the complaint will be addressed. Corrective actions and other recommendations including, where applicable, modifications to practices and procedures shall be made and closed out under the direction of the General Manager - Production.

7 Acronyms

AAPA	Aboriginal Areas Protection Authority
AIR	Australian Ilmenite Resources
ANZECC	Australia and New Zealand Environment Conservation Council
CEMP	Construction Environmental Management Plan
DoR	Department of Resources
EMP	Environmental Management Plan
ESCP	Erosion Sediment Control Plan
MSDS	Material Safety Data Sheet
NATA	National Association of Testing Authorities
NOHSC	National Occupational Health & Safety Commission
NRETAS	NT Department of Natural Resources, Environment, the Arts and Sport
OEMP	Operation Environmental Management Plan
SOP	Standard Operating Procedure
TO	Traditional Owner

8 References

EcOz Environmental Services 2012, *Public Environmental Report – Australian Ilmenite Resources*, Darwin, Northern Territory.

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Appendix M - Commitments

Australian Ilmenite Resources Pty Ltd


SILL80 Project

2012



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1 AIR Project Commitments

Subject	Description	Commitment	Compliance	Section in PER
Safety and Risk Management	Continual Improvement	There will be an annual assessment of risks, including incidents and near misses that will be incorporated into the risk management strategy.	Incidents and near misses reported in annual MMP update	Section 6 and Appendix L
Economic Contribution	Employment Opportunities	AIR will employ at minimum 3 indigenous people from local communities equating to a 12% indigenous employment commitment	All staff numbers reported in annual MMP update	Section 5.6
	Local sourcing of goods and services	AIR will provide a list of local businesses and individuals with relevant skills and services to all contractors to promote local economic growth; list will also be displayed within the camp for employee use and updated annually.	Reviewed during internal and external audits.	Appendix L
Protection of Flora and Fauna	Management	AIR will undertake active weed control in accordance with the Weed Management Plan (Appendix I).	Declared weeds must be reported as per the <i>Weed Management Act 2001</i> (Section 9).	Appendix I
	Vegetation clearing	AIR will report area cleared each year in the annual update of the MMP.	Area cleared each year will be reported in the annual update of MMP.	Appendix L
		Annual clearing predictions will be proposed each year in the MMP update, should additional clearing be required, and an amendment to the MMP will be sought.	Reported in annual update of MMP.	Appendix L
		AIR will mulch all woody material cleared for use in mulch berms and rehabilitation practices as detailed in the Rehabilitation Management Plan (Appendix K)	Audit against commitments in the EMP and non-compliance reported in the MMP	Section 6.3, Appendix K
		AIR will burn all non-woody material from clearing practices to prevent weed development and spread.	Audit against commitments in the EMP and non-compliance reported in the MMP	Section 6.3, Appendix K
	Exclusion of fauna species	AIR will erect fences to exclude stock and other large animals, from hazardous areas such as the processing area, mine pit and internal roads.	A description of areas fenced each year will be reported in the annual update of the MMP.	Section 6.3, Appendix K
	Weed Management	AIR will construct and use a wash down area for the cleaning of all vehicles and equipment arriving and leaving the site to prevent the	Maintenance of wash down log – reviewed during internal and external	Appendix I

Subject	Description	Commitment	Compliance	Section in PER
		possible spread of weeds onto site.	audits.	
		Declared weeds (including WONS) will be managed according to the <i>Weeds Management Act</i> . Undesirable species will be managed at Land Manager and AIR discretion pending the development of improved pasture as per the Rehabilitation Management Plan.	Declared weeds must be reported as per the <i>Weed Management Act 2001</i> (Section 9).	Appendix I
Protection of Water Resources	Surface water monitoring	AIR will enter a Service Level Agreement with NRETAS to receive flow rate alarm from the Red Rock gauging station as per the Water Management Plan.	Reported in MMP	Appendix G
		AIR will install a measuring plate at the abstraction point, calibrated against flows at the upstream (Mataranka) and downstream (Red Rock) gauging stations.	Annual Water Report, Internal and External audits	Appendix G
		AIR will not exceed a diversion rate of 100L/s from the Roper River	Pump installed will not be capable of diverting more than 100L/s. Internal and External Audits	Section 6.2 and Appendix G
		AIR will install and maintain a water flow meter on their pump and at the abstraction point and from the 50ML storage dam and will maintain a record of abstraction	Annual Water Report	Section 6.2 and Appendix G
		AIR will not extract more than 1649ML/a from the Roper River	Total volume extracted per year included in the Annual Water Report	Section 6.2 and Appendix G
		AIR will cease abstraction from the Roper River when the flow reaches 900L/s, as detailed in the Water Management Plan, and will initiate detailed water quality surveys at Roper Bar should further abstraction be required.	Annual Water Report will detail all instances of periods when flows were not conducive to extraction.	Section 6.2 and Appendix G
		AIR will monitor water extraction and Roper River flows at the extraction point as well as information obtained from Red Rock and Mataranka Gauging stations as detailed in the WMP.	Annual Water Report	Section 6.2 and Appendix G
		AIR will produce an annual Water Report detailing all water monitoring results from the procedures outlined in the WMP. This report will be submitted with the annual MMP update.	Annual Water Report submitted 3 months prior to MMP	Section 6.2 and Appendix G

Subject	Description	Commitment	Compliance	Section in PER
		AIR will engage NRETAS to monitor ecological response to extraction of water from the Roper River	NRETAS summary to be included with annual water report	Section 6.2 and Appendix G
		AIR will obtain water quality monitoring data at Ngukurr from PowerWater's ongoing Water Quality monitoring program (Annual Drinking Water Quality Reports) and incorporate in the annual assessment of abstraction.	Summary included in annual water report	Section 6.2 and Appendix G
	Ground Water Monitoring	AIR will develop a groundwater monitoring program (as detailed in the WMP) to assess potential seepage of leachate from the open pits. Should these leachates migrate further and/or contain concentrations of heavy metals in excess of current predictions, further investigations and assessments will be undertaken to implement the most appropriate mitigation measure.	GW monitoring summary to be included with annual MMP update	Section 6.2 and Appendix G
Rehabilitation	Monitoring	AIR will undertake routine photo monitoring of rehabilitation areas in accordance with the Rehabilitation Management Plan.	A summary of rehabilitation results will be included in annual MMP update.	Section 6.3 and Appendix L
		AIR will fulfil all rehabilitation objectives as per the Rehabilitation Management Plan.	Audit against the EMP. Non-compliance to be reported within the MMP.	Appendix L and Appendix K
	Topsoil and plant mulch	Topsoil will be stockpiled for later use in spreading over filled pit areas and managed to prevent infestation with weeds. To assist in the development of top soil and reestablishment of plants, the timber cleared from the site will be mulched, stockpiled and distributed over the site post mining.	Incorporated into maintenance log –	Section 6.3 and Appendices L and K
		Development of the Grazing Plan within specified timeframe and in conjunction with Numul Numul Station Managers	Rehabilitation progress to be reported within the MMP	Section 6.3 and Appendices L and K
	Fencing	Permanent fencing (3 barbwire) will be established and maintained post mining and prior to rehabilitation work.	Incorporated into maintenance log – Incidents of non-compliance reported through complaints register and presented in annual MMP update.	Section 6.3 and Appendix K
Social Impact	Stakeholder	Bi-annual consultation with TO's and affected land holders.	AIR will include the minutes from the bi-	Appendix D

Subject	Description	Commitment	Compliance	Section in PER
Management	engagement	Relevant stakeholder input or concerns will be addressed within the annually updated Mining Management Plan (MMP).	annual stakeholder consultations as an attachment to the MMP.	
	Complaints Register	AIR will have a complaints register and a corrective actions procedure outlining the handling of complaints	Copy of complaints and corrective actions included in annual update of MMP	Appendices D and L
	Maintenance of Current Land Use	Maintain land-owner and land-manager property access at all times, and where fences are breached temporary stock proof gates will be provided;	Incidents of non-compliance reported through complaints register and presented in annual MMP update.	Land holder agreement
	Road Safety	AIR commits to developing a standard operating procedure (SOP) aimed at limiting accidents particularly on the Roper Highway.	Incidents of non-compliance reported through incidents and near misses register and presented in annual MMP update.	Section 6.7.1
	Staff Training	All staff and contractors will undergo an induction which includes details on social and cultural impacts and management, 'cease work' protocols and access limitations.	Induction register reviewed during internal and external audits.	Appendices L and D and Section 6.7.2
Erosion and Sediment Control	Legislation	AIR will implement the site specific erosion and sediment control plan prior to mining development in accordance with Northern Territory Governments requirements. Erosion and sediment control structures will be maintained through the routine maintenance program.	Maintenance log reviewed in internal and external audits	Appendix H
	Sediment dams	Sediment dams will be constructed and maintained adjacent to stockpile area. Design will accommodate large rainfall events and will be monitored and maintained to ensure they remain effective.	Incorporated into maintenance log – reviewed during internal and external audits.	Appendix H
	Road development	All road design will follow the principles and procedures outlined in the ESCP.	Audit against EMP. Non-compliance reported within the MMP.	
		Erosion and sediment monitoring will be conducted over established roads in the project area in line with the Erosion and Sediment Control Plan.	Audit against EMP. Non-compliance reported within the MMP.	

Subject	Description	Commitment	Compliance	Section in PER
Waste and Hazardous Materials Management	Waste management (putrescibles)	Putrescibles will be disposed of into an excavated pit and burnt periodically to discourage scavenging animal attraction. Pit will be constructed in accordance with Guidelines for the Siting, Design and Management of Solid Waste Disposal Sites in the Northern Territory (NRETAS 2010) and operated in accordance with the Waste Management and Pollution Control Act 1998.	Incorporated into maintenance log – reviewed during internal and external audits.	Section 6.7.3 and Appendix L
	Waste management (non-putrescibles)	All non-putrescibles will appropriately stored on site prior to removal by a licensed contractor. Constructed septic waste systems will be periodically emptied as required. Hazardous wastes will be stored in appropriately bunded storage areas and will be labelled to the relevant standards.	Incorporated into maintenance log – reviewed during internal and external audits.	
	Waste Water	All wastewater generated from the mine site and main camp will be treated to a high quality and recycled according to the Northern Territory Department of Health Guidelines for Management of Recycled Water Systems (2011).	Incorporated into maintenance log – reviewed during internal and external audits.	
	Hazardous materials	All hazardous materials and dangerous goods will be purchased, transported, stored and used in accordance with the relevant Australian Standards, NOHSC guidelines, Work Health (Occupational Health and Safety) Regulations, Dangerous Goods Regulations and Northern Territory guidelines. Any relevant licences concerning hazardous substances will be obtained.	Incorporated into maintenance log – reviewed during internal and external audits.	Section 6.7.3 and Appendix L
	Training	Training on the use of hazardous substances will be provided to appropriate personnel. Only trained personnel will be allowed to use hazardous substances.	Training register maintained and reviewed during internal and external audits	
	Fuel storage	Hydrocarbons will be stored in appropriately bunded areas according to Australian standards AS/NZS 1940:1993 and AS/NZS 4452:1997. Bunding will be regularly inspected for damage and repaired as soon as is practicable if any damage is detected. Appropriate licences for storage will be obtained.	Incorporated into maintenance log – reviewed during internal and external audits.	
	MSDS	All Material Safety Data Sheets (MSDSs) of dangerous and hazardous substances will be stored at various locations on site and will be communicated and accessible to all staff.	Reviewed during internal and external audits	

Subject	Description	Commitment	Compliance	Section in PER
	Spill Kits	Spill kits will be strategically placed around the site with particular attention to high risk areas i.e. fuel storage and transfer areas. All staff will be appropriately trained in spill response procedures and in the use of spill kits.	Incorporated into maintenance log – reviewed during internal and external audits. Incidents to be reported as per the <i>Waste Management and Pollution Control Act 1998</i> .	
	Radioactive Materials	Once mining and processing begins AIR will conduct a radiological survey over the stockpile and processing area (see Radiation Assessment Report Appendix F).	Radiation assessment of areas to be mined included in annual update of MMP	Appendix F
Protection of Historic and Cultural Environment	Restricted areas	Whilst on site, workers, contractors and visitors will be restricted from accessing culturally sensitive areas. Any inappropriate behaviour will be responded to promptly, and the induction revised if necessary.	Incidents of non-compliance recorded and assessed through external audit	Section 6.7 and Appendix L
	AAPA Approval	Possess an Aboriginal Areas Protection Authority Certificate to protect areas of cultural importance from disturbance by the SILL80 Project.	Field manager to ensure all work areas are covered by a current AAPA certificate	Section 3.2.6 and Appendix L
	Archaeological sites	Immediate cease of work and assessment of any new archaeological, historic or cultural discovered during works; Notification of relevant authorities in accordance with the Northern Territory <i>Heritage and Conservation Act</i> and the <i>Sacred Sites Act</i> .	Incidents to be recorded and presented during external audits and reported in annual MMP update	Appendix L
Road and Transport Management	Road maintenance	Roads will be maintained for use by the pastoral station as per the land use agreement. If complaints are made about this, it will be handled through the complaints register. All road maintenance, including erosion maintenance, will be conducted as per the relevant Australian Standards and guidelines.	Incorporated into maintenance log – reviewed during internal and external audits. Records of maintenance work held by field manager	Section 6.7
	Product Transport	Transport of Ilmenite to Port of Darwin will be in covered trailers.	Reviewed during internal and external audits	Section 5.3

Subject	Description	Commitment	Compliance	Section in PER
	Signage	All roads will have appropriate signage indicating road conditions and speed limits. All staff will be made aware of the road rules on site through inductions. Any unexpected adverse road conditions will be communicated to staff through daily tool box meetings and rectified immediately. No AIR employees will be allowed to use roads other than approved mine access roads unless appropriate permission from mine and pastoral staff is given or in the event of an emergency.	Incidents of non-compliance recorded and assessed through external audit	Section 6.7 and Appendix L
	Road use	Vehicular traffic will be restricted to the proposed vehicle access road.	Incidents of non-compliance recorded and assessed through external audit	Section 5.5.1 and Appendix L
	Dust suppression	Dust suppression will be delivered via water trucks.	Incorporated into maintenance log – reviewed during internal and external audits.	Section 5.5.1 and Appendix L
Air Quality and Noise Management	Noise and air pollution	Due to the remote location of the project area, noise mitigation activities will focus on the occupational health and safety of employees. Adherence to the relevant Australian Standards will be used when performing activities likely to create excessive noise or dust. Hearing protection offered to staff that requires it.	AIR's Occupational Health and Safety program.	Section 6.7 and Appendix L
Greenhouse Gas Emissions	Vehicle emissions	Vehicles will be regularly maintained to minimise the quantity of greenhouse gases being produced by vehicular movement around the mine.	Incorporated into maintenance log – reviewed during internal and external audits.	Appendix L
Biting Insects Management	Water storage	AIR will minimise mosquito breeding areas in line with Biting Insect Management Plan (BIMP)	Incorporated into maintenance log – reviewed during internal and external audits.	Appendix J
	Mine site buildings	AIR will implement measures to minimise contact between personnel and mosquitos as per BIMP. Including screens placed on doors and windows to prevent mosquitos from entering buildings. Yellow lighting used to deter mosquitos from camp and mine site.	Incorporated into maintenance log – reviewed during internal and external audits.	
	Monitoring	AIR will undertake a baseline mosquito monitoring program as detailed in the BIMP	Results of monitoring program to be included with the MMP update following first years mining. All incidents of mosquito related illnesses reported	

Subject	Description	Commitment	Compliance	Section in PER
Decommissioning and Rehabilitation Requirements	Mine Closure Plan	AIR will develop a mine closure plan – two years prior to forecasted closure and submitted to DoR for approval – Plan will include consultation with landowners and land managers to determine the fate of all mining infrastructure, including the processing plant, concrete pad, sheds, office, roads and any other infrastructure in place	Mine Closure Plan.	Section 5.7 and Appendices L and K
	Revegetation	AIR will revegetate mined areas with the aim of the land going back to pastoral production as detailed in the Rehabilitation Management Plan and in close consultation with pastoral managers.	Annual rehabilitation areas and success rates reported in annual MMP update.	Section 5.7 and Appendix K
	Weed management	Upon mine closure, AIR will engage a suitably qualified botanist to perform a weed survey of the mining area with recommendations on measures for any identified weeds prior to closure.	Findings and actions reported in Mine Closure Plan.	Appendix L
	Ongoing mosquito control	Upon mine closure, all disturbed areas will be rehabilitated to be free draining where practical, and septic tanks and other artificial receptacles will be removed.	Reported in Mine Closure Plan	Appendix J
Environmental Management	Management Plans	All management plans will be updated annually and incorporated into the MMP.	Reported in annual MMP update.	Appendix L
	Maintenance Log	AIR will develop and utilise a routine maintenance log – including but not limited to; monitoring and maintenance of sediment dams, daily vehicle pre-start inspections, maintenance of waste and hazardous substance storage and bunding, mosquito controls etc.	Issues identified placed in maintenance register and remedied in a timely manner. Reviewed during internal and external audits.	
	Onsite inductions	All employees, contractors and site visitors will undergo inductions which will include information on environmental, social, cultural impacts and management, 'cease work' protocols and access limitations. AIR will also maintain an induction register specifying persons and dates of inductees.	Induction records to be maintained and included in annual MMP update	
	Audits	Annual external audits of AIR's performance against the MMP and EMP, commitments stated in this PER, and all relevant and current legislative requirements will be conducted.	Internal audit records to be presented for annual external audit	
Quarterly internal audit				

Subject	Description	Commitment	Compliance	Section in PER
Legislation and Permits	Implementation and compliance	All applicable legislation will be followed and all applicable licences and permits will be obtained before the relevant aspects of the project commence.	Detailed in MMP	Section 3, Section 6 and Appendix L



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Appendix N - Geochemical Characterisation



Australian Ilmenite Resources Pty Ltd
SILL80 Project



2012



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Executive Summary

Australian Ilmenite Resources (AIR) intends developing an ilmenite mine and processing facility at the Numul Numul Station, approximately 105km east of Mataranka Township and 8km south of the Roper Highway, in the Roper River Region, Northern Territory (Australian Ilmenite Resources Pty Ltd SILL80 Project Mineral Lease 27422). The SILL80 Project is a proposed open cut mine and processing facility, which entails gravity separation of the ilmenite, to produce 300,000t/a refined ilmenite with an expected mine life exceeding 20 years.

The principal intent of the geochemical assessment of soils is to assess:

- Morphological characteristics and grain size distribution of the near surface regolith materials.
- The surface regolith for its geochemical characterisation.
- Solubility of key elements that may mobilise due to soil-water interactions.

Background studies in the area to correlate significant variability of the geochemical behaviour of the soils are absent. The salient key observations of this study are:

- Locally the regolith and lateritic soils are composed of brown red clayey silt overlying silt, clayey sand and sand with gravel. Morphologically most of the regolith soil samples may be classified as medium fine sands.
- Concentrations of trace metals vary but most are below their limits of reporting with only iron and manganese significant.
- Nutrient capacities of the soils are diverse with relatively high concentrations of Total Nitrogen and Total Phosphorous.
- Most of the trace metals in leach solutions are below their LoRs with only aluminium, iron and zinc present at slightly elevated concentrations. This may indicate that these trace metals are immobile and may not pose a risk to the environment under the reported geochemical conditions.

To achieve sound environmental management of soils it is recommended to undertake:

- A soil-water interaction study using process waters (a mixture of recycled tailings water and water from the 50ML storage dam).
- Development of appropriate strategies and processes to manage soils as they have the potential to leach some concentrations of aluminium, iron and zinc.
- Management measures to preserve the nutrient capacities of soils for rehabilitation and revegetation activities.

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Appendix A: Soil Physical Descriptors.

Appendix B: Particle Size Distribution of Composite Soils.

Appendix C: Soil Analytical Results.

Appendix D: Leachate Analytical Results.

Abbreviations

Abbreviations

AAPA	Aboriginal Areas Protection Authority
AIR	Australian Ilmenite Resources Proprietary Limited
ANZECC	Australia and New Zealand Environment Conservation Council
CEC	Cation Exchange Capacity.
DoR	Department of Resources
EMP	Environmental Management Plan
ESCP	Erosion Sediment Control Plan
LoR	Laboratory Limit of Reporting
MLA	Mining Lease Application
MSDS	Material Safety Data Sheet
NATA	National Association of Testing Authorities
NOHSC	National Occupational Health & Safety Commission
NOI	Notice of Intent
NRETAS	NT Department of Natural Resources, Environment, the Arts and Sport
SOP	Standard Operating Procedure
TO	Traditional Owner
WCD	Water Control District
WMP	Water Management Plan

Units of measurement

mg/L	Milligrams per litre
µg/L	Micrograms per litre
m	metre
km	kilometre
mbgl	metre below ground level
°C	Degrees Celsius
ha	Hectares
pH	Measure of acidity (<7) or alkalinity (>7) of a (water) sample

Chemical Symbols

EC	Electrical Conductivity
TDS	Total Dissolved Solids
Tot.Alk.	Total Alkalinity
Tot.Hardness	Total Hardness
Ca	Calcium
Mg	Magnesium
Na	Sodium
SO ₄	Sulfate

Al	Aluminium
As	Arsenic
Cd	Cadmium
Co	Cobalt
CO ₂	Carbon dioxide
Cr	Chromium
Cu	Copper
Fe	Iron
FeS ₂	Pyrite
Mn	Manganese
Mo	Molybdenum
Pb	Lead
NO _x	Oxides of nitrogen
Se	Selenium
Zn	Zinc

Explanation of Terms

Berm	Horizontal strip or shelf built into an embankment or cut to break the continuity of the slope.
Colloidal material	Finely divided solids that will not settle but which may be removed by coagulation.
Regolith	The layer of unconsolidated residual or transported material that overlies solid rock and constituting the surface of most land.
Tailings	Fine waste rock material arising from the processing operation.

1 Introduction

1.1 Purpose of the Geochemical Assessment

Geochemical characterisation of the regolith at the SILL80 Project (Figure 1.1) aims at:

- Assessing morphological characteristics and grain size distribution of the near surface regolith materials.
- Determining whether certain elements occur at elevated concentrations and solubility of key dissolved constituents that may mobilise due to soil-water interaction.
- Assessing potential impacts on water quality and management.
- Informing water quality monitoring programs on which analytes should be included.

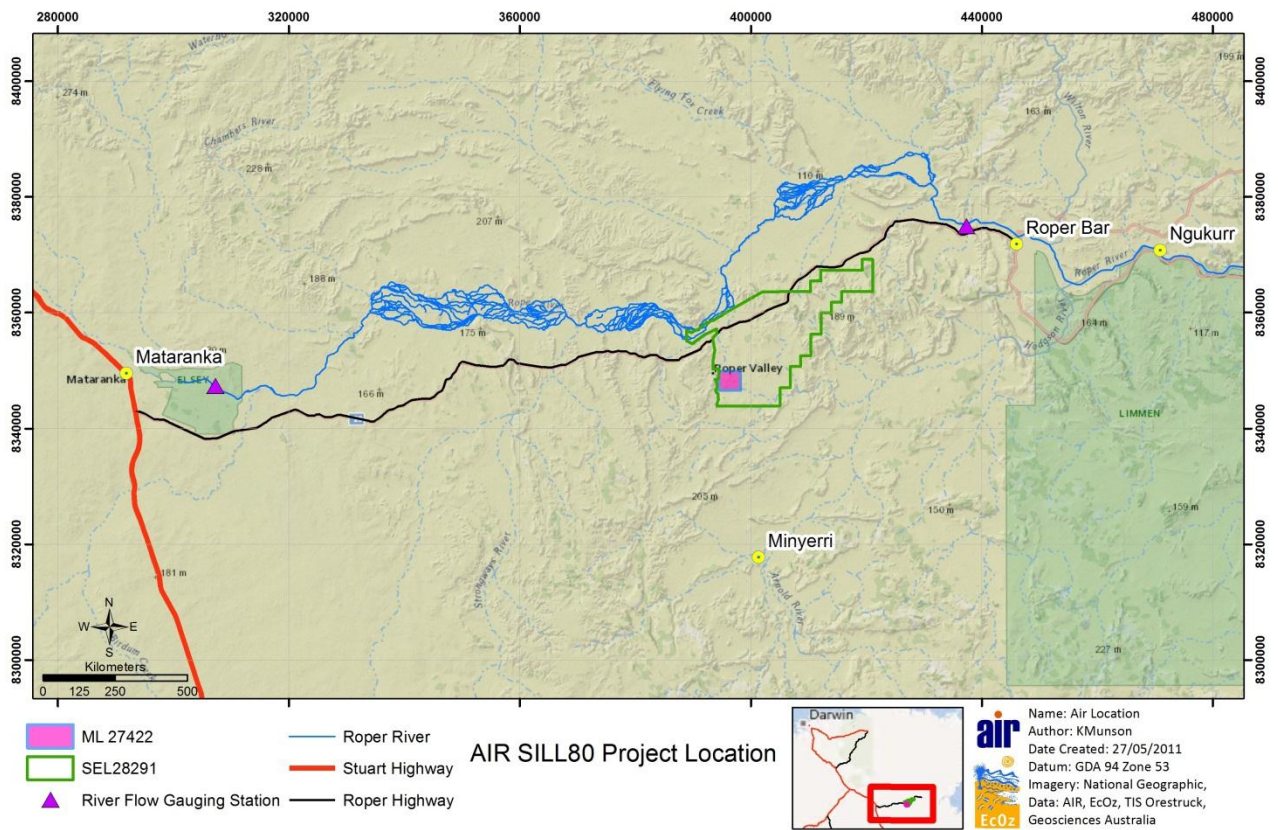


Figure 1.1: Location of the SILL80 Project.

2 Geology and Soils

2.1 Geology

The SILL80 Project is underlain by the Roper Group and specifically ilmenite-bearing dolerite sill horizons and their possible erosional transport trails. Sills of the Derim Derim dolerite were emplaced at various stratigraphic horizons from a primary magma source at depth. Extensive lateritised outcrops, sub-crops and regolithic soils of the dolerite have been mapped throughout the AIR tenements. The dolerite outcrops as low-relief medium to coarse grained, variably altered and weathered ('onion-skin' weathering) rounded boulders. In some areas these dolerite sills have only been recently exhumed (at higher elevations) and in other instances, larger areas of dolerite sills have been exposed for a longer geological time resulting in pisolitic laterite formation and attendant erosion (at lower elevations).

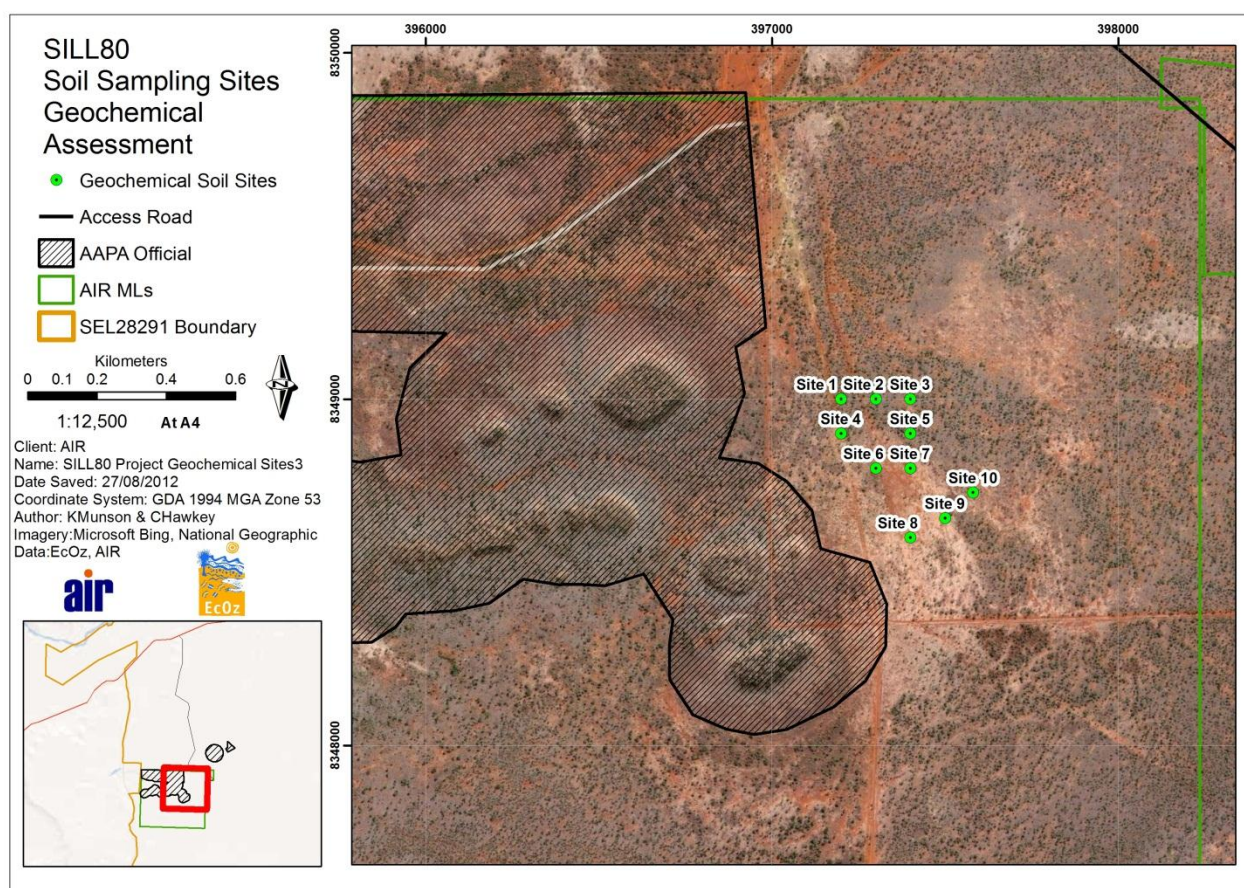


Figure 2.1: Location of Soil Samples for Geochemical Characterisation.

2.2 Soils

Regionally the regolith soils are deep (up to 6m below surface) red-purple-brown, clay-rich and contain abundant liberated ilmenite and, locally, with accessory titanomagnetite, magnetite and haematite grains. These areas are considered highly erodible, especially the sloping red soils.

Locally the regolith and lateritic soils are composing of brown red clayey silt overlying silts, clayey sands and gravelly sands to depths of about 3.0m below ground level (Figure 2.1 and Appendix A).

Whilst the clayey silts contain minor organics and significant finer to coarse grain sands, the silts and gravelly sands are mostly uniform with little or no organic materials. The gravelly sands are normally brown to cream and the coarse particulates range from coarse sands to cobbles.

Table 1 presents a summary of particle size distribution of all sites and Appendix B describes percentage passing of various grain sizes.

From the grain size distribution, most of the regolith soil samples can be classified as medium fine sands with Composite 9 being sand-gravel material. Composite is defined as mixture of soils of all profiles from 0.0 to 3.0mbgl.

Table 1: Particle Grain Size Distribution.

Passing	Soil Composite									
	Comp 1	Comp 2	Comp 3	Comp 4	Comp 5	Comp 6	Comp 7	Comp 8	Comp 9	Comp 10
% Fines (<75µm)	71	75	82	52	75	65	75	75	40	68
% Sand (>75µm)	27	24	18	45	25	35	25	23	38	32
% Gravel (>2mm)	1	1	<1	3	<1	<1	1	2	22	1
% Cobbles (>6cm)	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1

3 Soil Geochemistry

3.1 pH and Electrical Conductivity

The average pH of soils within the investigated area is circumneutral (pH 6.7) ranging from 6.0 to 7.5. Although near surface soils, to about 2.0m below surface, have pHs below 7.0, pH increases with depth at all the sites (Figure 3.1):

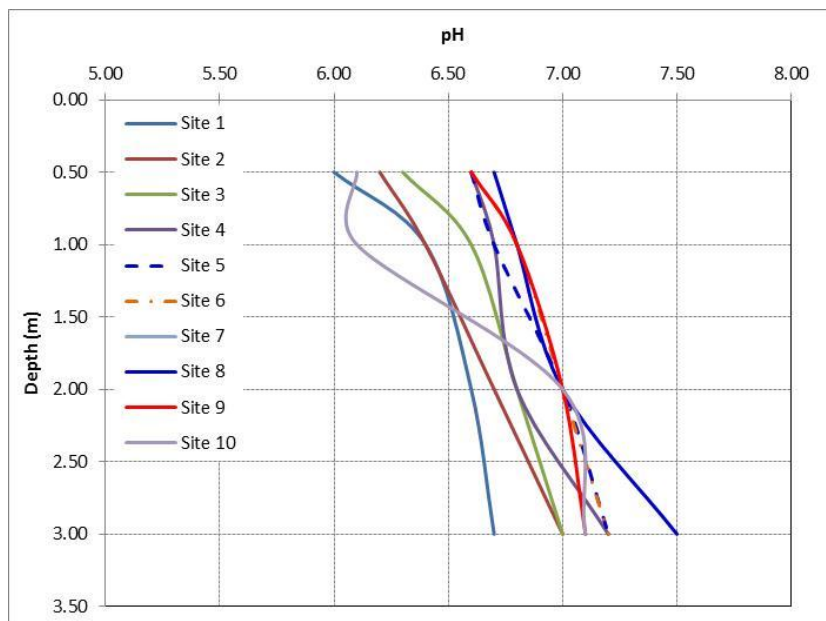


Figure 3.1: pH Distribution with Depth.

ECs range from 11 μ S/cm to 27 μ S/cm averaging 19 μ S/cm. While EC slightly decreases at near surface soil samples i.e. at Sites 1 to 4, EC increases with depth in most of the soils (Figure 3.2). Under the general criteria for the Assessment and Management of Saline/Sodic Wastes (1995) samples can be defined as non-saline sands (i.e. EC is <2000 μ S/cm).

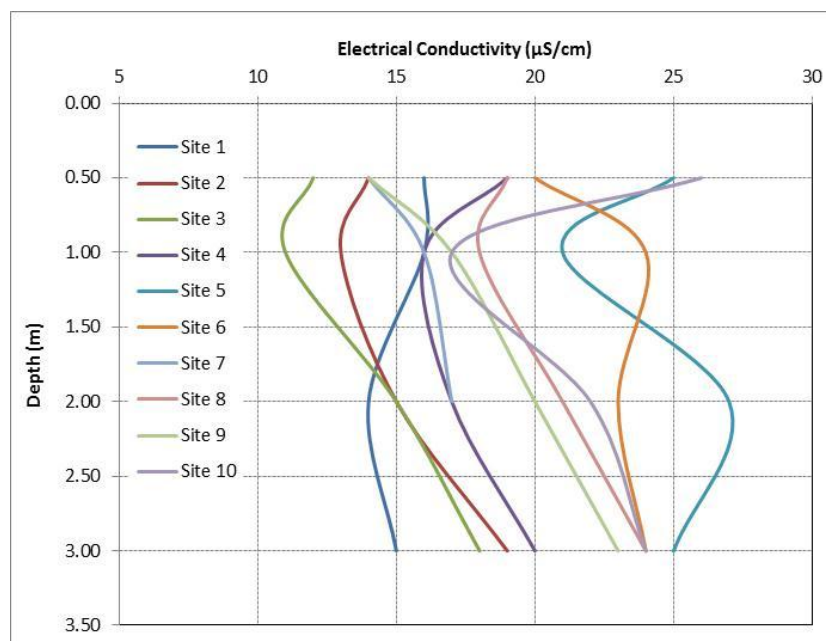


Figure 3.2: Electrical Conductivity Distribution with Depth.

3.2 Major Cations

With the exception of sodium in samples from Site 8 (3.0m) and Site 9 (1.0m), most of the major soluble cations were below their limits of reporting (LoRs). Sodium concentrations above the LoR were found in 16 of the 49 samples (Appendix C) averaging 15mg/kg with a peak of 40mg/kg.

3.3 Major Anions

Major anions, including chloride and sulphate, were predominantly below their LoRs at 10mg/kg.

3.4 Cation Exchange Capacity and Organic Matter

Cation exchange capacities (CECs) varied with an average of 18.2meq/100g and a minimum of 4.9meq/100g. The low CECs in the top soils increase with depth to reach a maximum of 41.7meq/100g at Site 9 (Figure 3.3). CECs at Site 1 remain constant with depth with an average of 6.7meq/100g indicating little fines, organic matter and moisture holding capacities. Low CECs in the topsoils are indicative of a sand size dominated texture prone to drought that invariably needs finer particulates and organic matter to improve water holding capacity. The higher CECs of the deeper soils are indicative of mineral sands likely to have higher concentrations of fine particulates such as clays and/or organic matter, poor drainage, limited structure but better affinities to retain solutes against leaching.

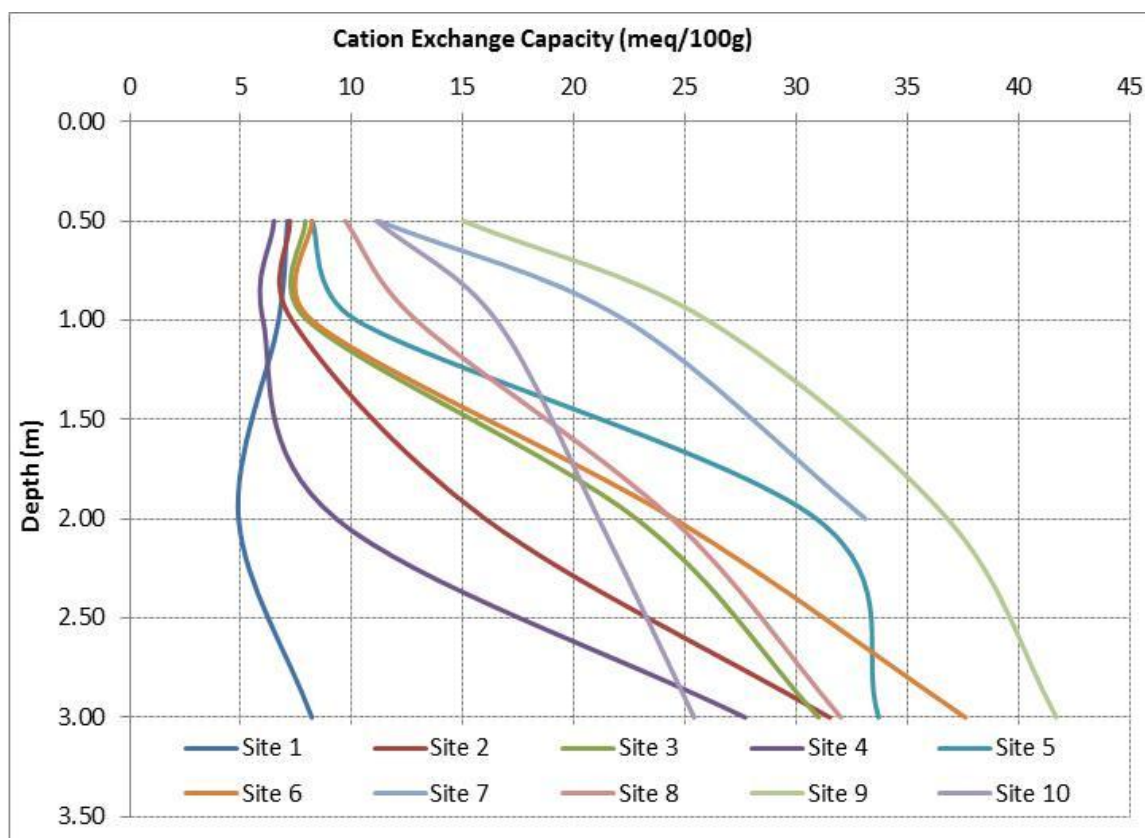


Figure 3.3: Cation Exchange Capacity of Soils.

Organic matter (%) significantly varies from 0.6% to 5.1% with an average of 1.6%. The highest concentrations are observed to be contained in the near surface soils and these steadily decrease with depth. The relative high concentrations may be influenced by dense vegetation comprising grass and small shrubs (Figure 3.4).



Figure 3.4: Vegetation.

3.5 Trace Metals

The concentrations of arsenic, molybdenum and selenium were below their LoRs in all samples (Table 2 overleaf and Appendix C). Concentrations of cobalt, copper, iron, lead, and zinc were above their LoRs but well below the National Environment Protection Measure Ecological Investigation Levels (NEPM, EILs).

Only one sample (Site 1: 2m) contained a relatively high concentration of cobalt at 70mg/kg (Figure 3.5). Cobalt may be weakly bound within the material matrix in colloid, oxide, hydroxide, or organic phases, most often within Fe-Mn oxide fractions (Basta *et al*, 2005).

Uranium concentrations were also above the LoR with an average of 0.6mg/kg and a maximum of 1.0mg/kg.

Iron and manganese concentrations are relatively high. Concentrations of manganese at an average of 1,102mg/kg, ranging from 278mg/kg to 2,640mg/kg are well below the NEPM Health Investigation Level of 7,500mg/kg. The concentrations of iron in the soil samples range from 18,800mg/kg to 106,000mg/kg with an average value of 74,415mg/kg. With the exception of samples from Sites 8 and 9 at which iron concentrations are at about 1.0mbgl (Figure 3.6), most of the sites present a uniformly decreasing iron distribution with depth.

Lateritic regoliths are naturally rich in iron and aluminium and are normally rusty-red because of iron oxides. These soils, particularly laterites, are developing within intense and long-lasting weathering environments such as those in the hot and wet tropics.

Table 2: Summary of Trace Metal Concentrations.

Trace Metals	Unit	Assessment Levels		Average	Maximum	Minimum	95 Percentile
		Ecological Investigation Levels (mg/kg)	Health Investigation Levels (mg/kg)				
Arsenic	mg/kg	20	410	<5	-	-	-
Cobalt	mg/kg	50	500	30	70	7	48
Copper	mg/kg	100	5,000	6.5	10.0	5.0	9.9
Iron	mg/kg	-	-	74,415	106,000	18,800	103,000
Lead	mg/kg	600	1,500	11	20	6	17
Manganese	mg/kg	500	7,500	1,103	2,640	278	1,590
Molybdenum	mg/kg	40	5,100	<2	-	-	-
Selenium	mg/kg	-	-	<5	-	-	-
Zinc	mg/kg	200	35,000	34	76	8	68
Uranium	mg/kg	-	-	0.6	1.0	0.3	0.9

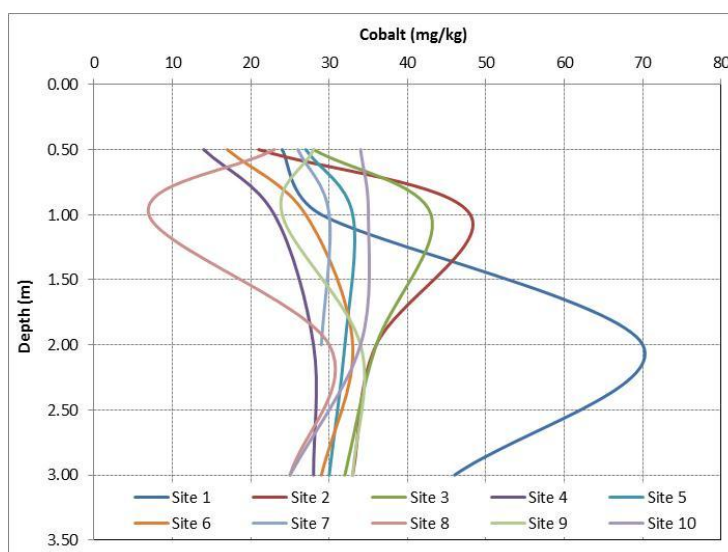


Figure 3.5: Cobalt Distributions with Depth.

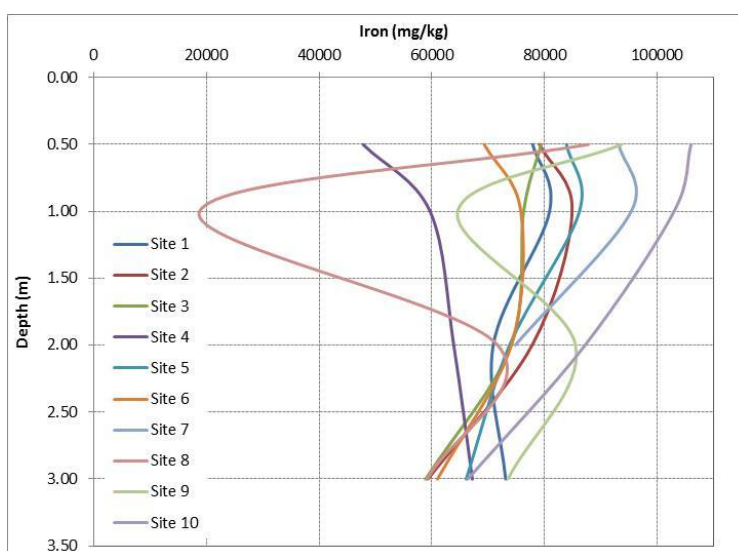


Figure 3.6: Iron Distribution with Depth.

3.6 Nutrient Capacity

Nutrient availabilities across the soil profiles vary markedly (Table 3 and Figure 3.7). Total Nitrogen and Total Phosphorous in soils samples are relatively high and behave differently. Whilst Total Nitrogen decreases with depth, Total Phosphorous substantially increases with depth. However, Total Phosphorus at Site 5 (deep soils) slightly decreases indicating less mobility of P and significant influence of hydroxides.

As expected Total Nitrogen is generally higher in the topsoils compared to the subsoils as this is where most of the organic matter and biological activity is found. Overall results indicate high to medium Total Nitrogen in the topsoils and only medium to low levels in the subsoils.

Table 3 : Nutrient Capacity of Soils.

Nutrient	Unit	Average	Maximum	Minimum	95 Percentile
Nitrite + Nitrate as N (Sol.)	mg/kg	0.6	2.4	0.1	1.9
Total Kjeldahl Nitrogen as N	mg/kg	264	610	30	540
Total Nitrogen as N	mg/kg	264	610	30	540
Total Phosphorus as P	mg/kg	419	1,260	132	1,050

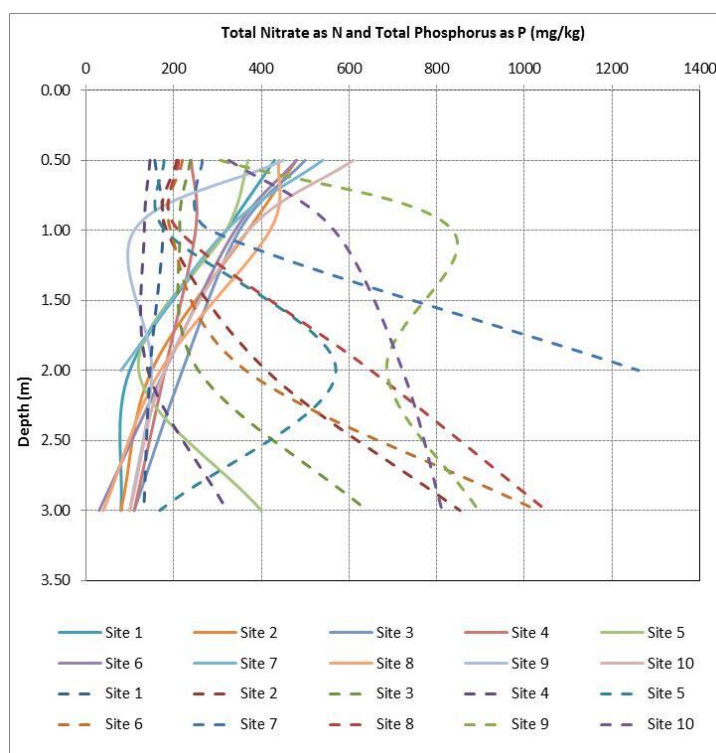


Figure 3.7: Nitrogen and Phosphorus (dashed) Distributions with Depth.

3.7 Management of Soils

The metal concentrations in the soils at the SILL80 Project are low with only manganese and iron presenting relative high concentrations. The results also indicate the potential of these soils to retain soil fertility to various degrees.

Soils in this context should be managed with a view that poor or inappropriate soils management may create environmental pollution and affect soil stability and plant growth across rehabilitated areas.

Adequate soil placement during excavations will facilitate preservation of nutrient capacity and prevent continuous leaching that may impact the surrounding environment.

4 Fate of Aqueous Metals

4.1 Soil Leachates

Selected soils were leached using deionised (DI) water to define whether key elements may be mobilising due to soil-water interactions (Appendix D). Leaching was undertaken in accordance with the Australian Standard Leaching Procedures (ASLP). Leach solutions attained from a total of 12 samples were analysed for pH, electrical conductivity (EC), total dissolved solids (TDS), major ions (calcium, magnesium, sodium, potassium, and alkalinity) and trace metals (aluminium, arsenic, cadmium, chromium, cobalt, copper, iron, lead, manganese, molybdenum, selenium and zinc).

4.2 pH, EC and TDS

Soil DI leach solutions are dominantly circumneutral with pHs ranging from 6.9 to 7.3; the highest pHs were found in subsoils and the lowest pHs in top soils. Electrical conductivities range from 17 $\mu\text{S}/\text{cm}$ to 53 $\mu\text{S}/\text{cm}$ with a TDS concentration of 58.0mg/L.

4.3 Major Cations

Major cations including calcium, magnesium, sodium and potassium are relatively low with sodium dominant and ranging between 3mg/L and 11mg/L. The highest sodium concentrations were detected in near surface soil leaches between 1m and 2m below surface.

4.4 Trace Metals and Metalloids

Most of the trace metals are below their LoRs with only aluminium, iron and zinc present at slightly elevated concentrations (Table 4).

Table 4: Trace Metal Concentrations in Soil Leaches.

Traces	Units	Concentrations		
		Average	Maximum	Minimum
Aluminium	mg/L	0.69	1.73	0.28
Iron	mg/L	1.83	9.04	0.07
Manganese	mg/L	0.03	0.05	0.01
Zinc	mg/L	0.35	0.62	0.09
Arsenic, Cadmium, Chromium, Cobalt, Copper, Lead, Selenium and Molybdenum occur in concentrations below their LoRs.				

4.5 Management of Leachates

Trace metals behaviour indicates that soils do not have readily available solutes and consequently loadings in leaching solutions would be insignificant. Long term management of these soils would entail monitoring of potential seepages from tailings.

5 Conclusions and Recommendations

Locally the regolith and lateritic soils are composed of brown red clayey silt overlying silt, clayey sands and sands with gravel. Morphologically most of the regolith can be classified as medium fine sands.

Trace metals occur in various concentrations but most of them are below their LoRs with only iron and manganese being significant.

The nutrient capacities of the soils are diverse with relative high concentrations of Total Nitrogen and Total Phosphorous.

Most of the trace metals are below their LoRs with only aluminium, iron and zinc present at slightly elevated concentrations. This may indicate that these trace metals are immobile and may not pose a risk to the environment under the reported geochemical conditions.

To achieve sound environmental management of soils it is recommended to undertake:

- A soil-water interaction study using process waters (a mixture of recycled tailings water and water from the 50ML storage dam).
- Development of appropriate strategies and processes to manage soils as they have the potential to leach some concentrations of aluminium, iron and zinc.
- Management measures to preserve the nutrient capacities of soils for rehabilitation and revegetation activities.

6 References

ANZECC, 2000: *An Introduction to the Australian and New Zealand Guidelines for Fresh and Marine Water Quality*.

Basta, N.T., Ryan, J.A., Chaney, R.L., 2005: Trace Element Chemistry in Residual-Treated Soil: Key Concepts and Metal Bioavailability. *Journal of Environmental Quality*, 34, pp 49–63.