Office of the Environmental Protection Authority
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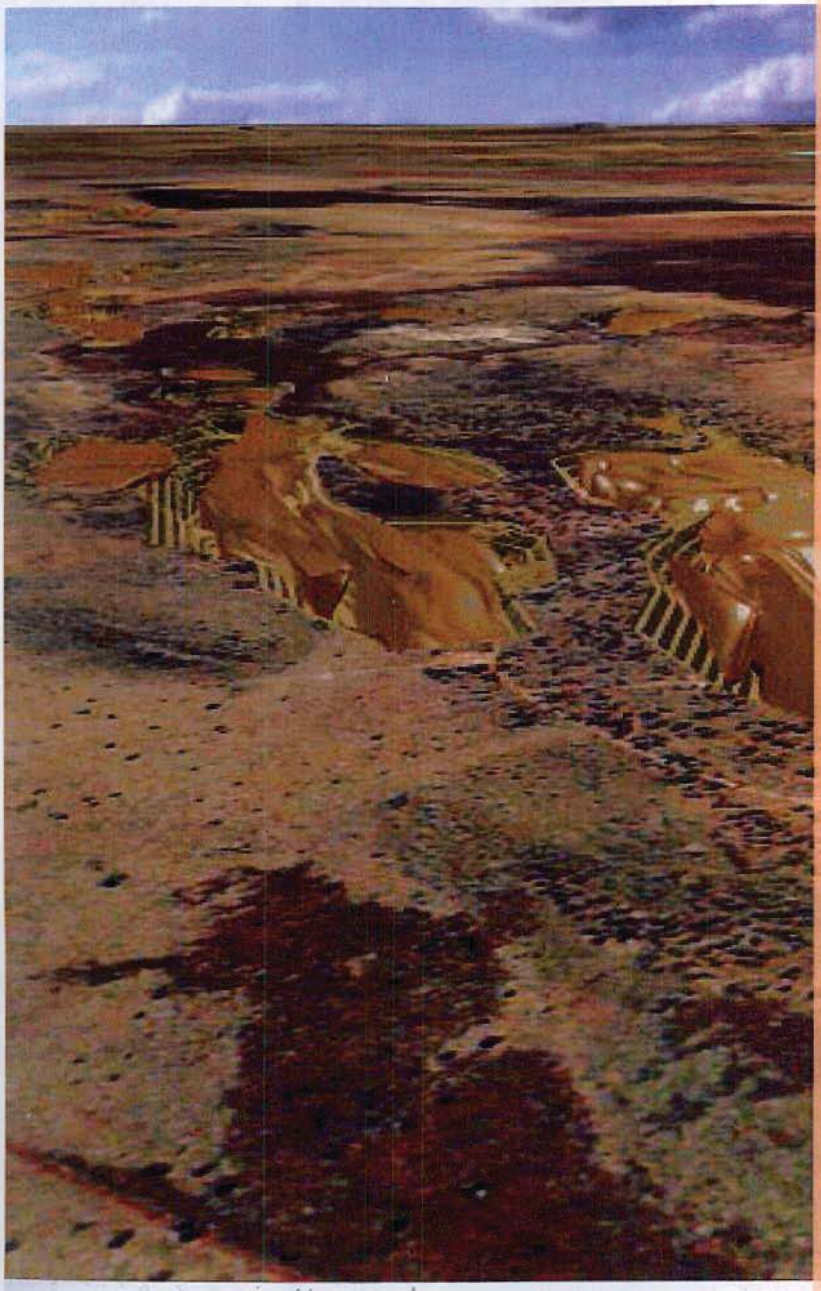

WINGELLINA NICKEL PROJECT

PUBLIC ENVIRONMENTAL REVIEW

04 | 09 | 2015

REPORT

EQUINOX ENVIRONMENTAL

SNC·LAVALIN

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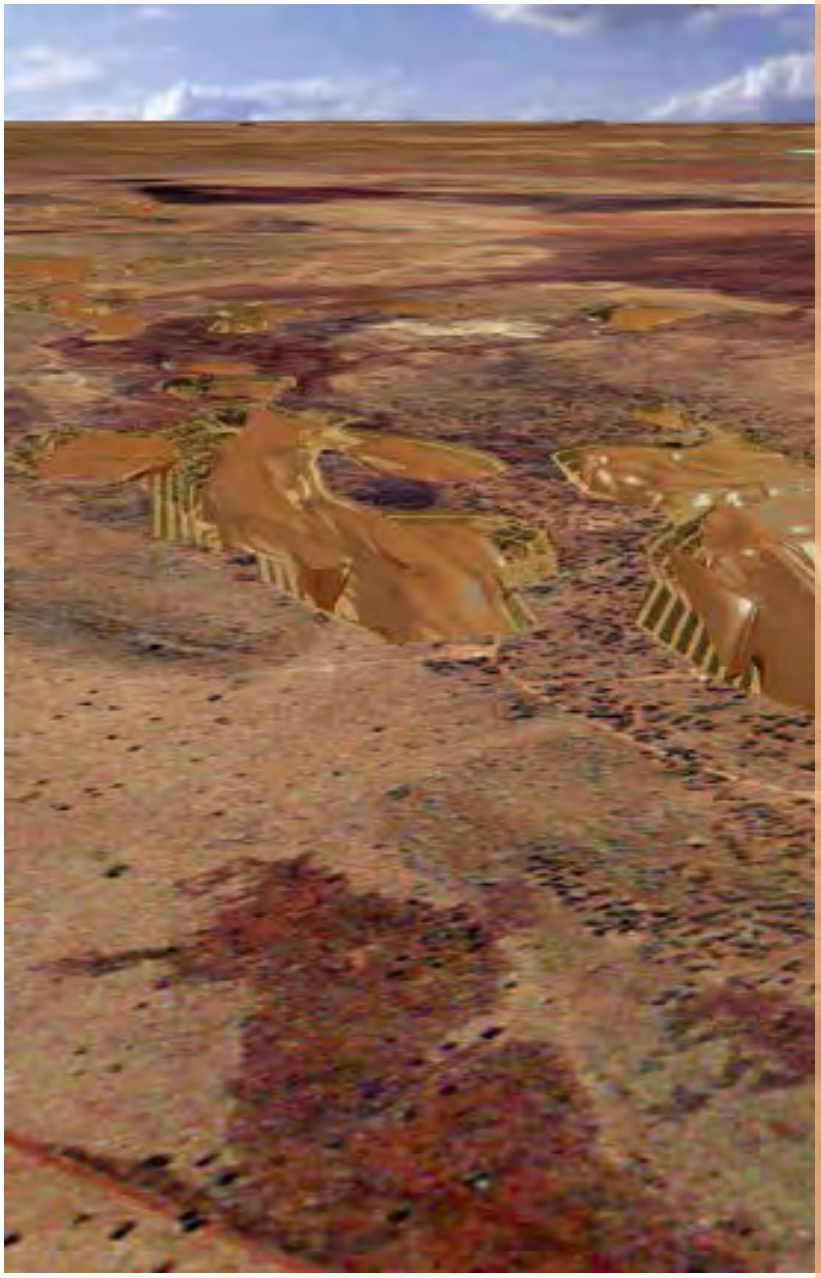

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Rev	Date	Issued for	Prepared By	Reviewed By	Approved By
00	24/10/2014	Revised Final addressing requirements for new ESD	AP	DH	AF
01	06/02/2015	Document Issue	DH/AP	AP	AF
02	14/08/2015	Final	DH/AP	AP	RC

REVISION CONTROL

☐ Coordinated Review

☒ Issued for use as Standard Specification

REVISION HISTORY

Revision	Pages Revised	Remarks
00	All	Master version reviewed by client
01	All	Full read through and mark up and Final
02	All	Revised to accommodate OEPA comments and Final

Invitation to make a submission

The Environmental Protection Authority (EPA) invites people to make a submission on this proposal. Both electronic and hard copy submissions are most welcome. The environmental impact assessment process is designed to be transparent and accountable, and includes specific points for public involvement, including opportunities for public review of environmental review documents. In releasing this document for public comment, the EPA advises that no decisions have been made to allow this proposal to be implemented.

Hinckley Range Pty Ltd proposes to develop the Wingellina Nickel Project located approximately 1,400 km north-east of Perth and 8 km south-west of Surveyor Generals' Corner, the junction between Western Australia, the Northern Territory and South Australia. In accordance with the *Environmental Protection Act 1986* (EP Act), a Public Environmental Review (PER) has been prepared which describes this proposal and its likely effects on the environment. The PER is available for a public review period of 8 weeks from 14 September 2015 closing on 9 November 2015.

Comments from government agencies and from the public will help the EPA to prepare an assessment report in which it will make recommendations to government.

Where to get copies of this document

Printed and CD copies of this document may be obtained from:

Hinckley Range Pty Ltd
18 – 32 Parliament Place
WEST PERTH WA 6005
Telephone no (08) 9220 5700

Hard copies of the PER main document may be purchased for $10 (including postage and packaging) and a hard copy of the Part B Appendices document may be purchased separately for $10 (including postage and packaging). Alternatively, a CD version containing electronic copies of both documents is available free of charge (including postage).

Copies may also be downloaded from MetalsX website (http://www.metalsx.com.au/nickel/).

Why write a submission?

A submission is a way to provide information, express your opinion and put forward your suggested course of action - including any alternative approach. It is useful if you indicate any suggestions you have to improve the proposal.

All submissions received by the EPA will be acknowledged. Electronic submissions will be acknowledged electronically. The proponent will be required to provide adequate responses to points raised in submissions. In preparing its assessment report for the Minister for the Environment, the EPA will consider the information in

submissions, the proponent's responses and other relevant information. Submissions will be treated as public documents unless provided and received in confidence, subject to the requirements of the *Freedom of Information Act 1992* (FOI Act), and may be quoted in full or in part in each report.

Why not join a group?

If you prefer not to write your own comments, it may be worthwhile joining a group interested in making a submission on similar issues. Joint submissions may help to reduce the workload for an individual or group, as well as increase the pool of ideas and information. If you form a small group (up to 10 people) please indicate all the names of the participants. If your group is larger, please indicate how many people your submission represents.

Developing a submission

You may agree or disagree with, or comment on, the general issues discussed in the PER or the specific proposal. It helps if you give reasons for your conclusions, supported by relevant data. You may make an important contribution by suggesting ways to make the proposal more environmentally acceptable.

When making comments on specific elements of the PER:

- Clearly state your point of view;
- Indicate the source of your information or argument if this is applicable; and
- Suggest recommendations, safeguards or alternatives.

Points to keep in mind

By keeping the following points in mind, you will make it easier for your submission to be analysed:

- Attempt to list points so that issues raised are clear. A summary of your submission is helpful;
- Refer each point to the appropriate section, chapter or recommendation in the PER;
- If you discuss different sections of the PER, keep them distinct and separate, so there is no confusion as to which section you are considering; and
- Attach any factual information you may wish to provide and give details of the source. Make sure your information is accurate.

Remember to include:

- Your name;
- Address;
- Date; and
- Whether and the reason why you want your submission to be confidential.

The closing date for submissions is: 9 November 2015.

The EPA prefers submissions to be made at: https://consultation.epa.wa.gov.au

Alternatively, submissions can be:

- Posted to: Chairman, Environmental Protection Authority,
  Locked Bag 10, EAST PERTH, WA 6892; or
- Delivered to: The Environmental Protection Authority,
  Level 4, The Atrium, 168 St Georges Terrace, Perth; or

If you have any questions on how to make a submission, please ring the Office of the EPA on (08) 6145 0800.

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EXECUTIVE SUMMARY

INTRODUCTION

This document and supporting appendices comprise the Public Environmental Review (PER) documentation for the proposed Wingellina Nickel Project (the Project). The PER documentation has been prepared in accordance with the *Guidelines for Preparing a Public Environmental Review* (EPA 2012), *Environmental Impact Assessment (Part IV Divisions 1 and 2) Administrative Procedures 2012*, the approved Project Environmental Scoping Document (ESD) (Appendix A), and relevant EPA Environmental Assessment Guidelines (EAG) including EAG 1, EAG 6, EAG8, EAG9.

The proponent is Hinckley Range Pty Ltd (Hinckley Range), which is a wholly owned subsidiary of Metals X Limited (Metals X). Metals X is a diversified mining company with experience in exploration, development and mining of mineral deposits in Australia.

The key characteristics of the Project are described in Table ES1. The layout of the proposed mining area is shown in Figure ES2.

PROJECT DESCRIPTION

Location

The Project is located approximately 1,400 km north-east of Perth and 8 km south west of the Surveyor General's Corner, which marks the intersection of the Northern Territory, South Australian and Western Australian borders (Figure ES1). The Project includes a mining area at Wingellina within tenement E69/535, a water supply borefield in the Officer Basin some 100 km to the southwest, and a connecting pipeline between these areas.

Mining & processing

The Project involves open pit mining of nickeliferous limonite ore from the Wingellina deposit and on-site processing using a high pressure acid leach (HPAL) process, to produce an intermediate mixed nickel-cobalt hydroxide concentrate. The anticipated mine life is about 40 years at a mining rate of >4 million tonnes per year (Mtpa), to produce approximately 40,000 tonnes (t) of nickel and 3,000 t of cobalt per year. Residues from ore processing will be discharged to a paddock style tailings storage facility (TSF), with separate evaporation ponds to manage both TSF decant water and storm water.

The nickel-cobalt hydroxide concentrate will be transported to overseas markets, via existing road and rail to networks the Port of Darwin or the Port of Adelaide.

Water supply

Up to 12 GL per year of process supply water will be sourced from the Central Officer Basin, located on tenement L69/12 and connected with the proposed mining area by an overland pipeline adjacent to and aligned with existing roads.

Gas supply

Natural gas (for the power plant) will be sourced from an existing gas field and transported to the Project via existing roads.

Disturbance footprint

The proposed disturbance footprint includes up to 2,973 hectares of native vegetation, including up to 2,762 hectares in the proposed mining area and 211 hectares associated with the Officer Basin borefield and pipeline route.

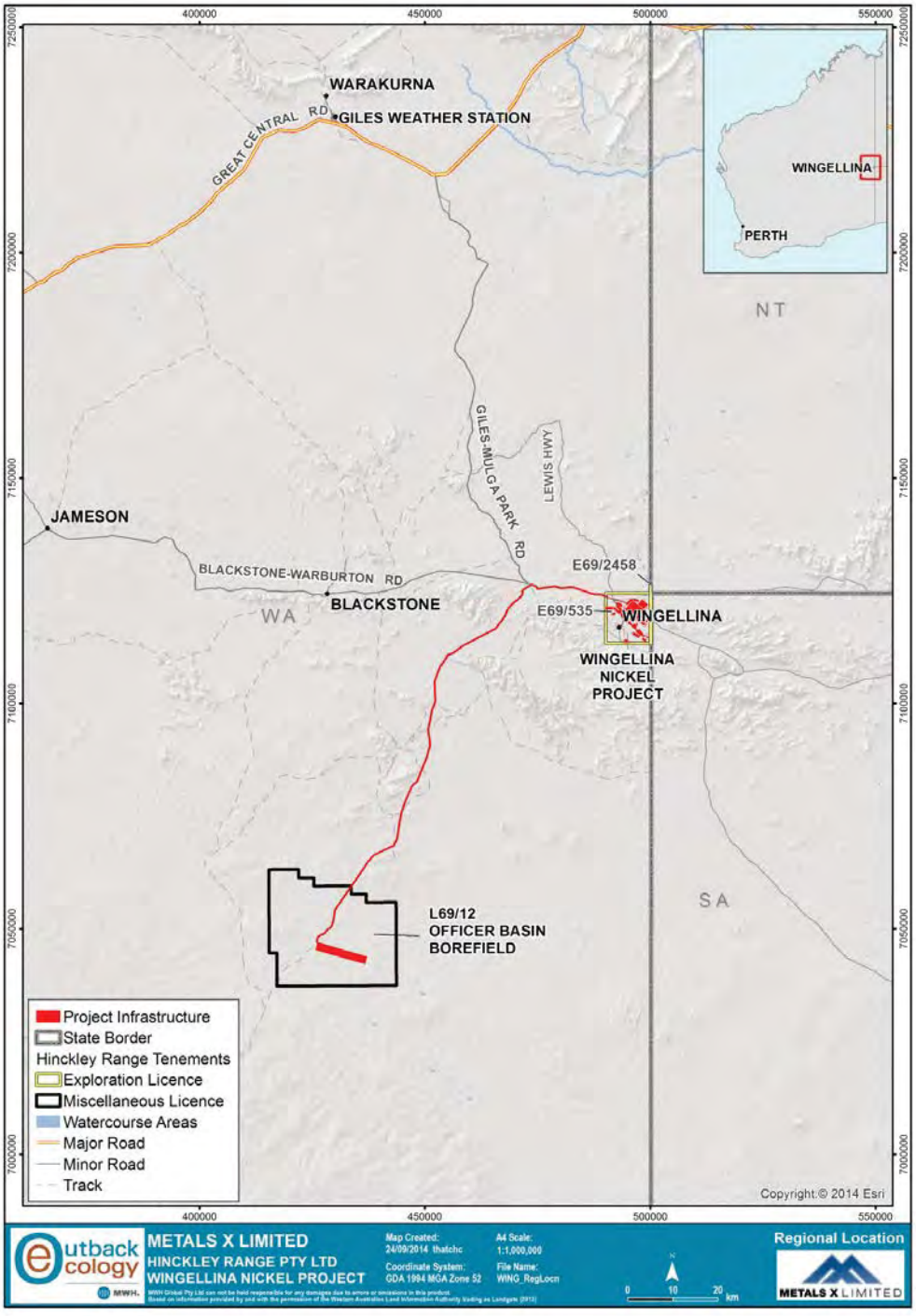

Figure ES1 Location of the proposed Wingellina Nickel Project

Table ES1 Key characteristics of the Wingellina Nickel Project

Summary of the Proposal

Proposal title	Wingellina Nickel Mine
Proponent name	Hinckley Range Pty Ltd
Short description	Mining of nickeliferous limonite ore from the Wingellina deposit located approximately 1,400 km east-northeast of Perth, and use of a HPAL process to produce a mixed nickel-cobalt hydroxide product for export to overseas markets.

Disturbance Footprint

Element	Description
Mining pits	Clearing of no more than 607 ha within a 5,875 ha development envelope.
Supporting mine infrastructure (including HPAL processing plant)	Clearing of no more than 736 ha (excluding TSF, borefield and waste rock landform's) within a 5,875 ha development envelope.
Topsoil and waste rock storage	Clearing of no more than 588 ha within a 5,875 ha development envelope.
Tailings Storage Facility	Clearing of no more than 831 ha within a 5,875 ha development envelope.
Raw water supply & pipeline from the Officer Basin	Clearing of no more than 211 ha within a 2,243 ha development envelope.

Operational Elements

Element	Description
Life of project (mine production)	Greater than 40 years (continual operation).
Size of orebody	Up to 180 million tonnes.
Depth of mine pits	Up to 200 metres (average pit depth of 110 m).

Element	Description
Watertable depth in mining area	Approximately 38 to 58 metres. Orebody dewatering will be required to access the deeper parts of the deposit.
Mine operation	24 hour per day operations, Monday to Sunday.
Processing plant	HPAL process, with in-feed of up to 4.5 million tonnes per year to produce an intermediate mixed nickel-cobalt hydroxide product.
Supporting infrastructure (refer to Figure ES2)	Major components include: • Waste rock landforms; • Topsoil stockpiles; • Tailings storage facility; • Water storage facility; • Workshops and washdown areas; • Explosive storage magazine; • Service roads (internal); • Airstrip (upgrade to existing); • Accommodation village; • Administration buildings; • Waste landfill; • Fuel storage area; • Co-generation power plant and power distribution network; • Septic waste treatment; and • Reverse osmosis water treatment units.
Maximum ore mining rate	Up to 4.5 million tonnes per year.
Tailings Disposal	Up to 5.5 million tonnes per year.
Mine dewatering	Up to 0.5 gigalitres per year.
Water Supply: Groundwater abstraction from the Officer Basin	Up to 12 gigalitres per year.

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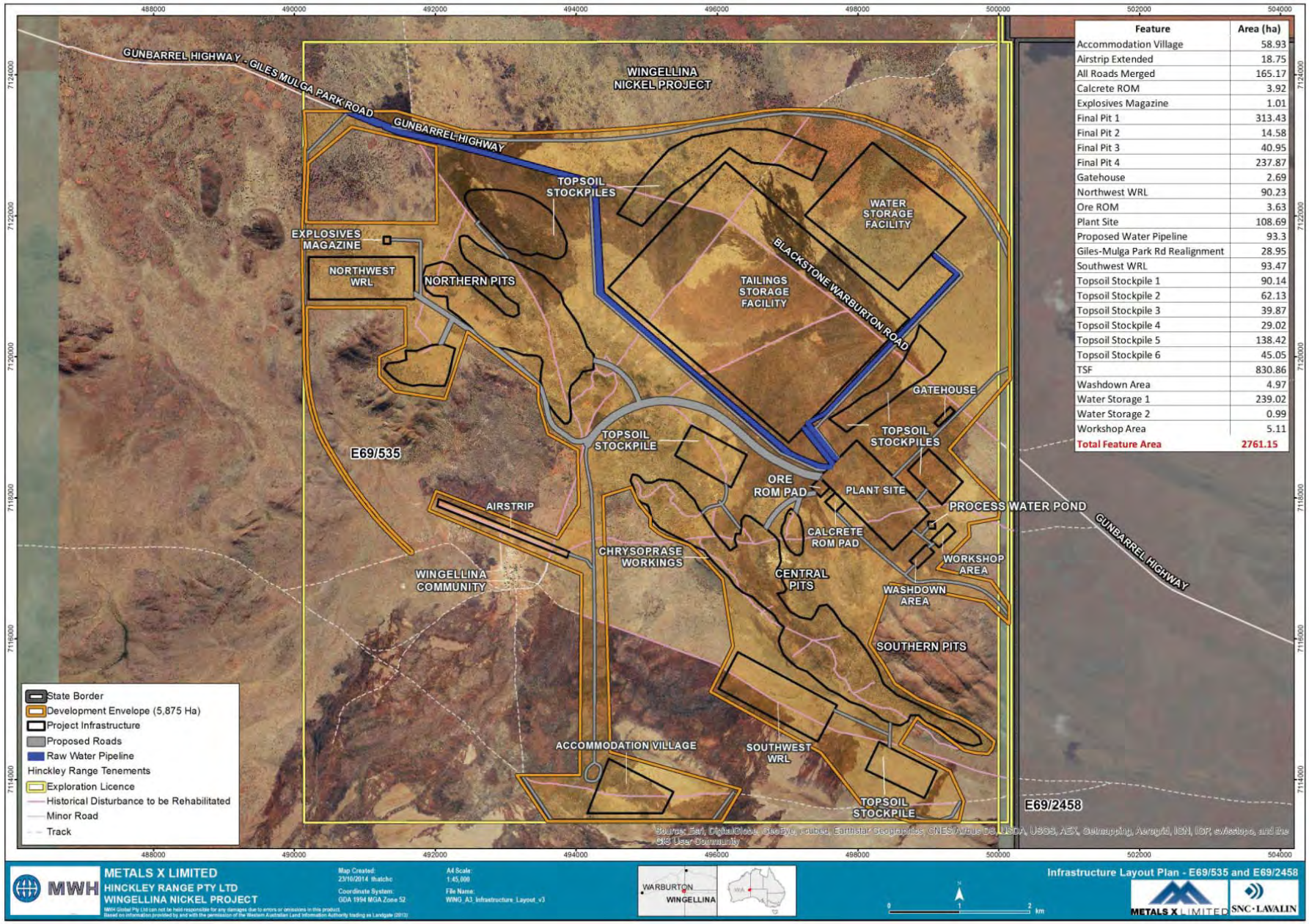

Figure ES2 Layout and disturbance footprint of the proposed Wingellina Nickel Project mining area

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PROJECT JUSTIFICATION

The Project will create benefits at local, state, and national levels. In particular, the development of the Project is expected to provide wide reaching economic and social benefits in an area devoid of commercial development and work opportunities for the local Aboriginal population. This includes employment, training opportunities, improved services and the creation of a basis for a number of additional ancillary industries at Wingellina.

Commercial justification for the Project is based on modelling forecasts of strong operating returns. Following the initial high capital construction cost, estimated at approximately $2.5 billion, the Project is expected to generate operating profit in the order of several hundred million dollars per year. Federal taxation revenue is expected to exceed $5 billion over the life of the Project, and WA State Royalty revenue is likely to be in the vicinity of $1 billion over the life of the Project.

The Project is anticipated to provide a number of environmental benefits at a local level, through the implementation of feral animal and weed management and control programs.

ASSESSMENT OF ENVIRONMENTAL IMPACTS

Commonwealth

The Project was referred to the Department of Environment in October 2013 under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The Commonwealth Minister of Environment and Heritage subsequently determined the proposed mining area development is “not a controlled action” but deferred assessment on the access road and support infrastructure (i.e. water borefield and pipeline, gas pipeline) (ref. EPBC 2013/7021). A separate referral may be required for infrastructure items outside tenement E69/535, depending on whether this infrastructure would significantly impact on matters of National Environmental Significance (NES).

Western Australia

The Project was referred to the Environmental Protection Authority (EPA) in September 2013 under Section 38 (Part IV) of the *Environmental Protection Act 1986* (EP Act). In November 2013 the EPA determined that the Project required formal assessment under the EP Act and set a Public Environment Review (PER) level of assessment with an eight week public review period.

An Environmental Scoping Document (ESD) was prepared and approved by the EPA on 4 July 2014 which identified ten key environmental factors for more detailed consideration in the PER document, as follows:

- Air Quality;
- Human health;
- Heritage;
- Amenity (noise, light and vibration);

- Hydrological processes;
- Flora and vegetation;
- Terrestrial fauna;
- Subterranean fauna;
- Rehabilitation and closure; and
- Offsets.

This PER document discusses potential environmental impacts on these factors related to the construction, operation and closure of the Project; and describes management measures to avoid, reduce and/or ameliorate these impacts in order to meet the environmental protection objectives of the EPA.

STAKEHOLDER CONSULTATION

Hinckley Range has consulted with the local community, government agencies and other key stakeholders prior to and during the preparation of the PER. Stakeholder and community consultation to date has been undertaken through formal meetings and briefings with government agencies, and community meetings with the Wingellina residents.

The remote location of the Project and its proximity to Aboriginal communities has emphasised the importance of regular and ongoing consultation with the Wingellina community. Hinckley Range has been working with the Ngaanyatjarra Council and the local community for over nine years, and has built strong relationships at the community and regional levels.

Hinckley Range is committed to ongoing consultation and engagement with the local community over the life of the Project, as will be the case with the Ngaanyatjarraku shire council and State government agencies.

EXISTING ENVIRONMENT

Climate

The regional climate is classified as desert: hot (persistently dry) under the modified Köppen classification system (Stern et al. 2000). It is characterised by hot summers and mild winters.

Mean annual rainfall is estimated to be less than 300 mm/year. Rainfall is highly variable on an interannual basis, with the majority received during summer in association with the ingress of low pressure troughs and tropical lows from the north. Winters are mild and associated with a high pressure subtropical ridge. Annual pan evaporation is estimated to be 3,300 mm to 3,400 mm and typically exceeds rainfall in all months of the year.

The prevailing winds are predominantly from the northeast to southeast. Winds are milder and wind direction more evenly distributed during the winter months.

Dust and Particulates

Field measurements of ambient air quality were undertaken to determine the baseline air quality at the Project site. This involved using local and regional metrological data, deposition gauges checked monthly in the period August 2008 to April 2011, and 12 months of continuous ambient air monitoring between October 2010 and November 2011. A predictive modelling study was also undertaken to determine the potential impacts of plant emissions and fugitive dust on air quality.

PM_{10} concentrations at Wingellina are generally low compared to other Western Australian locations. However, high particulate concentrations may occasionally at occur at Wingellina, in association with smoke generated by regional wildfires and dust storms (Air Assessments 2013).

Geology

The Project is located in the Musgrave Ranges in WA, and is bounded to the south by the Great Victoria Desert and to the north by the Great Sandy Desert. The most prominent landforms in the Project area are the Wingellina Hills and the Hinckley Range, which are ridges of mafic and ultramafic intrusive rocks that strike approximately in a NW to SE direction. The idealised sequence within these intrusions comprises a thick basal unit of dunite overlain by a thin unit of pyroxenite, which is in turn overlain by a thick unit of gabbro. The gabbroic rocks are relatively resistant to erosion, so that these typically crop-out and form ridges in the landscape.

The ore body is located in the North Hinckley Range adjacent to the Wingellina Hills. Chemical weathering of the dunite has produced a basal zone of magnesite and/or chalcedonic silica which is overlain by a variably thick zone of nickeliferous goethite, referred to as limonite ore.

Surface Hydrology

The Project is located in the northern part of the Warburton drainage basin, a large internally draining basin of about 340,000 km^2 encompassing the southern Gibson Desert and northern Great Victoria Desert in central Australia. Due to the region's arid climate, predominant low relief and extensive cover of aeolian sand, surface water only flows transiently after large rainfall events.

The proposed mining area intersects several sub-catchment areas defined by the Hinckley Range and Wingellina Hills, and a small range of hills running in a north-westerly direction between the two. The sub-catchments include a series of poorly defined, ephemeral drainages. There are no significant creeks or water bodies within the area.

Groundwater

Mining Area

Groundwater at the proposed mining area is associated with bedrock fractures/discontinuities, and pore-water within the weathered zone (Coffey, 2008).

Depending on the water table elevation, and more specifically the surface topography, the depth to water varies from about 18 to 55 m below ground level (mbgl). There is a steep rise in water table elevation along the south-western margin of the Wingellina ore body, attributed to the presence of a low-permeability fault that has the effect of restricting the regional flow of groundwater from the southwest to the northeast.

The salinity of the groundwater in the ore body area is predominantly brackish, ranging from approximately 4,000 mg/L to 41,000 mg/L and averaging about 11,000 mg/L.

The aquifer is characterised by low permeability due to the clayey nature of the weathering products of the Wingellina ore body, which are not conducive to water yielding conditions.

Officer Basin

The Central Officer Basin contains strata of Late Proterozoic age and is overlain by the Gunbarrel Basin (Rockwater, 2010). The target hydrostratigraphic unit is aeolian sandstone of the Lungkarta Formation as interpreted by Haines et al. (2008), which is overlain by the Vines Formation composed of sandstone and conglomerate, interbedded with minor claystone and siltstone.

Drilling and test pumping results indicate that the Central Officer Basin has the potential to supply water to the Project for approximately 37 years at a rate of 380 L/s (Rockwater 2012).

Heritage

The Project is within the granted Ngaanyatjarra Lands Claim which covers a total area of 9.8 million ha and has a population of approximately 1,840 people. The Ngaanyatjarra Lands Indigenous Protection Area (IPA) was declared in August 2002 and is the largest declared IPA in Australia.

Ten Aboriginal heritage exclusion zones have been delineated based on the outcomes of ethnographic surveys conducted in 2001 and 2006. These zones comprise approximately 13.5 km^2 or 12% of tenement E69/535.

Thirty five archaeological sites have been identified within tenement E69/535 comprising a variety of artefact scatters, quarries or knapping areas and sites containing grindstones and stone structures (Artefaxion, 2008).

Flora and Vegetation

The vegetation and flora of the Project area was originally surveyed in 2002, with additional surveys completed in the period 2009 to 2012.

A total of 13 vegetation communities were identified in the proposed mining area. The majority of the vegetation is classified as Sparse Tall Shrubland of *Acacia aneura* over hummock or tussock grasslands. Vegetation condition across the area was in good to excellent to pristine condition when surveyed, with localised areas that are more degraded.

Six vegetation communities were identified in surveys of the proposed borefield area, and ten vegetation communities in surveys of the pipeline route. This vegetation was predominantly in excellent to pristine condition when surveyed; although the borefield area includes a number of existing tracks.

All of the mapped vegetation communities are considered to be widely represented in the surrounding region. One community (Sparse Tall Shrublands of *Hakea lorea*) occurring on hill tops and ridgelines in southern portions of tenement E69/535 is considered to be locally significant.

No Declared Rare Flora (DRF), Priority Flora, Threatened Ecological Communities (TECs), or Priority Ecological Communities (PECs) were recorded in the Project area surveys. Four Priority taxa were recorded in the proposed mining area, and five Priority taxa were recorded in the proposed borefield area and pipeline route. These records were predominantly from locations outside the proposed development envelope.

Terrestrial Fauna

The fauna of the Project area was originally surveyed in 2002, with additional surveys completed in the period 2008 to 2011.

Four broad habitats were identified within the proposed mining area comprising: mallee woodland on stony slopes, rocky hills and escarpments, mulga over tussock grasslands and mulga-mallee over hummock grassland. These habitats are considered to be widely represented throughout the surrounding region. A total of 66 terrestrial vertebrate fauna species were recorded during the 2008 survey, comprising 16 mammal species (10 native and six introduced), 27 reptiles and 23 bird species (Outback Ecology, 2009). Six invertebrate taxa with the potential for short-range endemism were collected; however suitable habitat for these taxa is widespread outside the proposed disturbance footprint. Overall species diversity in the proposed mining area was indicative of the broader region.

Six broad habitats were identified within the proposed borefield area and pipeline route comprising: dense mulga woodland; mulga over hummock grassland; mulga over tussock grassland, mulga-mallee over hummock grassland, drainage line, and scattered Eucalypts over mixed shrubland. These habitats are considered to be widely represented throughout the surrounding region. A total of 60 terrestrial vertebrate fauna species were recorded during the 2011 survey including 14 mammal species (4 of which were introduced species), 15 reptiles and 31 bird species (Outback Ecology, 2012c). Overall species diversity in the proposed borefield area and pipeline route was indicative of the broader region.

Four vertebrate fauna species of conservation significance were recorded in the Project area during the 2011 survey:

- The Australian Bustard[1] (*Ardeotis australis*):listed as a Priority 4 species under by the Department of Parks and Wildlife (DPaW) at the time of the survey; recorded in the proposed mining area and propose borefield area;
- The Western Long-eared Bat (*Nyctophilus major tor)*: Listed as Priority 4 by the DPaW, recorded in the proposed borefield area;
- The Rainbow Bee-eater (*Merops ornatus)*: Listed as Migratory under the EPBC Act and Schedule 3 under the *Wildlife Conservation Act 1950* (WC Act), recorded in the proposed borefield area; and
- Brush-tailed Mulgara (*Dasycercus blythi*) - Listed as Priority 4 by the DPaW. Motion-sensor cameras captured two records of this species at the northern end of the proposed access track in the proposed borefield area.

Subterranean Fauna

Subterranean fauna surveys of the Project area and some additional areas were completed in the period 2008 to 2011. The proposed mining area does not include characteristic stygofauna or troglofauna habitats, and no obligate subterranean fauna were recorded in this area. No obligate subterranean fauna were recorded from the Officer Basin borefield area.

Wingellina Community

The Irrunytju Aboriginal community is located at the historic Wingellina exploration camp and is locally known as the Wingellina Township. The community still maintains some traditional activities such as hunting and gathering bush tucker. The majority of residents are Pitjantjatjara speakers.

Wingellina's population ranges from 60 to 100 people – 60 people who are generally permanent residents and an additional 40 people who are occasionally resident in the community (URS 2012).

The socio-economic conditions in this community are classified as low (URS,2012), attributed to a number of existing issues such as the remote location, poor living conditions, limited access to essential social services and lack of infrastructure. Low levels of income (below poverty line), limited employment opportunities and inadequate access to health and education services demonstrate a population that is very disadvantaged and vulnerable.

[1] Subsequent to the 2011 survey the Australian Bustard[1] (*Ardeotis australis*) has been delisted.

The township, as a result of wind erosion, has become a barren landscape. Dusty housing allotments and bare, open spaces give rise to windblown dust. This windblown dust is known to cause an excess of eye, chest and nasal complaints throughout community members. Other key existing health conditions resulting from a number of issues such as low socio-economic factors and remote location include poor nutrition, physical inactivity and high rates of smoking. These factors are contributing to the chronic diseases amongst the community such as diabetes, chronic renal disease, cardiovascular disease and respiratory diseases (URS 2012). Mental health issues were also identified as a problem in for the Ngaanyatjarra Lands (URS, 2012). It was also noted by URS (2012) that respiratory disease is worsened by the lack of sealed roads throughout most communities in the Ngaanyatjarraku Shire.

Existing Land Use / Disturbance

The physical local land use around the Project area is generally limited to hunting of both native and feral animals, and cultural ceremonies. The Ngaanyatjarra Council and the Traditional Owners have identified sites of heritage significance within the Project area that are excluded from development. The mine plan has been developed to avoid these exclusion zones and access is prohibited. The significance of these sites is held secret by Ngaanyatjarra Council and the Traditional Owners.

A small portion of tenement E69/535 has been disturbed in recent years, surrounding the Wingellina Township and rubbish tip. A small decommissioned mine for chrysoprase (a semi-precious gemstone) is located to the east of the Township, and the land immediately surrounding the old workings is heavily disturbed.

The fire regimes which occur in dense Spinifex and Mulga Woodland habitats within the Project area are inappropriate for biodiversity outcomes. It has been observed that fires have burnt extensive areas over the last ten years, with some areas having been burnt several times (Landgate, 2008). Inappropriate fire regimes and frequent broad-scale fires in particular, can simplify vegetation communities and lead to reduced heterogeneity of the landscape. A number of large fires have affected the Project area in the last decade.

ENVIRONMENTAL IMPACTS AND MANAGEMENT

Ten key environmental factors have been identified through the ESD process with respect to the potential impacts of the Project on the existing environment. The potential impacts, proposed management measures and predicted outcomes against each key factor are summarised in Table ES2. Further discussion of the impact assessment findings for each factor are detailed in the relevant chapters of this PER and supporting studies (attached).

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Table ES2 Summary Environmental Management Measures and predicted outcomes

EPA Factor/ Objective	Potential Impact (without mitigation)	Impact Assessment	Environmental Management and Mitigation Actions	Predicted Outcomes (Meets EPA Objective – Y/N)
Air Quality				
To maintain air quality for the protection of the environment and human health and amenity.	Sensitive receptors include the Wingellina townsite, air strip and workforce accommodation village. Increased dust levels on-site causing: • Reduced amenity; • Exceedance of target threshold limits for human health and well being; and • Localised smothering of vegetation.	Predictive modelling of particulates, PM_{10} and $PM_{2.5}$ indicate these will meet nationally accepted Air Quality standards and goals at the Wingellina townsite and workers accommodation village. Note: The majority of annual $PM_{2.5}$ concentrations are from background particulates with only small contributions expected from operations.	Regulation under Part V of the EP Act (Works Approval and Operating Licence). Implement the Air Quality Management Plan (Appendix B) addressing: • Establishment of air quality targets for sensitive receptors; • Practices to avoid and minimise dust emissions (e.g. application of water to working surfaces and stockpiles; progressive clearing and rehabilitation); • Monitoring of particulates; and • Maintenance of a community complaints and response register.	With the implementation of appropriate management measures, dust emissions will not exceed nationally accepted Air Quality standards and goals. Hinckley Range considers that the Proposal can be implemented to meet the EPA Objective for this factor.
	Sensitive receptors include the Wingellina townsite and workforce accommodation camp. Emission of SO_2, NO_2, and sulphuric acid mist to the atmosphere from the processing plant will exceed NEPM standards and established goals protective of health.	Predictive modelling under normal operating, and non routine operation (with an acid plant start up) indicates that concentrations of SO_2, NO_2, and sulphuric acid mist at all sensitive receptors will meet nationally accepted Air Quality standards and goals under all operating conditions.	Regulation under Part V of the EP Act (Works Approval and Operating Licence). Implement the Air Quality Management Plan (Appendix B) addressing: • Implement emission reduction controls in order to achieve air quality targets; • Establishment of air quality targets for sensitive receptors, monitoring of SO_2, NO_2, and sulphuric acid mist; and • Maintenance of a community complaints and response register.	With the implementation of appropriate management measures, emissions of SO_2, NO_2, and sulphuric acid mist will not exceed nationally accepted Air Quality standards and goals. Hinckley Range considers that the Proposal can be implemented to meet the EPA Objective for this factor.
	GHG emissions from construction, mining and ore processing, power generation, heavy transport equipment and light vehicles.	GHG emissions intensity during normal operating conditions is forecast to be 0.12 tonnes of CO2-e per tonne of ore milled. This value is comparable with similar operations in WA.	Compliance with the *National Greenhouse and Energy Reporting Act 2007* (NGER Act). Implement continual improvements to reduce GHG emissions, by increasing efficiency and applying efficient technologies.	The Project will be designed to minimise GHG emissions to the minimum practicable for economic production. Provided that adequate design and management measures are implemented, the impact of GHG emissions from the Project is expected to be minimised to acceptable levels. Hinckley Range considers that the Proposal can be implemented to meet the EPA Objective for this factor.

EPA Factor/ Objective	Potential Impact (without mitigation)	Impact Assessment	Environmental Management and Mitigation Actions	Predicted Outcomes (Meets EPA Objective – Y/N)
Human Health				
To ensure that human health is not adversely affected	The Wingellina community constitutes a sensitive receptor with respect to potential health impacts. The Project has the potential to produce both positive and negative health outcomes for the Wingellina community. The mine operations could reduce air quality at sensitive receptors in association with increased dust, exposure to high levels of nickel in respirable dust and emissions from the HPAL plant. This has the potential to increase respiratory ailments. Noise emissions and vibrations associated with air blasting and the movement of heavy traffic can contribute to stress, anxiety and sleep disturbance. Where experienced over an extended period, these conditions have been linked to the onset of cardiovascular disease. A greater number of traffic movements to and from Wingellina could result in an increased risk of traffic accidents, and indirectly contribute to the accessibility of illicit drugs and alcohol to the community. At a localised scale, mining and ore processing activities have the potential to contaminate soil and water with metals and hydrocarbons.	In 2012 the Proponent prepared a Social Impact Management Plan (SIMP) for the Wingellina community. The SIMP profiled the existing community, including existing health issues. Potential human health impacts associated with the Project were further evaluated through the completion of a Health Impact Assessment (HIA), undertaken in accordance with guidelines recommended by the Department of Health. The HIA involved a risk based evaluation of seven determinants of health, including an assessment of baseline health conditions and the potential for the Project to have positive and negative effects on each health determinant. The quality of health in the Wingellina community is strongly related to the current socio economic environment. Wingellina is disadvantaged by its remote location and is characterised by low levels of income, limited employment opportunities, limited access to essential social services (such as health and education) and a lack of infrastructure. The Project will provide benefits by contributing to improved community infrastructure and services. The Project will provide benefits by investment into the existing community infrastructure. Additionally, issues such as water quality and waste disposal within the community may improve as a result of the Project. The negative impacts may include easier access to alcohol and illicit substances. Further to the findings of the HIA, a more detailed Health Risk Assessment (HRA) was undertaken including reduced air quality (associated with emissions of dust, SO_2, NO_2), exposure to high concentrations of nickel in dust and increased ambient noise. Impact assessment studies including modelling suggest that these can be managed to meet National and regulatory standards, thereby avoiding any significant impacts on the health of the community.	The risk based health impact assessment informed the development of mitigation and management strategies to reduce negative health risks to acceptable levels, and enhance aspects of the Project contributing to positive health outcomes. Implement the Project Environmental Management Plans (Appendix B), which include specific items addressing air quality, noise, cultural heritage, waste management and measures to prevent contamination of soil and water. Implement monitoring for PM10 and Ni dust using hi-vol samplers in accordance with the relevant Australian Standards and EPA approved methodology so that the results can be compared with existing WA health guidelines Physical separation of mining and heavy haulage traffic movements from the Wingellina townsite. Regular (improved) maintenance of major roads and signage to support mining operations. Action the recommendations in the SIMP for improving community health such as: • Providing training and employment opportunities for the local community; • Mentoring and support school students and improve work-readiness; • Support for development of local businesses; • Improvements to town infrastructure; and • Increased availability of healthy foods, from supply to mine accommodation. Prepare and Implement an Aboriginal Employment Strategy that enables the training and employment of Ngaanyatjarra Lands people and includes flexible work practices that encourage Aboriginal participation in the Project workforce.	With the implementation of appropriate management measures: • Emissions of dust and other substances (i.e. SO2, and NO2,) will not exceed nationally accepted Air Quality standards and goals; • Exposure to nickel will be below WA department of Health annual average criteria of 0.003ug/m^3. • the Project is expected to comply with regulatory requirements for noise under Part V of the EP Act; • Risks of soil and water contamination will be minimised, and measures put in place to contain and remediate any local scale contamination; and • The local community is expected to benefit from improved health outcomes deriving from socio-economic improvements. Hinckley Range considers that the Proposal can be implemented to meet the EPA Objective for this factor and can provide improvements in health of the Wingellina Community.

EPA Factor/ Objective	Potential Impact (without mitigation)	Impact Assessment	Environmental Management and Mitigation Actions	Predicted Outcomes (Meets EPA Objective – Y/N)
Heritage				
To ensure that historical and cultural associations are not adversely affected.	Disturbance of ethnographic sites, including extant cultural associations with these areas.	Areas of ethnographic significance within tenement E69/535 have been identified. During the construction and operation phases of the Project, there is potential for the Project workforce to enter and disturb these areas.	The Project will be subject to the Cultural Heritage Management Plan (Appendix B). As part of the ethnographic survey completed in July 2001, ten Aboriginal heritage exclusion zones were delineated by the Traditional Owners within the proposed mining area. Signage and exclusion barriers will be installed and maintained to guide the avoidance of these areas by the Proponent. Cultural awareness induction and education programs will be conducted for all workforce personnel.	Through consultation and the identification of exclusion zones within tenement E69/535 the Project will not impact upon any ethnographic sites. Hinckley Range considers that the Proposal can be implemented to meet the EPA Objective for this factor.
	Disturbance of archaeological sites.	35 archaeological sites within tenement E69/535 have been identified. Two of these are located within the proposed Project disturbance footprint to the north of the central mine pits.	The Project will be subject to the Cultural Heritage Management Plan (Appendix B). Archaeological sites will be avoided wherever possible. Approval to disturb the two archaeological sites within the proposed Project disturbance footprint will be sought under Section 18 of the *Aboriginal Heritage Act 1972* prior to ground disturbance. A Register of heritage sites for the Project area will be maintained. Cultural awareness induction and education programs will be conducted for all workforce personnel.	The Project is expected to disturb two archaeological sites located to the north of the central pits. Any disturbance will be managed in accordance with the *Aboriginal Heritage Act 1972.* It is anticipated that all other recognised archaeological sites will be avoided. Hinckley Range considers that the Proposal can be implemented to meet the EPA Objective for this factor.

EPA Factor/ Objective	Potential Impact (without mitigation)	Impact Assessment	Environmental Management and Mitigation Actions	Predicted Outcomes (Meets EPA Objective – Y/N)
Amenity				
To ensure that impacts to amenity are reduced as low as reasonably practicable.	The construction and operational phases of the Project will result in noise emissions and ground vibration, in particular from blasting and the use of heavy equipment. Sensitive receptors include the Wingellina townsite and workforce accommodation village.	Predictive modelling indicates that: • Operational noise levels will be less than 35 dB L_{A10} at the Wingellina townsite and workforce accommodation village; • Construction noise will be up to 58 dB L_{A10} at the workforce accommodation village; and • Airblast noise will be 100 dB $L_{Linear\ peak}$ at the Wingellina townsite and workforce accommodation village. These values all meet Western Australian regulatory requirements; however it is noted that the predicted noise levels at the Wingellina townsite are close to the threshold criterion for a sensitive receptor under the *Environmental Protection (Noise) Regulations 1997*, Ground vibration velocity levels are predicted to be 0.22 mm/s at the Wingellina townsite and 0.08 mm/s at the workforce accommodation village. These values are lower than ground vibration threshold criteria described in *AS 2187.2-2006 Explosives Storage and use – Use of explosives*.	Compliance with the *Environmental Protection (Noise) Regulations 1997*. Implement the Noise and Vibration Management Plan (Appendix B) addressing: • Appropriate location of infrastructure; • Construction works to be carried out in accordance with relevant legislation and standards; • Noise monitoring network in place to demonstrate compliance and trigger actions; • Regular maintenance of all plant with specific attention to ensuring noise power levels do not increase over time; and • Maintenance of a community complaints and response register.	With the implementation of appropriate management measures, the Project is expected to comply with regulatory requirements for noise under Part V of the EP Act. Hinckley Range considers that the Proposal can be implemented to meet the EPA Objective for this factor.
	Increased use of the existing airstrip could increase noise impacts on the Wingellina townsite resulting from aircraft movements.	It is anticipated about 3 to 5 additional flights per week would be needed for mine operations. The airfield would only be operational during daylight hours, as per current operational restrictions. Based on sound power levels for a BAe146 aircraft, which is considered to be representative of the class of aircraft likely to be used for the mine operational purposes, estimated aircraft noise will be approximately 83 dB (A) max at take-off and 75 dB (A) max at landing. This noise level would be conditionally acceptable for airfields with less than 20 flights per day in accordance with *Australian Standard AS 2021-2000: Acoustics - Aircraft noise intrusion - Building siting and construction.*	Implement the Noise and Vibration Management Plan (Appendix B) addressing: • Noise monitoring network in place to demonstrate compliance and trigger actions; and • Maintenance of a community complaints and response register.	Noise resulting from aircraft movements is expected to be within acceptable levels consistent with *Australian Standard AS 2021-2000: Acoustics - Aircraft noise intrusion - Building siting and construction.* Hinckley Range considers that the Proposal can be implemented to meet the EPA Objective for this factor.

EPA Factor/ Objective	Potential Impact (without mitigation)	Impact Assessment	Environmental Management and Mitigation Actions	Predicted Outcomes (Meets EPA Objective – Y/N)
	Owing to 24 hour per day operations, the Project will increase artificial light emissions in the Wingellina locality during the night. Sensitive receptors include the Wingellina townsite and more distant Kalka and Pipalyatjara communities. The behaviour of light sensitive nocturnal fauna, in particular several bat species recorded in the area, could be affected.	Light emissions from night operations are expected to be visible from the Wingellina townsite. However, light impacts will not be severe, as the main Project infrastructure will be on the other side of the ridge out of the direct sight of the community and only a light halo is expected at this location. The light halo is also expected to be softened by existing ambient light from existing streetlights within the townsite. Lighting from the Project operations is expected to have minimal or no impact on the Pipalyatjara and Kalka communities, as the Hinckley Range will act as a visual barrier. Bat habitat occurs in the Project area but is also extensive in the surrounding landscape. None of the bat species recorded in the Project area have restricted distributions or a particular reliance on the habitat of the Project area (refer to Chapter 12). As such, no significant impacts of light emissions on bat species are expected.	Measures to minimise light emissions will include: • All lighting used during the construction of the Project will conform to Australian Standards and be selected to minimise the impact of light emissions on fauna and local communities; • Lighting will be directed towards construction and operations areas, with light shields installed where appropriate; • Minimal illumination levels will be used to illuminate work areas; and • Flights servicing the Project will only operate during the day.	With the implementation of appropriate management measures, lighting from the Project is not expected to result in significant impacts to sensitive receptors. Hinckley Range considers that the Proposal can be implemented to meet the EPA Objective for this factor.
Hydrological Processes				
To maintain the hydrological regimes of groundwater and surface water so that existing and potential uses, including ecosystem maintenance, are protected.	The Wingellina orebody extends below the water table, and will require dewatering to enable mining access. Aquifer drawdown from pit dewatering could potentially impact on groundwater dependent ecosystems or other water users.	The depth to groundwater in the proposed mining area varies from about 18 to 55 mbgl. Groundwater is considered to be primarily associated with bedrock fractures or discontinuities. Results of preliminary modelling under a worst case scenario (i.e. simultaneous dewatering of all pits over a 15 year period) predict drawdowns of up to two metres extending up to one kilometre from the pit margins. There is no groundwater dependent vegetation proximal to the proposed mining area, and the groundwater system does not provide habitat for stygofauna. The drawdown footprint is not predicted to reach the Wingellina town water supply bores. Consequently no significant environmental impacts are anticipated from groundwater abstraction for pit dewatering.	Drill and abstract groundwater in accordance with 26D and 5C licences issued under the *Rights in Water and Irrigation Act 1914.* A network of groundwater monitoring bores will be installed prior to the commencement of ground disturbing activities to enable the collection of baseline data and enable routine monitoring of groundwater levels and quality. Implement the Hydrological Processes Management Plan (Appendix B) addressing: • Groundwater monitoring of water levels within the proposed mining area; and • Volumes of water abstracted from the pits will be monitored (consistent with regulatory requirements), and kept to the minimum required for safe mining operations.	With the implementation of appropriate management measures, no significant impacts to groundwater resources or ecological communities are expected to occur over the life of the mine as a result of mine pit dewatering. Hinckley Range considers that the Proposal can be implemented to meet the EPA Objective for this factor.

EPA Factor/ Objective	Potential Impact (without mitigation)	Impact Assessment	Environmental Management and Mitigation Actions	Predicted Outcomes (Meets EPA Objective – Y/N)
	Groundwater in the Officer Basin, located approximately 100 km to the southwest of the proposed mining area, has been identified as a long term water supply option for the Project. There are currently no other users of this groundwater resource. Aquifer drawdown from the borefield could potentially impact on groundwater dependent ecosystems or other water users.	The depth to groundwater in the proposed borefield area varies from about 10 to 25 mbgl. The target aquifer occurs in aeolian sandstone of the Lungkarta Formation, which has an inferred depth of about 180 m and is bounded by lower permeability hydrostratigraphic units. The target aquifer has relatively low permeability and storativity. Modelling of the drawdown from multiple production bores suggests that the cone of depression produced by pumping will be narrow and steep-sided nearby to the production bores. There is no groundwater dependent vegetation proximal to the proposed mining area, and the groundwater system does not provide habitat for stygofauna. Consequently no significant environmental impacts are anticipated from the abstraction of water from this bore field. Note that based on characteristics of the target aquifer, a zone of drawdown is expected to persist within the aquifer following the cessation of groundwater abstraction.	Drill and abstract groundwater in accordance with 26D and 5C licences issued under the *Rights in Water and Irrigation Act 1914*. Implement the Hydrological Processes Management Plan (Appendix B) addressing: • Groundwater monitoring of water levels; and • The volume of water abstracted from production bores will be monitored (consistent with regulatory requirements).	The development and abstraction of water from the Central Officer Basin bore field will create zone of drawdown that is expected to persist within the aquifer following the cessation of groundwater abstraction. Hinckley Range considers that the Proposal can be implemented to meet the EPA Objective for this factor.
	Groundwater quality Contamination ground water from spills and seepage from TSF.	Potential groundwater contaminants associated with liquid seepage from the TSF include magnesium, calcium and manganese. Test pits carried out within the TSF footprint for the environmental baseline study indicate sandy clay to depths between 0.6 and 1.0 m. This material will inhibit seepage and this will be further reduced by the impermeable nature of the tailings (greater than $1x10^{-6}$ms). Mounding associated with the TSF was modelled and is not predicted to interact with vegetation root systems and therefore no impacts on vegetation communities resulting from mounding are expected. Modelling of mounding is not predicted to reach the Wingellina town water supply bores.	Regulation under Part V of the EP Act (Works Approval and Operating Licence). Landfills will be constructed with the requirements of the *Environmental Protection (Rural Landfill) Regulations (2002*) including containment of contaminated stormwater runoff. A network of groundwater monitoring bores will be installed prior to the commencement of ground disturbing activities to enable the collection of baseline data and enable routine monitoring of groundwater levels and quality. Implement the Hydrological Processes Management Plan (Appendix B) addressing: • Groundwater monitoring of water quality, to enable detection of potential contamination from TSF, WSF, HPAL processing plant area, process ponds, waste landfill and WWTP; • Practices to avoid and minimise contamination from the handling and storage of	With the implementation of appropriate management measures, no significant impacts to groundwater through contamination are expected to occur throughout the life of the mine. Hinckley Range considers that the Proposal can be implemented to meet the EPA Objective for this factor.

EPA Factor/ Objective	Potential Impact (without mitigation)	Impact Assessment	Environmental Management and Mitigation Actions	Predicted Outcomes (Meets EPA Objective – Y/N)
			hydrocarbons and other chemicals; and • Sewerage facilities will be constructed to comply with relevant regulatory requirements.	
	Altered drainage patterns and surface water quality from mine development and spills. Run-off from landfill and waste disposal areas may lead to contaminated surface water discharge with a range of substances including oils and hydrocarbons, biological oxygen demand (BOD), nutrients and particulate matter.	The Project area does not include any significant creeks, water bodies or other sensitive surface water receptors. The proposed mining area intersects several sub-catchment areas defined by the Hinckley Range and Wingellina Hills, and a small range of hills running in a north-westerly direction. The sub-catchments include a series of poorly defined, ephemeral drainages. Existing drainage pathways will be subject to minimal disturbance, and any localised contamination event is not expected to impact surface water quality.	Implement the Hydrological Processes Management Plan (Appendix B) addressing: • All site infrastructure will be constructed to minimise disruption to surface water flow, reduce the potential for flooding of infrastructure, and minimise the risk of groundwater contamination. A surface water management study for the proposed mining area has been completed, which includes recommendations for drainage and flood prevention structures; • Waste disposal areas will be constructed outside of known drainage lines and with contained drainage that discharges via a sediment sump/oily water separator; and • Contaminated storm water will be retained on site where practicable.	With the implementation of appropriate management measures, no significant impacts to surface water systems are expected to occur throughout the life of the mine. Hinckley Range considers that the Proposal can be implemented to meet the EPA Objective for this factor.
Flora & Vegetation				
To maintain representation, diversity, viability and ecological function at the species, population and community level.	Loss of biological diversity and reduced regional representation of flora and vegetation communities.	Up to 2,762 ha of native vegetation within a 5,875 ha development envelope will be progressively cleared within the proposed mining area. Additionally, up to 211 ha within a 2,243 ha development envelope will be cleared to establish the borefield (and associated access track) and pipeline to the proposed mining area. The majority of the vegetation in the proposed clearing footprint is good to excellent to pristine condition; however the affected vegetation types are widely represented in the surrounding region. Therefore the Project will not cause any significant impact upon the diversity of flora and vegetation at a local or regional scale.	Implement the Flora and Vegetation Management Plan (Appendix B) addressing: • Minimisation of clearing footprints during final design including the avoidance of drainage line and ridgeline vegetation where possible; • Mine planning to include progressive clearing and rehabilitation to minimise the amount of bare soil at any one time; and • Implementation of clearing permitting procedures to prevent accidental clearing of vegetation and undertake regular inspections.	The Project will result in clearing of up to 2,973 ha of native vegetation in total (mining area, borefield and pipeline route), the majority of which is good to excellent to pristine condition. With the implementation of appropriate management measures, no significant impacts to the biological diversity of vegetation and flora locally or regionally are expected to occur throughout the life of the mine. Much of the disturbed area will be rehabilitated with locally occurring native species. This will result in partial reinstatement of the biological diversity of the affected vegetation. Hinckley Range considers that the Proposal can be implemented to meet the EPA Objective for this factor.
	Loss of conservation significant flora or communities.	The Project area does not include DRF, TEC or PEC's. Eight Priority taxa are known from the Project area, however direct disturbance to individuals and populations will largely be avoided. Some individuals of *Menkea lutea* (Priority 1) and *Calotis latiuscula* (Priority 3) occur within	Implement the Flora and Vegetation Management Plan (Appendix B) addressing: • Demarcation and avoidance of Priority flora populations and individual plants; and • Regular monitoring of the condition of Priority flora in the Project area.	With the implementation of appropriate management measures, the Project is not expected to result in any significant impacts on conservation significant flora or communities. Hinckley Range considers that the Proposal can be implemented to meet the EPA Objective for this factor.

EPA Factor/ Objective	Potential Impact (without mitigation)	Impact Assessment	Environmental Management and Mitigation Actions	Predicted Outcomes (Meets EPA Objective – Y/N)
		the proposed development envelope in the south east corner of tenement E69/535. However, these species also occur in areas outside the development envelope.		
	The introduction and spread of weeds.	Eight introduced species including the highly invasive Buffel Grass (**Cenchrus ciliaris*) have been recorded in the proposed mining area, and three introduced species have been recorded in the proposed borefield area and pipeline route. Without adequate management, there is the potential for these weeds to be spread further and for new weed species to be introduced in association with vegetation clearing activities, earthmoving, topsoil management and off-road vehicle movements.	Implement the Flora and Vegetation Management Plan (Appendix B) addressing: • Practices to avoid the introduction and spread of weeds, including targeted measures to prevent the spread of Buffel Grass; • Monitoring of weeds; • Weed control activities; and • Workforce training and inductions.	With the implementation of appropriate management measures, the Project is not expected to result in the introduction and spread of weeds. Hinckley Range considers that the Proposal can be implemented to meet the EPA Objective for this factor.
	Increased risk of fire.	The Project area has been impacted by increased frequency of fire regimes related to local hunting practices, which continue to the present. The impact of changed fire regimes is identified as a threat to the Central Ranges Bioregion (Graham and Cowan 2001). The landscape around the borefield exploration area in the Great Victoria Desert Bioregion is also subject to frequent burning.	A Fire Management Plan will be developed for the Project and will include development and identification of the following responses and procedures: • Safe work procedures and permitting for welding and grinding work; • Personnel fire hazard procedures; • Fire response vehicles; • Bushfire contingency plans; • Emergency fire response procedures; • Installation of fire breaks where necessary; and • Workforce training and inductions.	With the implementation of appropriate management measures, there will be no significant change to the risk of fire related impacts on native vegetation. The Project will result in improved local area capacity to detect and respond to wildfires. Hinckley Range considers that the Proposal can be implemented to meet the EPA Objective for this factor.
	Consequential impacts to native vegetation related to increased human pressures in a relatively undeveloped remote area.	By contributing to improved infrastructure and access to Wingellina, the Project has the potential to increase unregulated human activity in the locality. This includes activities with the potential to damage native vegetation such as off-road driving and lighting fires.	Measures to minimise consequential impacts on native vegetation include: • Controls on human activities/land use pressures; • The workforce will be Fly-in-fly-out (FIFO) and restricted to accommodation camp and operations areas; • Compliance with human access and activity constraints applicable to Aboriginal Reserve 17614; and • Workforce training and inductions.	With the implementation of appropriate management measures, and given the large distance between the Project and human population centres, Hinckley Range considers that the risk of consequential impacts to native vegetation can be acceptably minimised.

EPA Factor/ Objective	Potential Impact (without mitigation)	Impact Assessment	Environmental Management and Mitigation Actions	Predicted Outcomes (Meets EPA Objective – Y/N)
Terrestrial Fauna (including short range endemic species)				
To maintain representation, diversity, viability and ecological function at the species, population and assemblage level.	Direct clearance or disturbance of fauna habitat Reduced connectivity of fauna populations, and/or isolation of local habitats.	Up to 2,762 ha of native vegetation habitat will be progressively cleared within the proposed mining area. Additionally, up to 211 ha will be cleared to establish the borefield (and associated access track) and pipeline to the proposed mining area. The habitat types and fauna assemblage recorded in the Project area are unexceptional with respect to biodiversity values, habitat values and regional conservation significance. The wider region has been subject to minimal human development, and similar habitat is extensive outside the Project area. Several conservation significant species are considered likely to occur in the Project area; however all have widespread distributions outside the Project area and are not considered to have any specific reliance on habitat within the Project area. Given the current level of disturbance in the immediate vicinity of the Project area associated with local hunting practices and altered fire regimes, the proposed clearing footprint is unlikely to significantly impact on habitat connectivity for the locally occurring fauna assemblage.	Implement the Terrestrial Fauna Management Plan (Appendix 8) addressing: • Minimisation of clearing footprints during final design including the avoidance of drainage line and ridgeline vegetation where possible; • Mine planning to include progressive clearing and rehabilitation to minimise the amount of bare soil at any one time; and • Implementation of clearing and other procedures to prevent accidental disturbance of vegetation.	The Project will result in clearing of up to 2,973 ha of vegetation habitat in total (mining area, borefield and pipeline route). With the implementation of appropriate management measures, no significant impacts to the biological diversity of terrestrial fauna locally or regionally are expected to occur throughout the life of the mine. The majority of the cleared area will be rehabilitated with locally occurring native species. This will result in partial reinstatement of the habitat values of the affected vegetation. Hinckley Range considers that the Proposal can be implemented to meet the EPA Objective for this factor.
	Increased risk of fauna mortality from vehicle strike.	Vehicle movements present an inherent risk of fauna mortality through strikes. Some species are more vulnerable at particular times of the day, for example those that forage at dawn or dusk, or nocturnal species at night.	Implement the Terrestrial Fauna Management Plan (Appendix 8) addressing: • Vehicle speeds to be controlled and vehicles to only use authorised access routes; • Maintain a register of vehicle impacts on vertebrate fauna; and • Workforce training and inductions.	With the implementation of appropriate management measures, the risk of fauna mortality resulting from vehicle strikes will be minimised. Hinckley Range considers that the Proposal can be implemented to meet the EPA Objective for this factor.

EPA Factor/ Objective	Potential Impact (without mitigation)	Impact Assessment	Environmental Management and Mitigation Actions	Predicted Outcomes (Meets EPA Objective – Y/N)
	Isolation of SRE habitat due to habitat fragmentation.	Several invertebrate species with the potential for short-range endemism (SRE) have been recorded in the Project area, or are considered likely to occur based on habitat considerations. However, potential impacts on SRE invertebrate habitat and species diversity are predicted to be minimal due to the relatively small size of favourable SRE habitats within the proposed disturbance footprint. Suitable habitat for SRE species is widespread outside of the proposed disturbance footprint.	The proposed clearing footprint has been designed to substantially avoid potential SRE habitat.	The development of the Project is not expected to have a significant impact on SRE fauna or their habitat. Hinckley Range considers that the Proposal can be implemented to meet the EPA Objective for this factor.
	Increased populations of introduced (feral) species.	An increase in human activity has the potential to increase the local population of feral animals, through the provision of extra water, food (e.g. food scraps and landfills), shelter (e.g. buildings) and increased immigration. Species commonly associated with human activity in the region and known from the Project area include the Wild Dog, Feral Cat, European Rabbit, One-humped Camel and the House Mouse. These species can predate or compete with native species and/or degrade their habitat.	Implement the Terrestrial Fauna Management Plan (Appendix 8) addressing: • Manage waste and water ponding to prevent the attraction and enhancement of feral animal populations. Monitor feral animal activity and implement control actions where necessary to prevent the build-up of feral animal populations; and • Workforce training and inductions.	With the implementation of appropriate management measures, the risk of accentuated feral animal activity will be minimised. Hinckley Range considers that the Proposal can be implemented to meet the EPA Objective for this factor.
	Disruption to animals resulting from dust, noise and light emissions. Animal entrapment and exposure to toxic substances in the TSF.	Noise and light emissions during construction have the potential to cause localised disturbance to foraging fauna, in particular bat species. However, foraging habitat for bats is widespread outside of the Project area and therefore these impacts are unlikely to be significant. No bat species of conservation significance are considered to occur in the Project area. Fauna is at risk of mortality from falling in and being trapped in trenches/excavated areas, particularly at night during nocturnal activity. Fauna may also be at risk of entrapment in the TSF.	Implement the Terrestrial Fauna Management Plan (Appendix 8) addressing: • Minimise fauna mortality as a result of falling into excavated areas by minimising the trench/excavation area open at any given time, install escape ramps into excavated areas and conduct regular inspections of excavated areas and trenches; • Use bird deterrent methods to minimise bird activity on the TSF; • Install animal egress matting on the sides of the TSF and WSF; and • Workforce training and inductions.	With the implementation of appropriate management measures, the risk of animal disruption and entrapment will be minimised. Hinckley Range considers that the Proposal can be implemented to meet the EPA Objective for this factor.

EPA Factor/ Objective	Potential Impact (without mitigation)	Impact Assessment	Environmental Management and Mitigation Actions	Predicted Outcomes (Meets EPA Objective – Y/N)
Subterranean Fauna				
To maintain representation, diversity, viability and ecological function at the species, population and assemblage level.	Pit dewatering and groundwater abstraction will impact groundwater habitat potentially used by stygofauna. Mining and related ground disturbance could potentially impact troglofauna habitat.	The Project area does not include suitable habitat for subterranean fauna. The findings of four sampling phases demonstrated a very low diversity and abundance of subterranean fauna species associated with habitats in the Wingellina region. No obligate subterranean fauna species were recorded from the Officer Basin borefield area, or from the Wingellina Pit or the Wingellina TSF sampling areas.	The implementation of the Project is not predicted to result in any significant impacts on subterranean fauna conservation values, given the lack of suitable habitat and species present in the proposed mining and borefield areas. As such, Hinckley Range considers that no special management requirements are necessary. The management strategies for mitigation of impacts to groundwater and surface disturbance are generally sufficient to protect the pre-disturbance subterranean habitat values.	The Project will not result in any significant impacts on subterranean fauna. Hinckley Range considers that the Proposal can be implemented to meet the EPA Objective for this factor.
Rehabilitation & Closure				
To ensure that premises are closed, decommissioned and rehabilitated in an ecologically sustainable manner, consistent with agreed outcomes and land uses, and without unacceptable liability to the State.	Rehabilitation failure. Post mining landforms are not safe and stable.	Hinckley Range has undertaken a risk based assessment of decommissioning, mine closure and rehabilitation as part of its feasibility investigations for the Project. On the basis of sodicity and dispersion tests, a proportion of mined materials is likely to be highly-erosive and will require targeted management. The variability of water holding characteristics of the sub-surface soils also has the potential to affect rehabilitation outcomes, and is an important consideration for final landform design particularly with respect to land surface covers. Three closure aspects were considered to have a significant residual risk, after assessment of proposed controls: • Tailings Storage Facility - Dispersive and sodic materials – rehabilitation failure; • Waste Rock Landforms - Dispersive and sodic materials – rehabilitation failure; and • Mining Infrastructure – Open Pits - Safety – public injury.	A Mine Closure Plan (MCP) has been prepared in accordance with relevant industry guidelines and standards (Appendix J). The MCP addresses closure objectives and completion criteria, legal compliance, post-mining landforms, rehabilitation, stakeholder consultation and the decommissioning of mining infrastructure. Specific aspects of the MCP with respect to managing environmental risks include: • Develop detailed landform designs which detail final height and surface water management and also consider materials characterisation, slope characteristics (shape, slope angle), topsoil placement and surface cover designs as relevant to each domain; • Undertake field trials to validate final landform and rehabilitation prescriptions during operations; • Develop and maintain a mine waste schedule; • Determine the volumes of the gabbro and saprock waste available for use in rehabilitation; • Determine the requirement to selectively mine waste (gabbro and saprock) specifically for use in rehabilitation of the landforms; • Review the mine schedule to ascertain if sodic or dispersive waste can be backfilled into the open pits on completion of mining;	With the implementation of the MCP throughout the life of the mine, Hinckley Range considers that the Proposal can be implemented to meet the EPA Objective for this factor.

EPA Factor/ Objective	Potential Impact (without mitigation)	Impact Assessment	Environmental Management and Mitigation Actions	Predicted Outcomes (Meets EPA Objective – Y/N)
			• Develop and implement a waste management plan that details the appropriate placement of erosive, dispersive or sodic material that will be generated throughout the LoM within the WRL; • Identify which vegetative species will be established according to the limitations of the landform and growth medium; Undertake rehabilitation trials throughout operations to test and validate proposed rehabilitation methods.	
	Formation of pit lakes post closure, with implications for groundwater quality and the future groundwater resource.	Mining will extend below the water table and at closure the formation of pit lakes is expected. Pit lakes are predicted to stabilise below the current regional water levels, even under conditions of high orebody permeability and high groundwater inflow. As such they will function as groundwater sinks following the cessation of dewatering. Groundwater will continue to flow towards the pits, so that any changes in water quality within the pits will not impact the regional groundwater system. Pit lake water balance modelling predicts that groundwater salinity will increase over time and reach levels of about 18,000 mg/L TDS after 30 years.	Monitor groundwater throughout the life of the mine, to determine the impact on groundwater quality and levels post-closure. Ongoing refinement of predictive modelling of pit lake water quality prior to closure to inform and optimise the closure strategy for the pit lakes. This includes consideration of the accumulation of salts over time, and the percolation of salts from the pit wall into the pit lake.	Optimisation of the design of pit lakes will be addressed as a component of the implementation of the MCP. Hinckley Range considers that the Proposal can be implemented to meet the EPA Objective for this factor.
Offsets				
To counterbalance any significant residual environmental impacts or uncertainty through the application of offsets.	Residual impacts associated with the clearing of up to 2,973 ha of native vegetation and prolonged groundwater drawdown.	• The Project will not impact on any critical or high value environmental assets recognised at the State level, or matters of national environmental significance recognised under the Commonwealth EPBC Act. It is distant from any known threatened ecological communities, wetlands and waterways, or formal conservation areas; • The Project area does not contain any rare flora species listed under the WC Act or EPBC Act. A number of priority flora species occur in the Project area; however populations of these species are largely outside the proposed	Residual environmental impacts resulting from the Project will be minimised and managed through: • Minimisation of clearing footprints during final design, including the avoidance of drainage line and ridgeline vegetation where possible; • Implementation of the Project Environmental Management Plans (Appendix B); • Implementation of the Mine Closure Plan (Appendix J); • Funding local community projects and social programs to rehabilitate existing degraded sites; and • Provision of support for future biological	With the implementation of appropriate management measures, the Project is not expected to result in any significant residual environmental impacts requiring offsets. As such, Hinckley Range considers that the Proposal can be implemented to meet the EPA Objective for this factor.

EPA Factor/ Objective	Potential Impact (without mitigation)	Impact Assessment	Environmental Management and Mitigation Actions	Predicted Outcomes (Meets EPA Objective – Y/N)
		clearing footprint and will therefore be avoided; • A number of conservation significant fauna species have been recorded in the Project area; however these are all mobile species that occur over a wide geographical range. The Project area does not include habitat of special conservation importance for these species; • The vegetation and habitats found in the Project area are considered to be widely represented throughout the surrounding region. The Project is located in a largely undeveloped landscape and will not result in any significant landscape fragmentation; and • Groundwater levels will slowly recover following the cessation of abstraction activities.	surveys in the wider region.	

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CONCLUSION

A range of specialist environmental, health and heritage investigations relating to the Project have been completed in accordance with relevant standards and guidelines to support the development of the PER. The outcomes of these studies have been used to understand the potential environmental impacts of the Project, and enabled measures to avoid or minimise impacts to be incorporated into the Project design.

Hinckley Range has undertaken extensive consultation with regulatory agencies, the Wingellina community and other stakeholders. This has also informed the design of the Project and associated environmental impact mitigation and management strategies.

Hinckley Range is committed to sound environmental policies and practices and a process of continuous improvement in environmental performance. As a component of the PER, Environmental Management Plans (EMPs) addressing each of the key environmental factors have been developed. These plans include measures to avoid, minimise and mitigate potential environmental impacts, as well as specifying monitoring and contingency actions applicable to the construction and operations phases of the Project. A Mine Closure Plan has been prepared which addresses requirements for the closure, decommissioning and rehabilitation of the Project area.

On the basis of the findings of the Environmental Review, if implemented in accordance with the proposed management measure, the Project is considered to be environmentally acceptable and consistent with the EPA’s principles and objectives for environmental protection.

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Glossary, Abbreviations and Units

1:100 year 72 hour rainfall event	The maximum rainfall likely to occur in 72 hours with a likelihood of occurrence of once every 100 years.
Absorbed Power	The volume of power used by site equipment.
Aeolian	Formed by wind action.
AS/NZS	Australian/New Zealand Standard.
Atterberg limits	Soil parameter measured for cohesive (clayey) soils to determine the range of moisture contents over which the soil changes from one physical condition to another.
Autoclave	A strong, certified, pressurized, steam-heated vessel.
BFS	Bankable Feasibility Study.
Biodiversity	Biological diversity - the variety of life forms: the different plants, animals and microorganisms, the genes they contain, and the ecosystems they form.
Bioregion	Biogeographic region as described by Thackway and Cresswell (1995).
BOM	Bureau of Meteorology.
Calcrete	Carbonate deposits that form in the soil or in the vicinity of the groundwater table as a result of the evaporation of soil water or groundwater respectively.
CAMBA	China-Australia Migratory Bird Agreement.
CCD	Counter-current decantation.
Chrysoprase	A semi-precious gemstone.
CSIRO	Commonwealth Scientific and Industrial Research Organisation.
CTD	Central thickened discharge.
DPaW	Western Australian Department of Parks and Wildlife.
Dispersive (soil property)	Structurally unstable, tends to disperse in water into basic particles i.e. sand, silt and clay. Dispersive soils tend to be highly erodible and present problems for successfully managing earth works.
DMP	Western Australian Department of Mines and Petroleum.
DO	Dissolved oxygen.
DOR	Northern Territory Department of Resources.
DRF	Declared Rare Flora.
DSD	Western Australian Department of State Development.

Dunite	A dense, intrusive, ultramafic igneous rock composed almost exclusively of olivine.
EC	Electrical conductivity.
EIA process	Environmental Impact Assessment process.
EIL	Ecological Investigation Levels.
Emerson class number	Classifies the behaviour of soil aggregates, when immersed, on their coherence in water, providing an indication of potential to produce turbidity.
EMS	Environmental Management System.
EP Act	Environmental Protection Act 1986.
EPA	Environmental Protection Authority.
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999.
Exothermic	Of a reaction or process accompanied by the release of heat.
Flocculant	An agent causing particles suspended in a liquid to form clusters, or 'flocs'.
GDA94 MGA	Geocentric Datum of Australia 1994 Map Grid of Australia.
GDE	Groundwater dependent ecosystem.
Geomorphic	Relating to the earth's surface shape or configuration.
Geotechnical stability	The stability of earth materials.
GL	Gigalitres (billion litres).
Greenhouse Gases	Gases in the Earth's atmosphere which absorb infrared radiation from the earth, causing global warming.
Ha	Hectare(s).
Hardsetting (soil property)	The property of undergoing structural breakdown during wetting and then setting to a hard structureless mass during drying.
Hardstand	An area of compacted earth or bitumen for storage of consumables and equipment.
HP	High pressure.
HPAL	High Pressure Acid Leach - a process to obtain high nickel and cobalt extractions from ore.
Hydrocarbons	Any of numerous organic compounds, such as benzene and methane that contain only carbon and hydrogen. Includes fuels and oils.
Hydrological	Of, or having to do with, water flow.
Hz	Hertz.

IBRA	Interim Biogeographic Regionalisation for Australia.
Intrusive (geological property)	Relating to igneous rock that is forced, while molten, into cracks or between other layers of rock.
Invertebrate	Animal species lacking a spinal cord. Includes molluscs and arthropods.
IPA	Indigenous Protection Area.
ISO 14001	Core set of standards used by organisations for designing and implementing an effective environmental management system, published by the International Organization for Standardization.
JAMBA	Japan-Australia Migratory Bird Agreement.
kPa	Kilopascals.
kV	Kilovolts.
L/s	Litres per second.
Laterite	A red residual soil formed by the natural leaching of silica and by enrichment with aluminium and iron oxides.
Lime	Any of various mineral and industrial forms of calcium oxide differing chiefly in water content and percentage of constituents such as silica, alumina, and iron.
LP	Low Pressure.
mbgl	Metres below ground level.
Mesic	Having or requiring a moderate amount of moisture.
MGA	Map Grid of Australia.
MHP	Mixed Hydroxide Precipitation.
MP	Medium pressure.
Mt	Megatonne (million tonnes).
Mtpa	Megatonnes per annum.
MW	megawatt (million watts).
NEPM	National Environment Protection Measure.
Nm3/h	Normal cubic metres per hour.
NOx	Oxides of nitrogen.
NPI	National Pollution Inventory.
Off-take agreement	An agreement to purchase all or a substantial part of the product produced by a project.
PAF	Potentially acid forming.
PEC	Priority Ecological Community.

PER	Public Environmental Review.
Permeability	A property (of soil, rock or earth) allowing the passage of water through it.
Permeability falling head	A method of measuring permeability in soils with intermediate to low permeability.
PFS	Pre-Feasibility Study.
pH	A measure of the hydrogen activity in a solution. Acidic solutions have pH <7.0, basic solutions have pH > 7.0, neutral solutions have pH = 7.0.
DMITRE	Department for Manufacturing, Innovation, Trade, Resources and Energy (DMITRE).
PLS	Pregnant leach solution.
Precipitation	The process of separating a dissolved substance from a solution as a solid.
Procumbent (plant property)	Trailing along the ground but not rooting.
Putrescible waste	Able to decay, e.g. organic matter.
Regolith	A layer of loose, heterogeneous material between top soil and bedrock.
Rheology	The science of the flow and deformation of matter (liquid or ‘soft’ solids) under the effect of an applied force.
RO	Reverse osmosis.
ROM pad	Run of Mine pad.
SAG Mill	Semi-autogenous grinding mill in which the rock being ground assists in the grinding process.
Slurry	A suspension of insoluble particles (e.g. lime or clay etc.) usually in water.
SMBS	Sodium metabisulphite.
SO2	Sulphur dioxide.
SOx	Oxides of sulphur.
SRE	Short Range Endemic.
Stygofauna	Subterranean fauna whose habitat lies below the water table.
t/d	tonnes per day.
t/h	tonnes per hour.
t/yr	tonnes per year.

Tailings	Fine grained remains of ore once most of the valuable material has been removed in the concentration process.
TEC	Threatened Ecological Community.
TJ/day	Terajoules per day (quadrillion joules per day).
Troglofauna	Subterranean fauna residing above the water table.
TSF	Tailings storage facility.
TSP	Total Suspended Particulate.
Turbidity	The cloudiness or haziness of a fluid caused by suspended particles (suspended solids) that are generally invisible to the naked eye.
USDA	United States Department of Agriculture.
Vertebrate	Animal species having a spinal cord.
WAM	Western Australian Museum.
WC Act	*Wildlife Conservation Act 1950 (WA).*
WRC	Western Australian Water and Rivers Commission.
WRL	Waste rock landform.
WSF	Water storage facility.
WWTP	Waste water treatment plant.

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CHAPTER 1

INTRODUCTION

1.0 INTRODUCTION

1.1 Project Overview

Hinckley Range Pty Ltd (Hinckley Range) proposes to develop the Wingellina Nickel Project (the Project) in the Central Musgrave area of Western Australia.

The Project involves open pit mining of nickeliferous limonite ore from the Wingellina deposit and on-site processing using a high pressure acid leach (HPAL) process, to produce an intermediate mixed nickel-cobalt hydroxide concentrate. The anticipated mine life is 40 years at a mining rate of approximately 4.3 million tonnes per year (Mtpa). The nickel-cobalt hydroxide concentrate will be transported to overseas markets, via road and rail to the Port of Darwin or the Port of Adelaide. The preferred transport route is expected to follow existing road networks, and will be determined following the outcome of a definitive feasibility study (DFS).

This document and supporting appendices comprise the Public Environmental Review documentation for the Project. The document includes:

- A description of the Project;
- A summary of the important physical, biological and social factors of the existing environment;
- An evaluation of potential impacts of the Project on environmental factors;
- Management strategies and measures to ensure the protection of environmental factors and values; and
- A discussion of the extent of community and government stakeholder consultation.

This document has been prepared in accordance with the approved Project Environmental Scoping Document (ESD), *Guidelines for Preparing a Public Environmental Review* (EPA 2012) and *Environmental Impact Assessment (Part IV Divisions 1 and 2) Administrative Procedures 2012*.

1.2 Proponent

The proponent is Hinckley Range Pty Ltd (Hinckley Range), which is a wholly owned subsidiary of Metals X Limited (Metals X). Metals X is a diversified group exploring, developing and mining mineral deposits in Australia. It is Australia's largest tin producer, being the 50% owner and operator of the Renison Tin Mine (Renison) and Mount Bishoff mines in Tasmania, is one of Australia's top ten gold producers located in the Kalgoorlie and Murchison Goldfields of WA and holds a pipeline of assets from exploration to development, including the Wingellina Project.

The proponent and owner details for the Project are:

Proponent Name:	Hinckley Range Pty Ltd
Proponent Address (Office):	Level 3 18 – 32 Parliament Place West Perth Western Australian 6005
Proponent Address (Postal):	PO Box 1959 West Perth Western Australia 6872
Proponent Contact:	Mr Warren Hallam Executive Director – MetalsX Limited Telephone: (08) 9220 5700 Facsimile: (08) 9220 5757 Email: wingellina@metalsx.com.au

1.3 Location

The Project is located approximately 1,400 km north-east of Perth and 8 km south-west of the Surveyor General's Corner, which marks the intersection of the Northern Territory, South Australian and Western Australian borders (Figure 1.1).

The proposed mining area is located in the area subject to Tenement E69/535 near the township of Wingellina. Water will be sourced from a proposed borefield in the Officer Basin, in the area subject to Miscellaneous Licence L69/12, located approximately 100 km to the southwest of the proposed mining area (Figure 1.2). This will be connected with the proposed mining area by an overland pipeline adjacent to and aligned with existing roads.

The proposed mining and borefield areas are wholly contained within the Shire of Ngaanyatjarra and Aboriginal Reserve 17614. They also occur within an area subject to native title rights under the Ngaanyatjarraku Lands Determination, which is managed for and on behalf of the Traditional Owners by the Ngaanyatjarra Council.

Tailings produced by ore processing facilities in the proposed mining area will be neutralised using calcrete sourced from an existing quarry in South Australia, and trucked to the operation on existing roads. The quarry is located within the freehold Anangu Pitjantjatjara Lands of South Australia.

Areas surrounding the Project are exclusively defined as Aboriginal land. The Project is distant from any conservation reserves or pastoral lease areas.

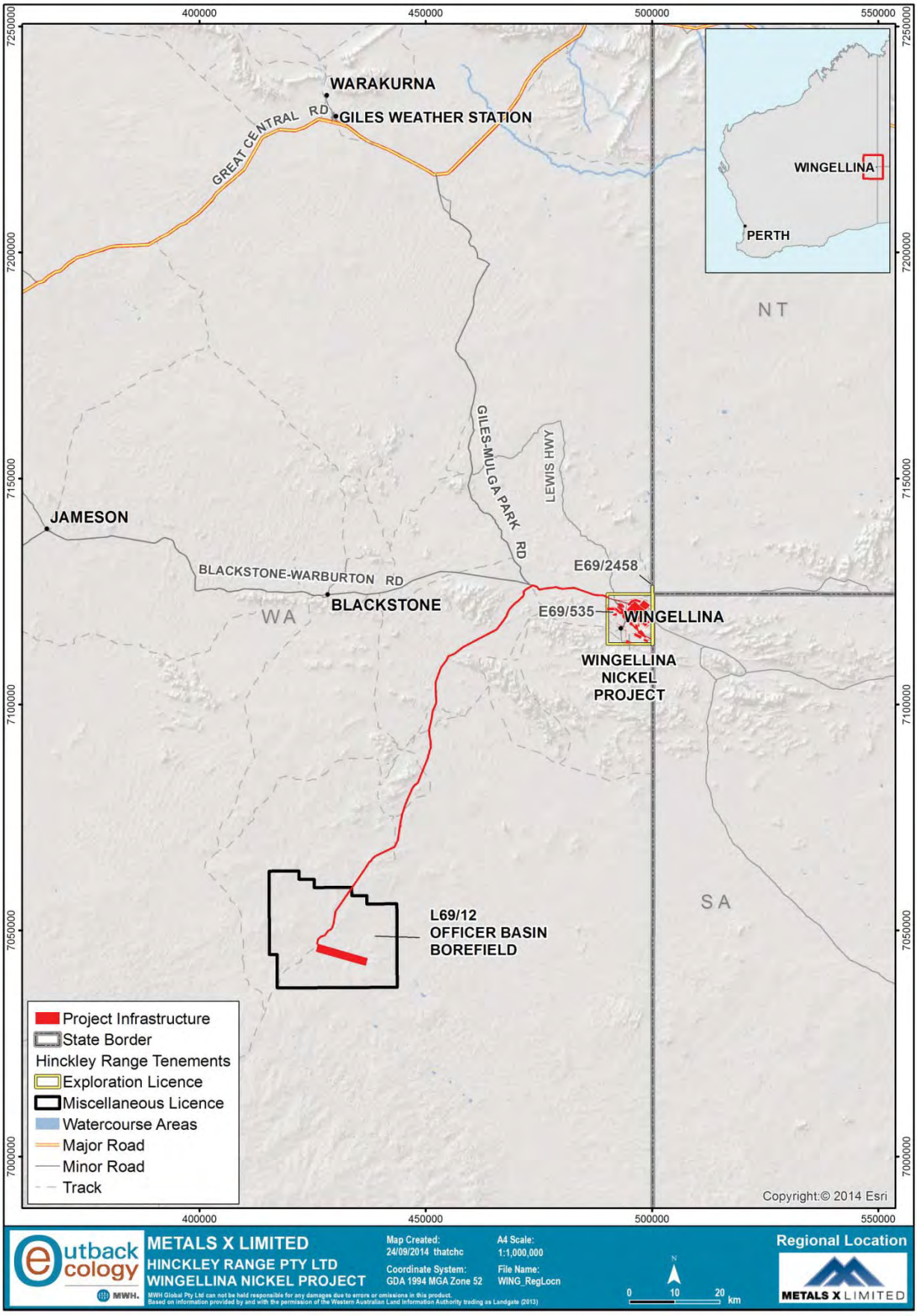

Figure 1.1 Location of the proposed Wingellina Nickel Project

1.4 Purpose of Public Environment Review

The Project was referred to the Environmental Protection Authority (EPA) in September 2013 under Section 38 (Part IV) of the *Environmental Protection Act 1986* (EP Act). In November 2013 the EPA determined that the Project required formal assessment under the EP Act and set a Public Environment Review (PER) level of assessment with an eight week public review period.

A PER is required for projects of regional and/or State-wide significance which raise a number of significant environmental factors or issues, some of which are considered complex and require detailed assessment. The EPA requires a formal public review, and compliance with the EP Act, to ensure that such proposals are implemented and managed in an environmentally acceptable manner.

This document discusses potential environmental impacts related to the construction, operation and closure of the Project; and describes management measures to avoid, reduce and/or ameliorate these impacts in order to meet the environmental protection objectives of the EPA. The findings presented in this document demonstrate that the Project can be implemented in an environmentally acceptable manner.

1.5 Project Team

This document has been prepared by SNC-Lavalin on behalf of the Proponent, with assistance from Equinox Environmental Pty Ltd. SNC-Lavalin has also completed the following supporting studies in accordance with Department of Health (DoH) guidelines:

- Health Impact Assessment (Appendix D); and
- Light impact assessment (Appendix F3).

Additional technical studies have been coordinated by SNC-Lavalin and completed by the following expert service providers as part of the environmental impact assessment process:

- Air Assessments – Air quality assessment (Appendix C1);
- Artefaxion - Ethnographic and archaeological surveys (Appendices E1 to E3);
- Greenbase – Greenhouse emissions assessment (Appendix C2);
- Lloyd George Acoustic – Noise impact assessment (Appendix F1);
- Outback Ecology:
  - Visual impact assessment (Appendix F2);
  - Flora and vegetation surveys (Appendices H1 to H7);
  - Terrestrial and subterranean fauna surveys (Appendices I1 to I7);
  - Soil survey; and
  - Mine Closure Plan (Appendix J).

- Rockwater:
  - Hydrogeological assessments (Appendices G1 to G5); and
  - Surface water management assessment (Appendix G6).
- URS – Social impact management plan (URS) (Appendix B3).

These studies have been completed in accordance with relevant EPA guidelines and standards, and other government standards where applicable.

1.6 Environmental Scoping Document (ESD)

A Project ESD was approved by the EPA on 4 July 2014. The ESD sets out the acceptable basis (form, content and timing) for the preparation of the PER documentation. During the environmental scoping process, ten environmental factors were identified for consideration in the PER document:

- Air Quality;
- Human health;
- Heritage;
- Amenity (noise, light and vibration);
- Hydrological processes;
- Flora and vegetation;
- Terrestrial fauna;
- Subterranean fauna;
- Rehabilitation and closure; and
- Offsets.

Descriptions of the ESD requirements for each environmental factor and how these have been addressed in the PER documentation are provided in Table 1.1.

Table 1.1 Wingellina Nickel Project Environmental Scoping Document Requirements

Factor	EPA Objective	Work and output required	How addressed in PER
Air Quality	To maintain air quality for the protection of the environment and human health and amenity.	Investigate and model impacts of dust from the mine (including tailings storage facility) as well as processing plant emissions (NO_x, SO_x, acid vapour) on the Wingellina community, transient communities, public areas and proposed workers accommodation.	Section 6.1.2 with discussion of findings in Section 6.5, and further detail provided in Appendix C1.
		Address greenhouse gas emissions as per EPA Guidance Statement 12; in particular provide a greenhouse gas inventory and benchmarking against similar technologies producing similar products or their analogues.	Section 6.3.2.3, with further detail provided in Appendix C1.
		Discussion of mitigation measures taken/proposed to avoid, minimize, and reduce impacts/emissions.	Section 6.6 with further detail provided in the Air Quality Management Plan (Appendix B).
		Provide an analysis of emissions intensity (i.e. quantity of significant emissions per tonne of product produced) compared to published benchmarked best practice for equivalent plants and equipment.	Section 6.4.1.
		Explanation of best practice for managing air emissions.	Section 6.4.
		Describe the proposed management, monitoring and validation for all predictions for all significant emissions.	Section 6.6 with further detail provided in the Air Quality Management Plan (Appendix B).
		Carry out air quality modelling in accordance with the Department of Environment (2006) *Air Quality Modelling Guidance Notes.* Cumulative air emission impacts should be modelled taking into account any locally significant emissions	Section 6.5, with further detail provided in Appendix C1.

Factor	EPA Objective	Work and output required	How addressed in PER
		sources (i.e. existing power generator) and cumulative emissions. If the actual information is not available an estimate from an equivalent plant should be used.	
		Prepare contingency plans for air emissions should predicted emissions be exceeded.	Section 6.6 with further detail provided in the Air Quality Management Plan (Appendix B).
		Conduct consultation with stakeholders, record stakeholder comments and provide proponent responses.	Chapter 4 Table 4.1.
Human Health	To ensure that human health is not adversely affected.	Undertake a Health Impact Assessment (HIA) and Health Risk Assessment (HRA) on air emissions and potential for human health impacts from toxic, bio-accumulating emission, to the requirements of the Department of Health.	Chapter 7. Completed HIA and HRA documents provided in Appendix D.
		Develop an emissions inventory (based on similar operating processes and mining operations), identify exposure pathways, and provide interpretation of outputs from modelling data and comparison with published standards protective of public health.	Section 6.1 and Appendix D.
		Provide a comprehensive baseline study of the health status of the Wingellina community.	Section 7.2.
		Provide information on the bioavailability of nickel and other metals of concern (e.g. hexavalent chromium) including management strategies for fugitive dust, including fibrous or asbestiform materials (adopting a risk-based approach in the event such materials are present) from the project, including from roads and from tailing storage facilities, during construction and operations, and post-closure.	Section 7.3.1 and 7.3.4 with impacts discussed in Table 7.4 and Appendix D.

Factor	EPA Objective	Work and output required	How addressed in PER
		Discuss mitigation measures taken/proposed to avoid, minimise and reduce impacts.	Section 7.3 (Table 7.5).
		Identification of appropriate mitigations to reduce any identified or residual risks.	Table 7.5.
		Conduct consultation with stakeholders, record stakeholder comments and provide proponent responses. Comprehensive and meaningful consultation with the Wingellina community and Land Council is required.	Chapter 4.
Heritage	To ensure that historical and cultural associations are not adversely affected.	Consult with both the Ngaanyatjarrarra people and the Department of Aboriginal Affairs in regards to heritage matters.	Section 8.1.1 and Chapter 4.
		Undertake ethnographic surveys in consultation with local Ngaanyatjarrarra people and the Department of Aboriginal Affairs.	Section 8.1.
		Consult with local Ngaanyatjarrarra people to ascertain social and cultural associations with the land and enable identification of environmental impacts as they affect heritage and cultural matters, such as hunting, collection of bush tucker, and access to traditional water holes and ceremonial sites. Report on concerns raised and provide mitigations for management of any changes to cultural and heritage environments relevant to the proposed development.	Chapter 4; with further detail provided in Appendices E.
		Discussion of mitigation measures taken/proposed to avoid, minimise and reduce impacts.	Section 8.4 with further detail provided in the Cultural Heritage Management Plan (Appendix B).

Factor	EPA Objective	Work and output required	How addressed in PER
		Discussion of potential impacts on Aboriginal cultural and heritage matters and how these impacts will be managed.	Section 8.4.2.
		Conduct consultation with stakeholders, in particular the Wingellina community and Department of Aboriginal Affairs, record stakeholder comments and provide proponent responses.	Table 4.1 - Chapter 4.
Amenity (noise, light and vibration)	To ensure that impacts to amenity are reduced as low as reasonably practicable.	Assess the visual impacts, of; the proposal (including mine, tailings storage, waste dumps and processing plant) on the local community, from local view sheds.	Section 9.2.
		Assess impacts of light overspill on the local community. Propose measures / design considerations to reduce and manage impacts from light overspill.	Section 9.3.
		Provide a map showing the locations of all noise sensitive receptors affected or likely to be affected by the Project.	Figure 9.1.
		Investigate sources of noise from the Project and estimate sound power levels based on best practice. Model predicted noise impacts on the Wingellina Community and proposed mine workers accommodation to assess whether noise from the proposal can be managed to comply with Noise Regulations at identified receptors.	Noise impact assessment report (Appendix F1) Predicted sound power levels contained in Figure 9.2, Section 9.1.3.4.
		Provide noise, air blast and ground vibration predictions for sensitive receivers in relation to the Project operations.	Table 9.1, Table 9.2 and Table 9.3.

Factor	EPA Objective	Work and output required	How addressed in PER
		Noise impact assessment including ambient noise measurements at all neighbouring noise sensitive premises, should be conducted by strictly following the Section 5 Detailed Assessment procedure set out it EPA Guidance No. 8.	Noise impact assessment report (Appendix F1).
		Assessment of predicted noise on the Wingellina community from the airstrip expansion and the increase in aircraft movement. Demonstrate that the proposal can meet applicable Australian standard for aircraft noise (*AS 2021-2000 Acoustics- Aircraft noise intrusion - Building siting and construction*, Appendix D). The methodology for assessing noise impacts from the airstrip expansion should be selected in consultation with the OEPA and the Department of Environment Regulation Noise Branch.	Section 9.1.3.4.
		Use the outcomes of the Noise Impact Assessment to discuss how noise from the Project activities can be managed to comply with the *Environmental Protection (Noise) Regulations 1997.*	Section 9.1.3 (Figure 9.2).
		Cumulative noise impacts should be modelled taking into account any locally significant emissions sources (i.e. power generator). If the actual information is not available an estimate from an equivalent plant should be used.	Section 9.1.1. Noise impact assessment report (Appendix F1).
		Modelling information should demonstrate that the proponent can demonstrate whether they can meet the *Environmental Protection (Noise) Regulations 1997*. Discussions of mitigation measures taken/proposed to avoid, minimise and reduce impacts at boundaries, including local sources influencing the analysis.	Section 9.1.5. Noise impact assessment report (Appendix F1).

Factor	EPA Objective	Work and output required	How addressed in PER
		In the situation that noise control measures are required, details of the design of the noise controls and their incorporation into the noise modelling to demonstrate compliance.	Not Required.
		Develop and document measures to mitigate impacts to amenity, based on modelling and assessments undertaken.	Sections 9.1.4, Section 9.2.4 and Section 9.3.4.
		Conduct consultation with stakeholders, record stakeholder comments and provide proponent responses.	Chapter 4.
Hydrological Processes	To maintain the hydrological regimes of groundwater and surface water so that existing and potential uses, including ecosystem maintenance, are protected.	Determine and identify the location of potential water resources available to meet water requirements for the proposal for life of mine.	Section 10.1.
		Discuss the results from hydrogeological investigations and modelling to provide predictions of hydrogeological change and impact as a result of abstraction and dewatering.	Section 10.4.1.1 and Section 10.4.2.
		Assess the effects of the borefield on the groundwater quality and quantity of the area and means through which water use can be minimised.	Section 10.4.2.
		Assess groundwater drawdown including from dewatering, associated with the proposal.	Section 10.4.1.1.
		Discussion of proposed management, monitoring and mitigation methods to be implemented.	Section 10.5.1.
		Assess any impacts to existing users resulting from the proposed abstraction of groundwater and dewatering of pit water.	Section 10.6.

Factor	EPA Objective	Work and output required	How addressed in PER
		Discuss mitigation measures to be implemented at the tailings storage facility to prevent groundwater contamination.	Section 10.4.1.2 and Section 10.5.3.
		Discussions of mitigation measures taken/proposed to avoid, minimise and reduce impacts.	Section 10.5.
		Conduct consultation with stakeholders, in particular the Wingellina community, record stakeholder comments and provide proponent responses.	Chapter 4.
Flora and Vegetation	To maintain representation, diversity, viability and ecological function at the species, population and community level.	Undertake flora and vegetation surveys in accordance with EPA Guidance Statement 51 to define vegetation communities, including groundwater dependent vegetation, and locations of conservation significant species within the mine site area, borefield and service corridors. Surveys should be conducted during the optimal period for detection and identification of the range of flora likely to occur. Optimal survey timing may vary from year to year but surveys should be undertaken 6-8 weeks after the occurrence of major "break of season" rainfall event.	Section 11.1.1.
		Provide a detailed description of the extent of clearing associated with the Project, including hectares of each vegetation community disturbed within the mine site area.	Figure 11.1 and Table 11.1.
		Analyse and describe impacts to flora and vegetation, with reference to flora and vegetation identified and mapped during vegetation and flora surveys of the mine site and Officer borefield.	Section 11.4.

Factor	EPA Objective	Work and output required	How addressed in PER
		Provide information on the impact to the extent and quality of flora and vegetation in the local and regional context, including impacts to flora and vegetation of conservation significance.	Section 11.4.1.2.
		Assess groundwater drawdown associated with the proposal and discuss any impacts to groundwater-dependent vegetation, expected as a result of the proposal operations.	Section 11.4.1.7 and Section 11.6.
		Discussions of mitigation measures taken/proposed to avoid, minimise and reduce impacts including environmental offsets (if necessary).	Section 11.5.
		Discussion of proposed management, monitoring and mitigation methods to be implemented.	Section 11.5 In addition a Flora and Vegetation management plan forms part of the project EMP (Appendix B).
		Conduct consultation with stakeholders, record stakeholder comments and provide proponent responses.	Table 4.1 - Chapter 4.
Terrestrial Fauna	To maintain representation, diversity, viability and ecological function at the species, population and assemblage level.	Undertake a Level 2 fauna survey of the mine proposal area including habitat assessment. Undertake a Level 1 fauna survey of the pipeline corridor, including habitat assessment. Survey to include both a desktop study and a basic ground truthing through a reconnaissance survey. Surveys should be conducted for different faunal groups during the optimal periods as outlined in Table 2 in the fauna Technical Guide.	Section 12.1.

Factor	EPA Objective	Work and output required	How addressed in PER
		Consultation with traditional owners in relation to fauna surveys.	Section 12.1.1 (Section 3.4.3, Appendix I1).
		Assess potential impacts to vertebrate fauna and Short Range Endemic invertebrate species (SRE's), with consideration made to findings from fauna surveys of the Project areas.	Section 12.3.
		Discussion of conservation significant fauna species recorded in the proposal area or likely to occur in the proposal area.	Sections 12.2.1.2 and Section 12.2.2.3.
		Discussion of potential direct and indirect impacts, and protection of, Specially Protected (Threatened) fauna, consistent with the provisions of the *Wildlife Conservation Act 1950.* A targeted survey may be required if conservation significant fauna are found.	Section 12.3.1.
		Discussions of mitigation measures taken/proposed to avoid, minimise and reduce impacts including environmental offsets (if necessary).	Section 12.4.
		Discussion of proposed management, monitoring and mitigation methods to be implemented.	Section 12.4.1. In addition a Terrestrial Fauna management plan forms part of the project EMP (Appendix B).
		Conduct consultation with stakeholders, record stakeholder comments and provide proponent responses.	Table 4.1 - Chapter 4.

Factor	EPA Objective	Work and output required	How addressed in PER
Subterranean Fauna	To maintain representation, diversity, viability and ecological function at the species, population and assemblage level.	Surveys of all areas likely to be directly or indirectly impacted by the proposal are to be undertaken in accordance with Environmental Assessment Guideline (EAG) No. 12 (EPA 2013) and Guidance Statement 54a (EPA 2007). The results of the level 1 study will be used to determine whether further survey will be undertaken in accordance with criteria in EPA (2013) and EPA (2007).	Section 12.1.1.2 and Section 12.1.2.1.
		Stygofauna - Level 1 study and description of the potential impacts from water abstraction from the borefield and determination of the likely presence of subterranean fauna (stygofauna) habitat.	Section 12.2.1.4 and Section 12.2.2.4.
		Troglofauna - Conduct a Level 1 survey according to the criteria in EAG No.12 to determine if limestone, karst, calcrete or other suitable geology likely to provide habitat for troglofauna is present in the area proposed to be mined. If habitat suitable for troglofauna is present a Level 2 survey consistent with criteria in EAG No.12 and Guidance Statement 54a should be conducted.	Section 12.2.1.4 and Section 12.2.2.4.
		For both stygofauna and troglofauna, a description of boreholes sampled will be provided together with maps showing their location indicating bores sampled including those where no specimens were recorded. Mapping should show the extent of known or predicted subterranean fauna habitat and the extent of impact area including drawdown contours.	No significant species detected Section 12.2.

Factor	EPA Objective	Work and output required	How addressed in PER
		Results of the studies should include discussion of potential impacts (direct and indirect, including from dewatering associated with the proposal, to subterranean fauna (both stygofauna and troglofauna) as a result of the proposal, the regional context of the project.	No significant species detected Section 12.2.
		Discussions of mitigation measures taken/proposed to avoid, minimise and reduce impacts.	No impacts as no significant species have been detected.
		Discussion of proposed management, monitoring and mitigation methods to be implemented for subterranean fauna.	None proposed.
		Conduct consultation with stakeholders, record stakeholder comments and provide proponent responses.	Table 4.1 - Chapter 4.
		Complete the biodiversity checklist.	Section 15.5.
Rehabilitation and Closure (Integrating factor)	To ensure that premises are closed, decommissioned and rehabilitated in an ecologically sustainable manner, consistent with	Submit with the PER a project-specific mine closure plan compliant with the Department of Mines and Petroleum (DMP)/EPA 2011 *Guidelines for Preparing Mine Closure Plans.* Consistent with the DMP/EPA Guidelines, the mine closure plan provided with the PER document needs to contain workable solutions to all significant closure risks.	Appendix J.
		Identify all stakeholders and their role in the mine closure process. Conduct consultation with stakeholders, in particular the Wingellina community, record stakeholder comments and provide proponent responses.	Section 14.2 and Appendix J.

Factor	EPA Objective	Work and output required	How addressed in PER
	agreed outcomes and land uses, and without unacceptable liability to the State.	Discuss mitigation measures taken/proposed to avoid, minimise and reduce impacts and (if necessary) environmental offsets.	Table 14.2 in Section 14.4 and Section 14.7.
		Assess potential risks associated with decommissioning and closure of the Wingellina Project, including unplanned or temporary closure.	Table 14.2 in Section 14.4.
		Identify artificial landforms to remain within the mine site area, post closure and provide a diagram indicating their locations.	Table 14.1 and Figure 14.1.
		Characterise physical and chemical properties of materials based on representative sampling. An assessment on total metals within the ore, waste rock and tailings materials will be evaluated to determine potential for bio-availability of metals. The total metal values above the Ecological and Baseline Investigation Levels will be captured within the Mine Closure Plan Risk Assessment and appropriate mitigations identified. Additional testing methodology (if required) will be selected in consultation with the Department of Environment Regulation (Contaminated Sites Branch) and documented in the PER.	Section 14.1 with detail in Section 4.5 Appendix J. Table 14.2.
		Desktop study of successful and unsuccessful rehabilitation strategies and outcomes in similar climates, geologies and vegetation types. Include a discussion of the different available methodologies and success rates for rehabilitation of the various proposed disturbance types including: • Created landforms (e.g. waste rock dumps, tailings storage facility);	Section 14.1, Table 14.2.

Factor	EPA Objective	Work and output required	How addressed in PER
		• Short-term disturbances (e.g. borrow pits and access tracks); • Long-term disturbances (e.g. construction camp, permanent accommodation village and administration buildings); and • Linear and/or fragmentation disturbances (e.g. roads, powerlines, bore fields).	
		Identify relevant closure learnings from other comparable projects (e.g. Tropicana and Mt Keith).	Section 14.1, Table 14.2.
		Propose workable site-specific mine closure methods for post-mining land forms including waste dumps, TSF and mine pits.	Table 14.3 Section 14.6.
		Identify workable methods for managing dispersive, sodic or saline materials, if present, and any other problem materials (e.g. fibrous or asbestiform materials) identified through materials characterisation.	Table 14.3.
		Identify materials for closure of the TSF and waste dumps. If rock armouring is to be used, is there sufficient competent and geochemically inert rock available and, given the quantities required, will it be economically feasible to transport the rock to the TSF? Will there be additional significant environmental impacts from quarrying the rock?	Section 14.4 with detail in Section 4.5 Appendix J.
		Based on learnings from other projects in similar environment, propose workable rehabilitation and revegetation techniques appropriate to this arid desert environment and the soils present at the site.	Table 14.3 Section 14.6.

Factor	EPA Objective	Work and output required	How addressed in PER
		Describe site specific contingencies to make landforms sate, stable and non-polluting in the event of unexpected or temporary closure.	Table 14.3.
		Extending the hydrological processes work and outputs from hydrogeological investigations and modelling assess hydrogeological change from closing the water supply borefield and discontinuing dewatering as follows: • Predict rates of groundwater recovery following cessation of pumping from the water supply borefield and discontinuing pit dewatering; • Assess the potential for processes such as groundwater inflow, changes in pH, and/or evaporative concentration which may develop after closure, and the risk (if any) of the development of harmful concentrations of metals or other inorganic constituents in the pit lakes over time; • Calculate seepage velocity and flow directions based on the conceptual hydrogeology and groundwater model particle tracking to estimate the magnitude and direction of potential contamination from the mine pit(s) after mine closure and risk (if any) of contamination plumes; • Evaluate the risk that water remaining in the pit after closure, and/or any water flowing or seeping out of the pit over time, will have a significant impact on human health, wildlife, surrounding ground or surface water, or on water holes or other water sources of significance to Aboriginal people; and	Section 10.4.1.6 (Appendix G5) Table 14.3.

Factor	EPA Objective	Work and output required	How addressed in PER
		• Outline the process for developing a strategy for decommissioning of water assets associated with the water supply borefield, water storage facilities, and the dewatering system when no longer required. If there is potential for significant risks to human health or the environment, further work will be undertaken to identify workable management measurers to either avoid those risks or to reduce or remediate to acceptable levels to ensure a sustainable "walk-away closure solution".	
Offsets (Integrating Factor)	To counterbalance any significant residual environmental impacts or uncertainty through the application of offsets.	Examination of significant residual impacts and, if required, development of a draft program of environmental offsets.	Chapter 15.
		Inclusion in the PER of a completed Environmental Offsets Reporting Form and any offsets required and proposed.	Section 15.5.
		Conduct consultation with stakeholders, record stakeholder comments and provide proponent responses.	Table 4.1 - Chapter 4.

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CHAPTER 2

PROJECT JUSTIFICATION

2.0 PROJECT JUSTIFICATION

2.1 Project rationale and benefits

The Project will create benefits at local, state, and national levels. In particular, the development of the Project is expected to provide wide reaching economic and social benefits in an area devoid of commercial development and work opportunities for the local aboriginal population. This has created active interest from both State and Federal Ministers and respective departments to support the Musgrave region infrastructure development efforts. This has resulted in the creation and development of the Midwest-Musgrave Corridor Initiative under the WA Department of Regional Development.

Commercial justification for the Project is based on modelling forecasts of strong operating returns. Following the initial high capital construction cost, estimated at approximately $2.5 billion, the Project is expected to generate operating profit in the order of several hundred million dollars per year. Federal taxation revenue is expected to exceed $5 billion over the life of the Project, and WA State Royalty revenue is likely to be in the vicinity of $1 billion over the life of the Project.

At the local level, the Project will provide the opportunity for sustainable development in the region, providing direct work opportunities at the mine and a basis for the establishment of ancillary industries which support both the Wingellina development and other functions within the region. The Project will deliver significant and lasting benefits to employees, the community and other key stakeholders by bringing services to the Project area and providing employment, training and business development opportunities.

Feasibility assessments of the development have shown the Project can be operated in an environmentally sustainable manner. Operational management plans will incorporate the use of recycled water as far as possible within the HPAL processing plant, and use of steam and gas generated electricity to minimise emissions as far as practicable. Other technologies and best practice approaches will be evaluated during the final Project planning and design stage, to help ensure that impacts to the receiving environment are minimised.

The Project is anticipated to provide a number of environmental benefits at a local level, through the implementation of feral animal and weed management and control programs. Project impacts, such as those arising from clearing, will be contained within the proposed Project disturbance footprint and species of conservation significance will largely be avoided and protected.

The Project provides the opportunity to protect and enhance the condition of an important ethnographic site (a “billabong”) near Wingellina, which has become badly degraded by camels. As a component of its social engagement activities, Hinckley Range proposes to protect the ethnographic site with fencing. This fencing project will provide training and employment opportunities for the local community.

2.2 Consideration of alternatives

The Wingellina Project is a mining and mineral processing project, and there are limited alternatives for the economic and environmental execution of the Project.

The type of deposit does not lend itself to mining by underground methods, and the nature of the ore material dictates extraction by mostly free-digging open pit mining.

The location of the ore deposits dictates the spatial extent of the mine pits. The remaining mining and site infrastructure requirements (including the TSF and waste rock landforms) have been strategically positioned to minimise the overall disturbance footprint, potential disturbance to the surrounding environment, disruption to visual amenity, and ensure that areas of Aboriginal heritage importance are protected. Note that local Traditional Owners were consulted during development of the site layout plan, and several changes to the plan were made to accommodate the feedback received (refer to Section 4). The Project is distant from any critical State environmental assets. The Project is located within the Ranges of the Western Desert (Place ID: 9861), which is listed on the Register of the National Estate and recognised has having 'Indigenous values of National Estate significance'. This area comprises over 8 million hectares including a system of ranges with many gorges and valleys. By virtue of its scale, the Project will have a negligible impact on this area.

2.2.1 Assessment of Process Options

The HPAL process selected for the Project is considered to be the most efficient for the recovery of nickel from nickeliferous limonite ore bodies. The HPAL process is a proven, well-defined technology with a low level of technical risk. The HPAL process has been operated effectively at Murrin Murrin and Ravensthorpe in Western Australia, and also at a number of overseas operations including Moa Bay that was originally constructed in 1959.

2.2.2 Tailings Storage Facility Options

An assessment of three tailings storage options for the Project was completed in 2008 by ATC Williams. The option for co-disposal of tailings and waste in an integrated waste landform was discarded, owing to a low ratio of waste material to ore associated with the deposit. A central thickened discharge (CTD) tailings facility was identified as the preferred option, in comparison with conventional paddock style facilities, principally on the basis of higher water use efficiency, lower potential for seepage and lower potential for dust generation. The land disturbance requirements for each option were evaluated to be similar.

Subsequent to the 2008 assessment, an available water resource has been confirmed and the rheology of the tailings has been assessed. This additional information together with a review of operating TSF's with similar material characteristics has indicated the suitability of a paddock style TSF as the preferred option.

The deposition methodology will be optimised during the DFS stage of project development and will be determined primarily by the anticipated tailings slurry solids concentration, rheology and the anticipated beach slopes at discharge. The availability of competent cover material will also be considered in the detailed design of the final landform shape.

Based on the proposed life of mine and disturbance footprint of a 'paddock style' TSF there are enough suitable materials to close the facilities.

2.2.3 Assessment of Transport Route Options

The nickel-cobalt hydroxide concentrate will be transported to market via road and rail to port for shipment to customers overseas. The three transport options recommended in the Pre-feasibility Study to gain access to the railway are as follows:

- 450 km road transport to Impadna rail siding in the Northern Territory, linking to the port of Darwin;
- 500 km road transport to Kulgera rail siding in the Northern Territory, linking to the port of Darwin; or
- 480 km road transport to Chandler Siding in South Australia, linking to the port of Adelaide.

A preferred option will be selected based on the outcomes of the DFS.

2.2.4 Support Infrastructure

Hydroxide product storage and handling facilities at the Port and rail siding will be required to allow transport of the product to occur.

A number of reagents for the HPAL process (including elemental sulphur) will be transported to site using the same route for export of the mixed nickel-cobalt hydroxide product. Infrastructure will be required to facilitate the transport of product to site, such as reagent storage facilities at the Port and rail siding.

Options for the placement of this infrastructure will be assessed following the selection of the preferred transport route.

2.2.5 Assessment of Gas Supply Options

Natural gas will be used in conjunction with the steam produced from the sulphur acid plant to generate power for the Project. Recent advances in natural gas storage and transport technology have negated the requirement for an overland gas pipeline. Pending the outcomes of the DFS, it is anticipated that gas will be sourced from an existing gas field in the Northern Territory and transported to the site.

2.2.6 No development option

Mining is a pivotal component of the Western Australian economy. In 2013 the value of Western Australia's mineral and petroleum sector was $113.8 billion, generating more than $5.9 billion in State royalties used for law enforcement, education, health, roads and community development programs (DMP 2014).

If the Project does not proceed, the substantial economic and social benefits described in preceding sections would be foregone. In particular, opportunities for supporting the Wingellina community through economic development, training and

employment and engagement in environmental management activities would be unrealised.

2.3 Changes since project referral

Since the Project was referred to the EPA in September 2013, further evaluation of the potential environmental impacts of the Project has occurred, specifically around mine closure and rehabilitation. Also, in line with the requirements of the ESD, a review of similar existing successful mining operations was considered, resulting in some modifications to the proposed mining area and tailings process. These key changes include:

- The site layout has been adjusted to provide for additional areas for topsoil and waste rock placement. This has increased the maximum extent of the disturbance footprint in the proposed mining area from 2,205 ha to 2,762 ha; and
- Selection of a 'paddock style TSF' as the preferred option for tailings management.

The additional areas of disturbance identified are within current flora and fauna and heritage survey boundaries and will not impact on any of these values and will not adversely impact the overall regional environmental values. Consideration of the environmental impact assessment can be adequately covered within this PER.

These changes were referred to the EPA under section 43A of the *Environmental Protection Act 1984* prior to finalisation of the PER.

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CHAPTER 3

REGULATORY FRAMEWORK

3.0 REGULATORY FRAMEWORK

The Wingellina Nickel Project requires environmental assessment and approval by:

- The Western Australian Minister for Environment in accordance with the provisions of the *Environment Protection Act 1986* (EP Act); and
- The Commonwealth Minister for Sustainability, Environment, Water, Population and communities (SEWPaC) in accordance with the provisions of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The processes for environmental assessment under the EP Act and EPBC Act respectively are outlined in Section 3.1 and Section 3.2 as follows.

3.1 Western Australian Environmental Approval Process

The Project is subject to State environmental referral and assessment under Part IV of the *Environmental Protection Act 1986* (EP Act). The EP Act is the principal statute relevant to environmental protection in WA, which is administered by the EPA. The EP Act makes provision for the prevention, control and abatement of pollution and for the conservation, preservation, protection, enhancement and management of the environment.

The EPA has set the level of assessment for the Project at the level of PER with an eight week public review period. An overview of the PER assessment process is provided in Figure 3.1. At the conclusion of the public review period, the EPA will review the comments received and will determine what issues and matters require a response. Hinckley Range will prepare a report that provides responses to the comments received. Once the EPA is satisfied with Hinckley Range's report, it will prepare an assessment report and will make recommendations to the Minister of the Environment. After reviewing the EPA's report and recommendations, the Minister will determine whether or not to approve the Project, and if so under what conditions.

The timing of the State approvals process is described in Table 3.1 consistent with the Wingellina Nickel Project ESD (Appendix A).

Table 3.1 Approvals schedule for the Wingellina Nickel Project

Key stage of proposal	Agreed milestone under the ESD
ESD document submitted to EPA.	17 June 2014
EPA approval of the ESD Document.	11 July 2014
First draft of the PER Document submitted to EPA.	24 Oct 2014
OEPA provides comment on first draft PER Document.	6 weeks 18 Dec 2014
Proponent submits adequate* revised draft PER document.	17 Aug 2015
EPA authorises release of PER Document (2 weeks)	31 Aug 2015
Hinckley Range releases approved PER Document.	14 Sep 2015
Public Review of PER Document.	8 weeks 9 Nov 2015

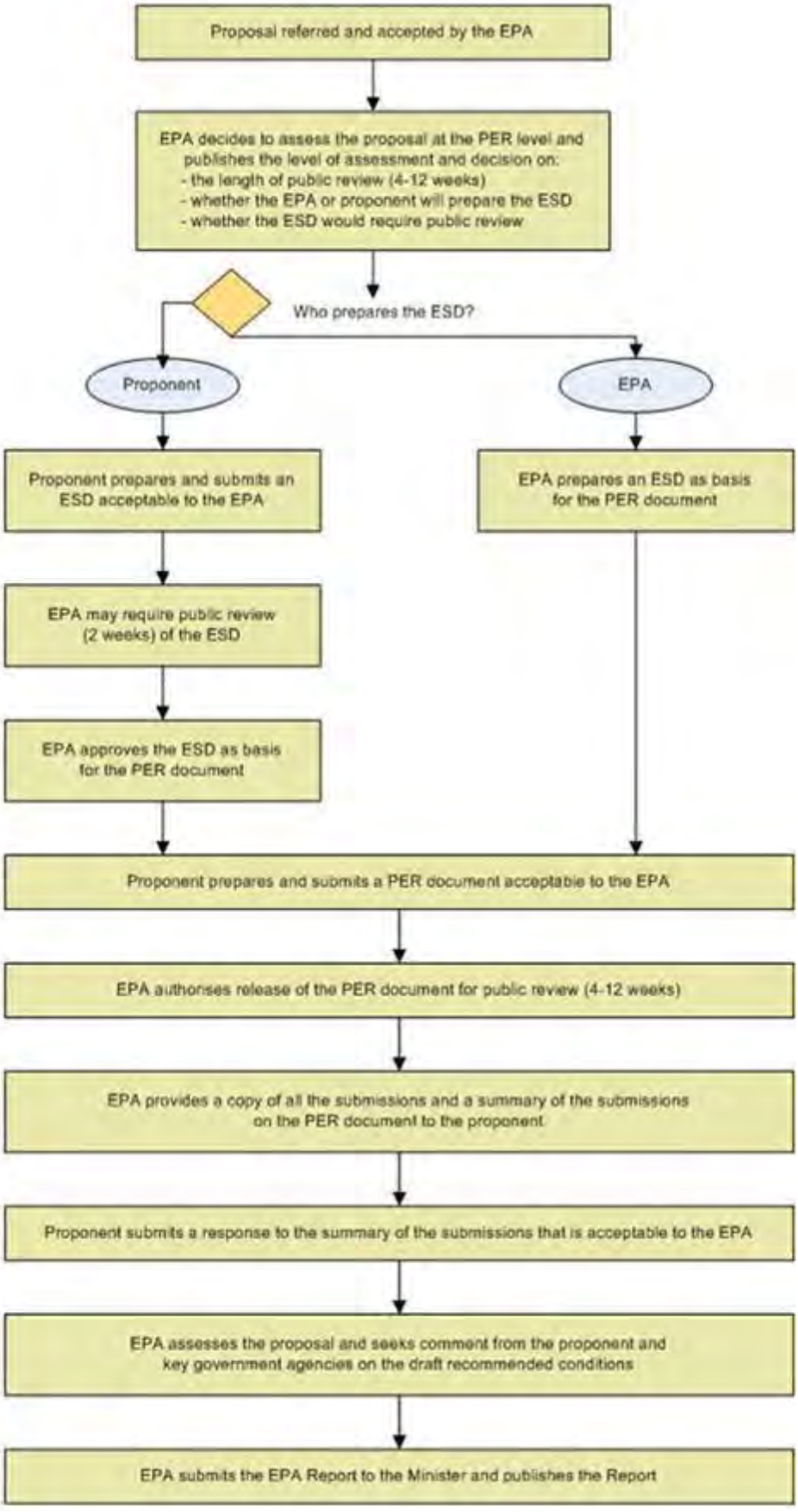

Figure 3.1 The Public Environmental Review assessment process in Western Australia (EPA 2013a)

3.2 Commonwealth Environmental Approval Process

3.2.1 *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)

The Project is subject to Federal assessment under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act). The EPBC Act is the Australian Government's central piece of environmental legislation. It provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places.

Under the EPBC Act, an action requires approval from the Federal Minister for the Environment and Heritage if the action has, will have, or is likely to have, a significant impact on a matter of National Environmental Significance (NES).

The Project lies within Place Id: 9861, the Ranges of the Western Desert, which is a matter of NES as it is listed on the Register of the National Estate. Consequently the Project required referral to the Department of Environment under the *EPBC Act 1999*.

The Project was referred to the Department of Environment on 1 October 2013. The Commonwealth Minister of Environment and Heritage subsequently determined the proposed mining area development is “not a controlled action” but deferred assessment on the access road and support infrastructure (i.e. water borefield and pipeline, gas pipeline) (ref. EPBC 2013/7021). A separate referral may be required for infrastructure items outside Tenement E69/535, depending on whether this infrastructure would significantly impact on matters of National Environmental Significance (NES).

3.2.2 National Native Title Act 1993

The Commonwealth *National Native Title Act 1993* is relevant to the Project given the proposed mining area is subject to Native Title, and within Aboriginal Reserve A17614.

3.2.3 The National Environment Protection (Ambient Air Quality) Measure (NEPM) 2003

The National Environment Protection (Ambient Air Quality) Measure (NEPM) establishes a nationally consistent framework for the monitoring and reporting of air quality, and establishes national ambient air quality standards that apply in all states and territories and land controlled by the Commonwealth. The NEPM is generally applicable to exposed communities of a certain population size. However, the guidelines and criteria identified in this measure are commonly used in the evaluation of impacts on sensitive receptors regardless of population size.

3.2.4 National Greenhouse and Energy Reporting Act 2007

The National Greenhouse and Energy Reporting Act 2007 established a mandatory reporting system for corporate greenhouse gas emissions and energy production and consumption. The first reporting period under the Act commenced on 1 July 2008.

Key features of the Act are:

- Reporting of greenhouse gas emissions, energy consumption and production by large corporations;
- Public disclosure of corporate level greenhouse gas emissions and energy information; and
- Consistent and comparable data available for decision making.

3.2.5 Other Commonwealth Legislation

Other Commonwealth legislation that is applicable to the protection of environmental and heritage values of the Project area are:

- *Aboriginal and Torres Strait Islander heritage Protection Act 1984*; and
- *Energy Efficiency Opportunities Act 2006*.

3.3 Relevant Western Australian Legislation and Regulations

Key State environmental legislative and regulatory requirements relevant to the Project are described in Table 3.2.

Table 3.2 Key Western Australian legislation applicable to the Project

Title	Aspect
Legislation	
Aboriginal Heritage Act 1972	Archaeological and ethnographic heritage.
Agriculture and Related Resources Protection Act 1976	Control of weeds and pests.
Bushfires Act 1954	Wildfire prevention and suppression.
Contaminated Site Act 2003	Pollution abatement.
Dangerous Goods Safety Act 2004	Dangerous goods management.
Environmental Protection Act 1986	Works approvals, licensing and native vegetation clearing permits.
Health Act 1911	Employee health management.
Land Administration Act 1997	Government lands administration.

Title	Aspect
Local Government Act 1995	Development approvals and management.
Main Roads Act 1930	Control of access areas.
Mining Act 1978	Conditions on mining leases.
Mining Rehabilitation Fund Act 2012	Operation of the Mining Rehabilitation Fund.
Occupational Safety and Health Act 1984	Duty of care requirements for employers and employees.
Rights in Water and Irrigation Act 1914	Protection of water resources.
Soil and Land Conservation Act 1945	Land and soil resources management.
Waste Avoidance and Resource Recovery Act 2007	Provides for the development of a Waste Strategy for Western Australia and local government waste plans. Guidelines and standards relating to the siting, design, operation and post-closure management of landfills.
Wildlife Conservation Act 1950	Protection of native flora and fauna.
Regulations	
Dangerous Goods Safety (Storage and Handling of Non-explosives) Regulations 2007	Dangerous goods management.
Dangerous Goods Safety (Explosives) Regulations 2007	Dangerous goods management.
Environmental Protection Regulations 1987	Pollution control.
Environmental Protection (Unauthorised Discharges) Regulations 2004	Unauthorised discharges control.
Environmental Protection (Clearing of Native Vegetation) Regulations 2004	Native vegetation clearing.
Environmental Protection Regulations (Noise)1997	Noise standards and management.
Environmental Protection (Controlled Waste) Regulations 2004	Controlled waste management.
Health (Treatment of Sewage and Disposal of Effluent and Liquid Waste) Regulations 1974	Sewage management.

Title	Aspect
Mining Regulations 1981	Mining tenement conditions and reporting.
Mining Rehabilitation Fund Regulations 2013	Rehabilitation liability categories and unit rates.
Occupational Safety and Health Regulations 1996	Workplace safety requirements.
Waste Avoidance and Resource Recovery Regulations 2008	Waste collection permits, operation of landfill facilities.

3.4 Interstate Approvals

The Project is located entirely within the boundary of Western Australia and as such is not subject to interstate approvals. However Hinckley Range has consulted with the following interstate agencies to progress related approvals for mining and infrastructure requirements within the Northern Territory (NT) and South Australia (SA):

- Department for Manufacturing, Innovation, Trade, Resources and Energy, SA – Division of Mineral Resources regarding the calcrete deposit. Discussion with the SA government remains ongoing;
- Department of Lands, Planning and Environment, NT regarding transport corridors railheads and gas pipeline; and
- Department of Resources Development, NT regarding port requirements.

3.4.1 South Australia

Approval is required by the Government of SA Department for Manufacturing, Innovation, Trade, Resources and Energy (DMITRE) in accordance with the *Mining Act 1971* (SA) legislation to mine the calcrete deposit located within SA. Should Hinckley Range decide to mine this deposit then a Programme for Environmental Protection and Rehabilitation (PEPR) will be required to be approved under the *Mining Act 1971* (SA).

If Adelaide is chosen as the port facility for the Project, approval will be required from the SA government to use road and rail to transport product to the Port on the Adelaide to Darwin Rail and reagents to the mine. Flinders Ports operates Port Adelaide on behalf of the SA Government.

3.4.2 Northern Territory

Should Darwin be chosen as the port facility for the Project, approval will be required from the NT Government to use road and rail to transport product to the Darwin Port on the Adelaide to Darwin Rail and reagents to the mine. The Darwin Port Authority would be responsible for obtaining the necessary approvals from the

NT Department of Lands, Planning and Environment, to stockpile product at its Port facilities.

The NT Government, through the application of the *Environmental Assessment Act 1982* (NT), would establish the state environmental approvals requirements.

3.5 Guidelines and standards

Guidelines and standards considered in the preparation of the Project PER documentation, consistent with the approved ESD, are listed in Table 3.3.

Table 3.3 Key EPA guidelines and standards relevant to the Wingellina Nickel Project

Title
EPA Position Statements
Position Statement No. 2 - *Environmental Protection of Native Vegetation in WA* (EPA 2000a).
Position Statement No. 3 - Terrestrial Biological Surveys as an Element of Biodiversity Protection (EPA 2002b).
Position Statement No. 7 - *Principles of Environmental Protection* (EPA 2010).
Position Statement No. 9 - *Environmental Offsets* (EPA 2006a).
EPA Environmental Assessment Guidlines (EAG)
EAG No. 1 – *Environmental assessment guide for defining the key characteristics of a proposal* (EPA 2012)
EAG No. 12 *Environmental assessment guide for consideration of subterranean fauna in environmental impact assessment in Western Australia* (EPA 2013)
EAG No. 13 *Environmental assessment guide for consideration of environmental impacts from noise* (EPA 2014)
EPA Guidance Statements
Guidance Statement No. 3 - *Separation Distances between Industrial and Sensitive Land Uses* (EPA 2005b).
Guidance Statement No. 6 - *Rehabilitation of Terrestrial Ecosystems* (EPA 2006).
Guidance Statement No. 8 - *Environmental Noise* (EPA 2007a). .
Guidance Statement 12 - *Guidance Statement for Minimising Greenhouse Gas Emissions* (EPA, 2002a).
Guidance Statement No. 19 – *Environmental Offsets* (EPA 2008).
Guidance Statement No. 20 - *Sampling of Short Range Endemic Invertebrate Fauna for Environmental Impact Assessment in Western Australia* (EPA 2009).
Guidance Statement No. 41 - *Assessment of Aboriginal Heritage* (EPA 2004).

Title
Guidance Statement No. 51 - *Terrestrial Flora and Vegetation Surveys Environmental Impact Assessment in WA* (EPA 2004b).
Guidance Statement No. 54a - *Sampling methods and survey considerations for subterranean fauna in Western Australia* (EPA 2007).
Guidance Statement No. 56 - *Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia* (EPA 2004a).
Other standards and guidelines
ANZECC/ARMCANZ Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC and ARMCAZ 2000).
AS 2021-2000 *Acoustics - Aircraft noise intrusion - Building siting and construction.*
Guidance Note S301, *Storage of Dangerous Goods Licensing and Exemptions* (DoCEP 2006).
Australian Standard 1940 - 2004: *The storage and handling of flammable and combustible liquids.*
Australian Standard AS 2436 - 1981 *Guide to Noise Control on Construction, Maintenance and Demolition Sites.*
Australian Standard AS 2985 *Workplace Atmospheres – Method for sampling and gravimetric determination of respirable dust.*
CRC-CARE. *Guidance document for the revegetation of land contaminated by metal(loid)s*, Technical Report No. 20, March 2012.
Department of Aboriginal Affairs 2013 *Aboriginal Heritage Due Diligence Guidelines*, Version 3.
Department of Environment 2006 *Air Quality Modelling Guidance Notes*.
Department of Environment and Conservation 2011 *A guideline for managing the impacts of dust and associated contaminants from land development sites, contaminated sites remediation and other related activities*.
Department of Health 2008 *Health Risk Assessment in WA*.
Department of Health 2010 *Health Risk Assessment (Scoping) Guidelines*.
Department of Health 2013 *Guidance Note on Public Health Risk Management of Asbestiform Minerals Associated with Mining*.
Department of Mines and Petroleum, 2010 *Management of fibrous materials in Western Australian Mining Operations*.
Department of Health (undated) *Public Health Consultation: A Guide for Developers*.
enHealth 2012 *Environmental Health Risk Assessment - Guidelines for Assessing Human Health Risks from Environmental Hazards.*
Department of Water 2000 *Water Quality Protection Guidelines No. 1. Water Quality Management in Mining and Mineral Processing: An Overview*.

Title
Department of Water 2009 *Field Sampling Guidelines*.
Department of Water 2013 *Western Australian Water In Mining Guideline* (May 2013).
DMP/EPA *Guidelines for Preparing Mine Closure Plans*, June 2011.
DMP 2013 *Tailings Storage Facilities in Western Australia – Code of Practice.*
EPA. *Checklist for documents submitted for EIA on marine and terrestrial biodiversity* (Appendix 2 of the EPA's Draft Environmental Assessment Guideline No. 6 on Timelines for Environmental Impact Assessment of Proposals).
EPA and Department of Conservation Technical Guide - *Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment*, September 2010.
EPA (2008) Environmental Protection Bulletin No. 1 - *Environmental Offsets - Biodiversity.*
EPA (2013) *EPA Offsets Reporting Form*.
EPA Environmental Protection Bulletin No. 19 *EPA Involvement in Mine Closure*, July 2013.
Government of Western Australia (2011) *WA Environmental Offsets Policy*.
International Network For Acid Prevention 2012, *Global Acid Rock Drainage Guide (GARD Guide).*
International Council on Mining and Metals 2008 *Planning for Integrated Mine Closure.*
Department of Industry, Tourism and Resources 2007 *Managing Acid and Metalliferous Drainage, Leading Practice Sustainable Development Project for the Mining Industry*.
National Environmental Protection Council (Ambient Air Quality) Measure (NEPM) 2003.
National Water Commission 2012 *Australian groundwater modelling guidelines*.
Oldham CE 2013, *Environmental sampling and modelling for the prediction of long term water quality of mine pit lakes*, The University of Western Australia Publishing, Perth.
Policy Statement No 9 - *Conserving Threatened Species and Ecological Communities* (CALM 2003).
Strategic Framework for Mine Closure (ANZMECC/MCA 2000).

3.6 Principles of environmental protection

In 2003, the EP Act was amended to include the following five core environmental principles. These guide the EPA in carrying out its role and responsibilities (EPA 2004a):

- Precautionary principle;
- Principle of intergenerational equity;
- Principle of the conservation of biological diversity and ecological integrity;
- Principles relating to improved valuation, pricing and incentive mechanisms, and
- Principle of waste minimisation.

These principles were taken into account when developing impact mitigation and management measures for the Project, as described in Table 3.4.

Table 3.4 Environmental Protection Act principles of environmental protection considered in the Wingellina Project Public Environmental Review

Environmental Protection Act principle	Consideration given in the PER	Section(s) where addressed in PER document
1. Precautionary principle. Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, decisions should be guided by: (a) careful evaluation to avoid, where practicable, serious or irreversible damage to the environment; and (b) an assessment of the risk-weighted consequences of various options.	The Project Environmental Scoping Document (ESD) was developed using a risk based approach. The ESD has informed Project planning and design, and helped to frame the terms of reference for pre-mining site investigations (for example vegetation, flora and fauna surveys).	Chapter 1.
	Optimal designs for the TSF have been explored and considered with respect to minimising environmental impacts. Environmental risks will be considered when finalising options for product and reagent transport and other key project design choices.	Chapter 5.
	A conservative approach was used for modelling the potential impacts of the project on air quality, groundwater resources, and associated with noise and vibration.	Chapter 6; Chapter 8; and Chapter 9.
	A Health Risk Assessment was completed.	Chapter 7.
	A mine closure risk assessment was completed.	Chapter 14.
2. Intergenerational equity. The present generation should ensure that the health, diversity	The development of the Project has involved extensive stakeholder consultation.	Chapter 4.

Environmental Protection Act principle	Consideration given in the PER	Section(s) where addressed in PER document
and productivity of the environment is maintained or enhanced for the benefit of future generations.	The Project is subject to a land use agreement with Aboriginal stakeholders. This agreement includes measures to support employment opportunities for the local community. Heritage exclusion areas within the Project area have been delineated and will be protected.	Chapter 8.
	A comprehensive approach for mine rehabilitation and closure has been developed, taking into account processes for establishing agreed post-mining land use objectives with stakeholders.	Chapter 14.
	Potential residual impacts of the Project, including the need for any environmental offsets, have been assessed.	Chapter 15.
3. Improved valuation, pricing and incentive mechanisms. Environmental factors should be included in the valuation of assets and services. The polluter pays principle – those who generate pollution and waste should bear the cost of containment, avoidance or abatement. The users of goods and services should pay prices based on the full life cycle costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any wastes. Environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, which enable those best placed to	The importance of improved valuation, pricing and incentive mechanisms is recognised. Environmental goals will be pursued in the most cost effective way, using a combination of company resources and external expertise where appropriate.	Generally applicable.
	The potential pollution impacts of the project have been identified, and management measures to minimise these impacts have been developed. Pollution will largely be addressed through a combination of minimisation and on-site treatment, resulting in minimal export of pollutants off site.	Chapter 6.
	A comprehensive environmental management framework for the Project has been proposed, including a set of environmental management plans addressing key environmental factors.	Appendix B.

Environmental Protection Act principle	Consideration given in the PER	Section(s) where addressed in PER document
maximise benefits and/or minimise costs to develop their own solutions and responses to environmental problems.	A comprehensive approach for mine rehabilitation and closure has been developed.	Chapter 14.
4. Conservation of biological diversity and ecological integrity. Conservation of biological diversity and ecological integrity should be a fundamental consideration.	Conservation of biological diversity and ecological integrity has been a key consideration in the design of the project, and is integral to project implementation. Baseline biological investigations have been completed, and are continuing, within and adjacent to areas affected by the Project. These investigations will identify any flora or fauna of conservation significance that require protection. The location of key infrastructure has taken into account the values of the surrounding environment. Hinckley Range proposes to avoid and mitigate impacts on biodiversity and ecological integrity through implementation of key commitments made in this PER.	Chapter 5; Chapter 8; Chapter 11; Chapter 12; and Appendix B.
	Rehabilitation of the project area post-mining will be subject to clear objectives and completion criteria. Sustainable endemic vegetation communities will be established, consistent with reconstructed landforms and surrounding vegetation.	Chapter 14.
5. Waste minimisation. All reasonable and practicable measures should be taken to minimise the generation of waste and its discharge into the environment.	The Project includes measures to minimise the generation of waste and reuse and recycle waste materials, wherever possible including water recycling. Project emissions have been estimated and benchmarked against other industry projects.	Chapter 6; Chapter 8; and Appendix B.

CHAPTER 4

COMMUNITY AND STAKEHOLDER CONSULTATION

4.0 COMMUNITY AND STAKEHOLDER CONSULTATION

This chapter describes the community and stakeholder consultation undertaken prior to and during the preparation of this PER. A summary of identified stakeholders, meetings and other consultation activities is provided.

4.1 Community Consultation

The remote location of the Project and its proximity to Aboriginal communities has emphasised the importance of regular and ongoing consultation with the Wingellina community. Hinckley Range has been working with the Ngaanyatjarra Council and the local community since 2005, and has built strong relationships at the community and regional levels. Table 4.1 summarises the recent consultation since 2008 coinciding with commencement of the preliminary feasibility study (PFS).

The consultation approach adopted by Hinckley Range has been guided by the following principles for effective consultation:

- Recognises the high importance of developing and growing long-term relationships and partnerships based on mutual understanding and trust, cooperation, consultation and respect;
- Aim to develop mutual understanding, respect and trust with stakeholders;
- Respect the value of cultural heritage and cultural diversity;
- Communicate openly and honestly;
- Support the development and implementation of sustainable social and economic initiatives within the local community, through cooperation and participation;
- Consult with all stakeholders within the wider community;
- Ensure that company employees are aware of, understand and respect the interests of the local community and other stakeholders; and
- Maintain a continuous presence in the Project area for more than 9 years to allow frequent updates to, and answers to queries from, the local community.

4.2 Stakeholder Consultation

Stakeholder engagement is equally important to ensure those individuals and organisations with broader interests in the Project are given the opportunity to contribute to the development of the Project. A number of stakeholders with an interest in the Project are identified in Section 4.3.

4.2.1 Consultation Objectives

For the purposes of the PER, the objectives of the stakeholder consultation process are:

- Identify and engage relevant stakeholders;

- Ensure stakeholders are informed about the Project;
- Allow stakeholder interests and concerns relating to the Project to be considered; and
- Maintain and document stakeholder information, and all communication and consultation aspects throughout the life of the project.

4.3 Identification of Stakeholders

The following stakeholders with a potential interest in the Project were identified as a component of the PER process:

Aboriginal Groups

- Ngaanyatjarra Land Council Western Australia (NLC);
- Anangu Pitjantjatjara Yankunytjatjara South Australia (APY); and
- Central Land Council Northern Territory (CLC).

Government Agencies Western Australia

- Department of Environment and Conservation (DEC);
- Department of Mines and Petroleum (DMP), formerly DoIR;
- Department of Water (DoW);
- Department of Aboriginal Affairs (DAA), formerly Department of Indigenous Affairs (DIA);
- Department of Health (DoH);
- Department of Planning and Infrastructure (DPI);
- Office of the Environmental Protection Authority (OEPA); and
- Department of State Development (DSD).

Government Agencies South Australia

- Department for Manufacturing, Innovation, Trade, Resources and Energy (DMITRE), formerly Department of Primary Industries and Resources (PIRSA).

Government Agencies Northern Territory

- Department of Natural Resources (DNR);
- Department of Resource; and
- Port of Darwin.

Non-government Organisations

- Pastoral lease holders relevant to off-site transport corridors;
- Australian Rail Group; and

- Outback Way.

Shire Councils

- Shire of Ngaanyatjarraku.

4.4 Community and Stakeholder Engagement Processes

Stakeholder consultation methods used to date include:

- Formal meetings and briefings with government agencies; and
- Community meetings with the Wingellina residents.

4.4.1 Consultation Outcomes to Date

In July 2010, Hinckley Range signed a landmark mining agreement with the Traditional Owners and the granted Native Title holders of the Project. The agreement is the first to be successfully negotiated on the Ngaanyatjarra lands and the Aboriginal Reserve. The agreement provides consent for the grant of a mining lease and subsequent mining operations. Hinckley Range has cultivated a very strong relationship with the Traditional Owners, which is evidenced by successfully negotiating the agreement.

The employment of a Project Liaison officer by Hinckley Range has ensured information relating to the Project is efficiently and effectively communicated to the Wingellina community. Consultations have been undertaken in meetings over multiple days with legal, technical and anthropological representation provided by Ngaanyatjarra Council staff and consultants. This consultation to date has included discussions regarding the formation of a mining agreement, the scale and nature of the proposed mine, environmental risks and management, and general project requirements and details.

A summary of these and other consultation outcomes to date are provided in Table 4.1.

4.4.2 Ongoing Consultation Activities

Hinckley Range is committed to continue to engage with the Wingellina residents on a regular basis, with a full time presence on the land and monthly visits to the community. Consultation and engagement with the local community will be undertaken for the life of the Project, as will be the case with the Ngaanyatjarraku Shire Council and State government agencies. A project implementation committee has also been put in place which included the representatives of the Wingellina community, land council and Hinckley Range. All ongoing consultation with stakeholders will be documented.

Table 4.1 Details of Stakeholder Consultation

Stakeholder consulted	Date / type of consultation	Topics/issues raised	Proponent response/outcome
Decision Making Authorities / Regulatory Agencies			
Office of the Environmental Protection Authority (OEPA)	May - June 2015 Correspondence and meetings regarding other Government Agency comments on the draft PER. Meeting on 04 June 2015.	Government agency feedback on assessment of factors, of particular note: • Air Assessment; and • Flora and fauna surveys. Requirement for further information on the regional extent and specific range extensions for taxa. Confirmation specimens collected were submitted to the WA Museum collection.	MetalsX to update and expand floristic assessments based on regional mapping photography and targeted survey effort in area's outside of proposed development to understand significance of development on Flora and Fauna. MetalsX to discuss Subterranean fauna in a separate chapter to terrestrial fauna having regards for outcomes of hydrological maps and information. MetalsX to identify a suitable peer reviewer for Air Assessment, to be undertaken concurrently with public review period.
	16 December 2014 Meeting to discuss OEPA comments on the draft PER.	Comments on the consultation section of the PER, requiring further explanation of issues raised and outcomes. Proponent to review the key characteristics table and detail provided in the project description to ensure flexibility in the assessment. Resolve some formatting and minor typographical errors.	MetalsX to submit an updated version of the draft PER to OEPA by February 2015.
	October 2014 Telephone call and emails to confirm timing of draft PER for OEPA review.	The OEPA requested a meeting prior to submission to ensure key environmental factors were adequately addressed.	Key attendees were unavailable due to travel and other commitments. Dialogue and briefing of DMA's occurred prior to submission of the draft PER at end October 2014.
	April 2014 Presentation of ESD to EPA.	The EPA provided the following feedback/guidance: • Clear and comprehensive information on the baseline health status of the remote Aboriginal community is required; • Consultation and cooperation with the local community and land council is expected to be inclusive and meaningful; • The formation of pit lakes after closure is certain. An understanding of risks around progressive salinity and leakage over time is required. Modelling needs to be undertaken; • Atmospheric emissions need to take into account background levels and cumulative emissions; • Comments from DMA's need to addressed in the PER; • Risk of fibrous and asbestiform minerals present in the material needs to be assessed using data from exploration drilling and geological characterization; and • Engagement with the Department of Health (DOH) when undertaking the HIA & Risk Assessment.	The Proponent discussed the scope of the HIA study with the Environmental Health section of DOH and established a peer review process to guide and review the baseline and Health Impact Assessment. The Proponent continued dialogue with Wingellina community and land councils advising of refinements to the Project and further studies being undertaken. A local resident at Wingellina was engaged as a full time aboriginal liaison officer. Reviewed exploration logs and analysis for the presence of fibrous minerals. Additional samples were analysed as part of broad spectrum materials characterisation for the mine closure assessment. Further consultation with DMA's was undertaken, with additional feedback gained and refinements to the Project as a result of updated findings discussed. Final ESD re-issued June 2014.

Stakeholder consulted	Date / type of consultation	Topics/issues raised	Proponent response/outcome
	April 2014 Meeting to discuss key issues and environmental factors relevant to the project.	Discussed Air & Noise assessment and implications to the health outcomes of the Wingellina residents, the amount of consultation with community around the proposed change, and mine closure aspects including lessons leant from similar projects.	The Proponent refined the presentation to the EPA board to address these key issues in its subsequent presentation of the draft ESD. Additional research of closure issues and experiences pertaining to similar mines was undertaken. TSF design options were re-examined in light of operating issues and closure objectives.
	November 2013 Meeting to consider the draft ESD.	Refinements around the Health factor to include a Health Impact Assessment (HIA) to requirements of Health Department. Identified that a formal Mine Closure Plan (MCP), rather than a higher level mine closure strategy, would be required in the PER. Discussed the importance of completing adequate materials characterisation including materials availability to ensure the mine is able to be closed sustainably.	The Proponent met with DOH to confirm the specific requirements and expectation around the HIA. Engaged specialist consultants to undertake further studies including: • Health Impact Assessment (including peer review); • Environmental offsets; and • Further materials characterisation, and review and update of the MCP.
	August 2013. Meeting to confirm referral process.	The need for careful consideration of the impact of the Project on the Wingellina community required, especially with respect to health issues. The close proximity of the proposed HPAL processing plant and mining area to the Wingellina townsite (within 3 km) was identified as requiring further input from the DOH. This issue was not factored into the original scoping document as this earlier assessment was based on the town being relocated. As a consequence of this significant change, it was identified that the current assessment would need to be revoked and a new referral submitted to the EPA with an appropriate level of public consultation.	The Proponent discussed these issues with the Wingellina Steering Committee prior to advising the EPA they no longer wanted to proceed with the current referral. The EPA was presented with a new project referral in September 2013.
	August 2013 Meeting to discuss the proposed changes to the PER to include the Wingellina townsite as a sensitive receptor.	Implications for the current approval process were discussed. The OEPA advised that it would seek further advice on the appropriate process for dealing with the change in scope.	The OEPA advice was noted.

Stakeholder consulted	Date / type of consultation	Topics/issues raised	Proponent response/outcome
	June 2013 Meeting to introduce the Project consultant team, provide an update on the progress of PER and preliminary findings of environmental studies.	Recent developments with respect to EPA involvement in mine closure assessment were discussed. The OEPA expressed concern about the potential for significant mine closure issues relating to the sodic and dispersive nature of mined materials. The OEPA advised that a Mine Closure Plan conforming to the *Guidelines for Preparing Mine Closure Plans* (DMP 2011) would be required to meet EPA expectations for this factor. Consultation with DMP on these matters was recommended given that the EPA will receive advice from DMP as part of the assessment process. With respect to Commonwealth assessments under the EPBC Act, bi-lateral arrangements needed to be initiated at the scoping phase of EPAs assessment. The Project requires a separate assessment under the EPBC Act. Requirement for a formal change to project under s45C of the EP Act to consider the Wingellina community as a sensitive receptor in Noise and Air impact assessments.	The Proponent met with DMP to seek advice on closure plan requirements. The draft closure strategy was provided and feedback from DMP requested. A Project referral under the EPBC Act was submitted the Commonwealth. The Proponent engaged in further dialogue with the OEPA with respect to the assessment of the Project under the EP Act. Based on the advice received, the Proponent subsequently withdrew the current referral and resubmitted a new referral for the Project.
	August 2011 Wingellina Site Tour.	Officers of EPA conducted a tour over the proposed mining area in the Wingellina tenement and the Officer Basin water borefield and pipeline route.	The tour enabled the EPA to gain an improved understanding of the Project location and environmental context.
	February 2010 - September 2010 Regular meetings held with the officers of the Environment Protection Authority (EPA).	Review of Hinckley Range's development and submission of the Environmental Scoping Document (ESD). Discussion of Project issues such as the location of Wingellina townsite, project water requirement and supply source options.	Alterations and additions to the ESD as recommended by the EPA were implemented.
Department of Environmental Regulation (DER)	December 2014 Telephone discussion of PER findings with respect to ambient noise measurements and the Aircraft Noise assessment.	The DER was reasonably satisfied with the update and explanation of findings, including conformance with relevant noise assessment guidelines. It was identified that a follow up meeting was not required. The DER indicated that additional advice could be provided during the public review phase of the PER assessment process or as otherwise requested by the OEPA.	The DERs response was noted.
	June 2014 Joint meeting with OEPA and follow up conversations and emails to clarify the relevance of sequential extraction techniques to assess the bioavailability of metals in the ore, waste rock and tailings material, within the updated Environmental Scoping Document.	The proximity of the Aboriginal community to the proposed mining area dictates that the land use needs to be considered as sensitive. The value and importance of establishing a baseline for metals bioavailability was discussed, including in relation to bush tucker foods. Potential management options for dealing with bioavailable substances were also discussed, such as the creation of exclusion zones around the TSF or waste rock landforms and community education programs.	Agreed sequential extraction techniques would not be undertaken until Total Metals have been assessed. The total metal values which are above the EILs will be captured within the Mine Closure Plan (MCP) Risk Assessment and commitments will be made within the MCP to undertake further work during the DFS. The ESD was modified in consultation with the OEPA to reflect these requirements.

Stakeholder consulted	Date / type of consultation	Topics/issues raised	Proponent response/outcome
	August 2013 Meeting to discuss the Environmental Noise Assessment results relevant to the Wingellina townsite.	DER sought clarification on the assumptions and sound power & equipment lists used in the noise modelling and impact assessment. The issue of threshold noise levels (35dB contour) at edge of the Wingellina townsite indicated by the modelling was discussed. An explanation of the basis of noise & sound power levels used in the modelling study, which represented a "worst case" scenario, was presented at the meeting by the Proponent and accepted by DER.	The Proponent re-examined contingency measures to address unanticipated noise exceedances (for example such as day time only mining in pits closest to the townsite). The discussions with the DER were considered in the development of the Project Noise Management Plan.
Department of Aboriginal Affairs (DAA)	August 2014 Meeting to discuss issues related to accessing the proposed mining area.	Permitting requirements of the Aboriginal Land Trust (for example entry and re-entry permitting for undertaking works).	Following the meeting, confirmation of the existing Access Permits was investigated given the respective mining interests over time related to Project area. Access Permits were subsequently confirmed by DAA.
	August 2014 Meeting to discuss the Project and the protection of heritage sites.	• Extent of consultation and working relationship with the Shire of Ngaanyatjarraku and the Irrunytju Community; • Accuracy of mapping heritage sites, including the process for resolving mapping areas; • The Proponents legal obligations for Aboriginal sites registered under the *Aboriginal Heritage Act 1972* and mechanisms for continued protection; and • The DIA requested the development of a Project Heritage Management Plan to accompany the PER.	All heritage sites were mapped and documented in the PER as exclusion zones. A Heritage Management Plan has been prepared as part of a project EMP and included in the PER documentation (Appendix B).
Department of Mines and Petroleum (DMP)	August 2013 Meeting to update on the status of the PER and mine closure requirements.	The need for DMP to review the draft Decommissioning Closure and Rehabilitation Plan (DCRP) and determine whether it can be included in the PER in its current form.	The Proponent provided the DMP with a formal request for this review along with the draft DCRP. Subsequent to receiving feedback from the DMP the referral was revoked and re-referred with new scoping requirements for mine closure agreed.
	2009 - 2010 Ongoing communications relating to the Project.	Project status, feasibility outcomes, designs for plant and mine impacts.	Advice from the Department of State Development (DSD), DEC, Department of Mines and Petroleum (DMP), Department of the Environment, Water, Heritage and the Arts (DEHWA), Department of Aboriginal Affairs (DAA) was incorporated into the ESD/PER.
Department of Water (DOW)	November 2014 Telephone discussion to request a meeting on PER findings and update on the further work relating to pit lakes, dewatering and o TSF design options.	The DOW indicated that it had not received a copy of the draft PER for comment. The DOW reconfirmed the licensing application process for groundwater dewatering and abstraction. Updates relating to additional modelling studies addressing pit lake water quality were discussed. It was identified that pit voids would function as groundwater sinks post mine closure. Given that changes since last briefing were non-substantial, it was agreed that a follow up meeting was not required. The DOW indicated that additional advice could be provided during the public review phase of the PER assessment process or as otherwise requested by the OEPA.	The DOWs response was noted.

Stakeholder consulted	Date / type of consultation	Topics/issues raised	Proponent response/outcome
	June 2014 Exchange of emails and phone discussion to confirm the minimum requirements for hydrological assessments relating to borefield development and mine closure.	General reference to post closure modelling based on 2012 Australian Groundwater Modelling Guidelines. Compliance to this level of modelling required detailed monitoring which is typically done during a Definitive Feasibility Study (DFS) phase of mine development. A conceptual modelling approach was presented in accord with Chapter 3 of the AGM guidelines to assess hydrogeological change from closing the water supply borefield and discontinuing dewatering. The proposed water supply borefield (12 GL/yr) will likely require a H3 Hydrogeological Assessment for a DoW 5C licence. Hydrogeological studies including pumping tests and a numerical model are to be consistent with DoW operational policy 5.12.	The Proponent engaged specialist consultants to undertake hydrological assessments in support of mine closure planning. The advice/response of the DoW was noted.
	August 2013 Meeting to brief DoW on Project status and discussion of preliminary findings from surface and groundwater assessments.	Areas of primary interest to DoW include licensing for pit dewatering and abstraction from the water supply borefield. A groundwater monitoring program including annual reporting will be required. Groundwater modelling is necessary to contribute to the assessment of potential impacts of the Project on the environment and water users (such as the Wingellina community).	The advice/response of the DoW was noted.
	June 2012 Discussion of the proposed Project water supply option in the Officer Basin and review of DOW Project assessment requirements.	At the time of the meeting, insufficient detailed hydrogeological information was available to enable the DoW to make a full assessment of the proposed water supply option. It was identified that further detail on the viability and availability of water to meet life of mining requirements needed to be compiled.	Further drilling and pumping work t was undertaken to evaluate the water supply potential of the Officer Basin resource for the Project.
Health Department	July 2015 Correspondence on the revised Health Risk Assessment (HRA) and findings around nickel exposure.	DoH reviewed the findings of the HRA specifically around nickel exposure and predicted nickel exposure of Wingellina community and proposed accommodation village.	MetalsX amended the PER chapter and the draft Air Quality Management Plan to reflect the comments received and regarding pre development requirements.
	28 May 2015 Meeting to confirm methodology around nickel exposure assessment in the HRA.	Statistical assessment of the available dust deposition data was presented to demonstrate the data set which was reliable (above limits of detection) and consistent with the PM_{10} ambient monitoring. Agreement was reached over the assumptions, limitations and use of the data set in the exposure assessment for the HRA.	MetalsX to undertake the nickel exposure assessment using available deposition data to extrapolate nickel in dust concentrations to PM_{10} data. Use the dust deposition data to update the HRA and use the DoH assessment criteria for Ni of 0.003ug/m^3.
	30 April 2015 Meeting to discuss comments on the HIA and HRA.	DoH was not confident on the exposure assessment relying on nickel concentrations in Soil to extrapolate to concentrations in dust. Whilst it was a line of evidence it did not allow comparison with established air criteria. Preference for HVAS data but would consider use of dust deposition data if this could be shown to be reliable.	MetalsX would retrieve all monthly dust deposition data (30 months) and review this to see if it could be used in the exposure assessment.

Stakeholder consulted	Date / type of consultation	Topics/issues raised	Proponent response/outcome
	November 2014 Telephone conversation to request a meeting to discuss the key findings of the HIA & HRA.	The DoH was unavailable to meet but supportive of the peer review process instigated by the Proponent. Key findings and comments from Peer Review process were provided during the discussion. The DoH advised that it had not received any reports or request for advice from OEPA with respect to the Project. The DoH indicated that additional advice could be provided during the public review phase of the PER assessment process or as otherwise requested by the OEPA.	The advice/response of the DoH was noted.
	April 2014 Telephone discussion on proposed soil sampling to collect further data around baseline Ni content in dust to improve the HRA.	The DoH advised that Ni content in the sub 45μm fraction of soil particles, used to estimate PM_{10}, would be of key importance for the assessment.	A Sampling and Analysis Plan (SAP) for the HRA was developed and reviewed by the DoH and an independent peer reviewer. Surface soil samples from the Project area were collected as per the SAP. The HRA was updated based on the data resulting from the implementation of the SAP.
	December 2013 and January 2014 Meeting to discuss scoping requirements for the ESD and preliminary findings from the HRA.	The need for additional data to complete a dose response / quantitative assessment consistent with DoH guidelines was identified. The DoH recommended the involvement of an independent peer reviewer in the process of finalising a HRA and HIA for the Project. It was noted that one facet of the HRA approach is to capture health benefits that may arise from the Project.	The Proponent completed a HIA for the Wingellina Community and engaged independent peer reviewers for the HRA and HIA.
	August 2013 Discussion of Air & Noise Impact Assessments, additional work required to progress assessment of the Wingellina Community as a sensitive receptor.	Modelling of key environmental factors (dust, noise and vibration) demonstrated minimal impact on the Wingellina townsite in its current location resulting from the Project resulting from the Project. Possible approaches for undertaking a HRA and HIA for the Wingellina community were discussed, taking into consideration the small population size of the town.	The Proponent engaged SNC-Lavalin to undertake a Health Risk Assessment (HRA) for the Project based on available data to quantify baseline risk from dust and other emissions.
Department of Parks and Wildlife (DPaW)	March 2014 Meeting to discuss potential requirements for environmental offsets associated with the Project.	The nature of potential residual environmental impacts associated with the Project was discussed. The DPaW outlined the merits of considering regional scale approaches (at the Bioregion scale) in the design and delivery of offset programs. It was suggested that offset approaches adopted by other companies in the broader region could be reviewed. It was identified that the Project had been subject to assessment under the Commonwealth EPBC and found to be “not a controlled action”.	In May 2014 the Proponent consulted with representatives from the Tropicana Joint Venture gold mine and the appointed independent trustee managing offset studies associated with this mining project.
Department of Housing and Works (DHW)	January 2010 Discussion of departmental requirements for EIA prior to submission of scoping document.	No issues requiring follow up actions were identified. The potential for the Project to deliver economic improvements to the Wingellina community was noted.	The advice/response of the DHW was noted.

Stakeholder consulted	Date / type of consultation	Topics/issues raised	Proponent response/outcome
Stakeholders directly affected by the project			
Implementation Committee (Comprising representatives from the Wingellina community, Yarnangu Ngaanyatjarraku Parna Aboriginal Corporation (YNPAC), Ngaanyatjarra Council (NgC), Ngaanyatjarra Land Council (NLC) and the proponent) Meetings also open to the general public.	December 2010 to October 2014 Regular (quarterly) meetings to update Land Councils and Traditional Owners on the status of the Project.	Key Issues Raised during this period are summarized as follows: • The actions required from the LUA are the key focus for implementation by this joint committee; • Establishing trusts required under the LUA; o money distribution of Compensation and Mining Royalties for AREA B - Ngaanyatjarra (Wingellina) Mining Agreement (Traditional Owners); • Progress of Anthropological Studies allowed under the Agreement; • Potential Hinckley Range involvement in Young Mining Leaders Course; • Calcrete (limestone) issues; • Water drilling activities on L69/12 and L69/13; • Selection of location options for the new township; and • Survey of Wingellina townsite by Whelan's surveyors and update on new townsite progress.	The implementation Committee membership committed to undertake the work necessary to identify, solve and implement LUA actions which addressed issues, tracked through meeting minutes and ongoing communications between the Committee membership. Metals X Ltd provided leadership, mentoring, support, funding and expertise to enable the creation of the Trust, the development of the community capability and capacity to benefit from the economic opportunities created by the project. Community resources were identified, trained and utilized on project works in developing the project.
Coordination Committee (Made up of senior Traditional Owners, Ngaanyatjarra Council staff and advisers.) Meeting open to general public. Wide representation from surrounding communities (including SA communities).	May 2008 to July 2010 Regular meetings held to negotiate and develop mining agreement and support exploration.	• Concern on the current status of the Town Facilities and it's maintenance; • Proximity of the town in relation to the Mine; and • Discussed examples of issues addressed in other agreements. o Answered a number of questions regarding the project; o Established protocols – e.g. negotiation; and o Sharing information on similar projects elsewhere (e.g. Murrin-Murrin).	Land Use Agreement (LUA)/Mining agreement developed & signed. Establishment of Implementation Committee and continued consultation. Metals X committed to the relocation of the Town and has put budget provision for this as part of the Royalty payments under the draft agreement.
			Troppo Architects and Kimberly Service providers were engaged to report on benefits of a new town, improved design practices, and likely timeframes once work starts.
			Negotiated access to L69/12 and L69/13 for water exploration purposes.
Ngaanyatjarra Land Council	February 2010 Formal Council Meeting: Ngaanyatjarra Council CEO, Ngaanyatjarra Council advisors, Senior Traditional Owners.	Detailed discussions on existing mining agreement and a number of negotiation points previously communicated by the council.	Reached general agreement on points and agreed to present a mining Agreement proposal at a public meeting at Wingellina in or around March 2010.
	April 2008 to December 2009 Ongoing meetings, discussion and communication have been held with the Ngaanyatjarra Council & Traditional Owners.	Various meetings regarding the Wingellina project and provision of improved community services at Wingellina – e.g. water quality, reliable power, health & communications, town relocation, social impacts, environmental factors, mining agreement requirements, and infrastructure requirements.	Inclusion of Wingellina Town infrastructure (water, power, airstrip, road etc) requirements into the Project Feasibility Study. Assist the Ngaanyatjarra Land Council and community to engage with Government to advance the opportunity and needs of the Musgrave region.

Stakeholder consulted	Date / type of consultation	Topics/issues raised	Proponent response/outcome
	July 2008 to present Ongoing communication through discussions with Advisor John Thurtell, and full time aboriginal liaison officer.	Constant contact on site is maintained at the company exploration camp. Senior Traditional Owners are regular visitors to the camp. Several Traditional Owners requested completion of a mining agreement either personally or via liaison officer. The parties remain in communication regarding the project, progression of environmental works, operation of the existing exploration agreement, town relocation and mining agreements. Topics have also included town relocation, social impacts, environmental factors, mining agreement requirements, and infrastructure requirements.	Mining Agreement progressed, Trust establishment progressed, the Project advancement updated.
	May 2008 Meeting with Anangu Pitjantjatjara (APY) Council Executive.	• Presentation to monthly executive meeting; • Discussed Wingellina project and opportunities within the APY lands; • Discussed project scale and transport requirements; and • Discussed calcrete deposits and potential use at the Wingellina project.	Opportunities were identified through exploration which is ongoing (a deposit has been Identified near the NT border) and through provision of services to the Wingellina Project.
Ngaanyatjarra Land Council.	May 2014 Implementation Committee meeting in Wingellina.	Implementation Committee meeting with Ngaanyatjarra Land Council and Traditional Owners.	Resolved concerns with Project delays due to PER process and Board approval for the Project (commodity market deteriorated).
	September 2013. Meeting to discuss advice from OEPA on approval process and requirement to re-refer ESD.	This delay was not seen as consistent with the Agreement between MetalsX & community – influenced by a party “external” to the LUA.	Both parties reviewed the clause in the Mining Agreement and were satisfied with process and Metals X continued commitment to progress with the relocation of the Wingellina community as the most preferred option. A letter of support from the NLC was provided to accompany the referral.
Individuals of Wingellina Community, District Health Nurse.	April 2011 A series of meetings and voluntary interviews with local residents of Wingellina and remote health service providers.	The following key issues were raised by locals during the SIMP interview process: • Opportunities for training and employment at the mine; • Community members access to proposed mine village; • How the cemetery will be managed and if they can still visit; • Management of traffic & dust, sealed section of road built nearby communities; • New facilities for the town (swimming pool & Church); and • What will remain at the current townsite after the town is relocated?	• Metals X prepared and endorsed a Social Impact Management Plan; • Preparation of a draft Aboriginal Business Development Strategy; and • All facilities and town relocation are a legal commitment in the mining agreement.
Regional Shire Councils, Development Commission & Government Authorities.	June 2008 - July 2014 Presentations & discussion with Stakeholders regards Transport corridor from Wingellina to port.	The Wingellina project is located in an extremely remote location (~1600km equidistant from any capital city). The region is influenced by Multi-jurisdictional (State and Community) governance and challenges. There is no infrastructure available to the region and no significant historical database of the region or its characteristics (e.g. social impact, environment, weather etc.).	Metals X Ltd has undertaken to facilitate, educate and mobilise the regions representative groups in a coordinated approach to developing the economic and social opportunities. Includes three levels of Government, industry (mining) and community. The creation and development of the Midwest-Musgrave Corridor Initiative under the WA Department of Regional Development is an outcome of that Metals X commitment and investment into the Musgrave region.

Stakeholder consulted	Date / type of consultation	Topics/issues raised	Proponent response/outcome
Broader stakeholders with an interest in regional mining projects			
Tropicana JV, Independent Trustee	May 2014 Meeting at Hinckley Range to discuss closure, offsets and the establishment of Great Victoria Desert Biodiversity Trust.	It was noted the two sites were located in different but connected bio-regions and there could be some synergies should Metals X wish to participate in the program. Noted Tropicana had formal triggers due to significant species requiring offsets. This is not the case for the Wingellina Project.	Metals X to complete the offsets assessment and engage win further dialogue with Trust to determine any contributions to projects which may assist in improving body of knowledge around interconnectivity between significant species common to both bio regions.
Musgrave mining representatives	November 2013 - Ongoing Meetings & communications to discuss the Wingellina project and impact on infrastructure, common dataset etc. for Musgrave development.	Common issues of remote access, lack of services & infrastructure in Central Australia.	Formulate an alliance of mining companies exploring and developing projects in the region to leverage outcomes for appropriate infrastructure and regional environmental information.

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CHAPTER 5

DESCRIPTION OF THE PROJECT

5.0 DESCRIPTION OF THE PROJECT

The Project involves open pit mining of nickeliferous limonite ore from the Wingellina deposit at a rate of approximately 4.3 million tonnes per year (Mtpa), and on-site processing at a processing plant using a high pressure acid leach (HPAL) process, to produce an intermediate mixed nickel-cobalt hydroxide product. The estimated average mine production capacity is approximately 40,000 tonnes (t) of nickel and 3,000 t of cobalt metal in concentrate per year for 40 years.

The following supporting infrastructure is included in the Project: administration buildings, HPAL processing plant, tailings storage facility (TSF), fuel storage, workshops, laboratory, internal service roads, explosive storage magazine, waste landfill, septic waste treatment, communications systems, gas fired co-generation power plant and workforce accommodation village. The existing Wingellina airstrip will be upgraded to cater for a fly-in-fly-out (FIFO) workforce.

Tailings from the HPAL processing plant will be piped to the TSF at a rate of up to 5.5 Mtpa. Tailings will be neutralised using calcrete sourced from an existing supplier in South Australia, and trucked to the operation on existing roads.

Tailings deposition will be from a spigotted delivery line around the perimeter of two or more cells forming the TSF impoundment (paddock style). This will also include a supplementary Water Storage Facility (WSF) with one cell to be used for the managing tailings return water.

Approximately twelve gigalitres (GL) per year of water is required for the operation of the mine, processing plant and accommodation village. Water will be sourced from the Officer Basin, 100 km to the south of the proposed mine operation, and supplemented with mine dewatering volumes and recovery from the TSF. It is estimated that mine dewatering could provide a maximum of 0.3 GL/year and recovery from the TSF approximately 1 to 2 GL/year. Two reverse osmosis (RO) units will be used to generate water for potable use and for the HPAL processing plant.

The processed nickel-cobalt hydroxide will be transported to overseas markets, via road and rail to the Port of Darwin or the Port of Adelaide. The transport route is expected to follow existing road networks. A preferred transport route will be selected based on the outcomes of the DFS.

The estimated disturbance footprint of the mine and associated mine infrastructure is up to 2,762 ha within a 5,875 ha development envelope contained within tenement E69/535; with an additional up to 211 ha associated with the borefield and pipeline development.

5.1 Key characteristics

A summary of the key characteristics of the Project is presented in Table 5.1. A preliminary site plan showing the major Project components and key environmental features is shown on Figures 5.1 to 5.4.

Table 5.1 Key characteristics of the Wingellina Nickel Project

Summary of the Proposal

Proposal title	Wingellina Nickel Mine
Proponent name	Hinckley Range Pty Ltd
Short description	This Proposal is to mine nickeliferous limonite ore from the Wingellina deposit located approximately 1,400 km east-northeast of Perth, and use a HPAL process to produce a mixed nickel-cobalt hydroxide product for export to overseas markets.

Disturbance Footprint

Element	Description
Mining pits	Clearing of no more than 607 ha within a 5,875 ha development envelope.
Supporting mine infrastructure (including HPAL processing plant)	Clearing of no more than 736 ha (excluding TSF, borefield and waste rock landform's) within a 5,875 ha development envelope.
Waste rock storage	Clearing of no more than 184 ha within a 5,875 ha development envelope.
Topsoil Storage	Clearing of no more than 404 ha within a 5,875 ha development envelope.
Tailings Storage Facility	Clearing of no more than 831 ha within a 5,875 ha development envelope.
Raw water supply & pipeline from the Officer Basin	Clearing of no more than 211 ha within a 2,243 ha development envelope.

Operational Elements

Element	Description
Life of project (mine production)	Greater than 40 years (continual operation).
Size of orebody	Up to 180 million tonnes.
Depth of mine pits	Up to 200m (average pit depth of 110 metres).
Watertable depth in mining area	Approximately 38 to 58 metres. Orebody dewatering will be required to access the deeper parts of the deposit.

Element	Description
Mine operation	24 hour per day operations, Monday to Sunday.
Processing plant	HPAL process, with in-feed of up to 4.5 million tonnes per year to produce an intermediate mixed nickel-cobalt hydroxide product.
Supporting infrastructure (refer to Figure ES2)	Major components include: • Waste rock landforms; • Topsoil stockpiles; • Tailings storage facility; • Water storage facility; • Workshops and washdown areas; • Explosive storage magazine; • Service roads (internal); • Airstrip upgrade (extension and sealing surface); • Accommodation village; • Administration buildings; • Waste landfill; • Fuel storage area; • Co-generation power plant and power distribution network; • Septic waste treatment; and • Reverse osmosis water treatment units.
Maximum ore mining rate	Up to 4.5 million tonnes per year.
Tailings Disposal	Up to 5.5 million tonnes per year.
Orebody dewatering	Up to 0.5 gigalitres per year.
Water Supply: Groundwater abstraction from the Officer Basin	Up to 12 gigalitres per year.

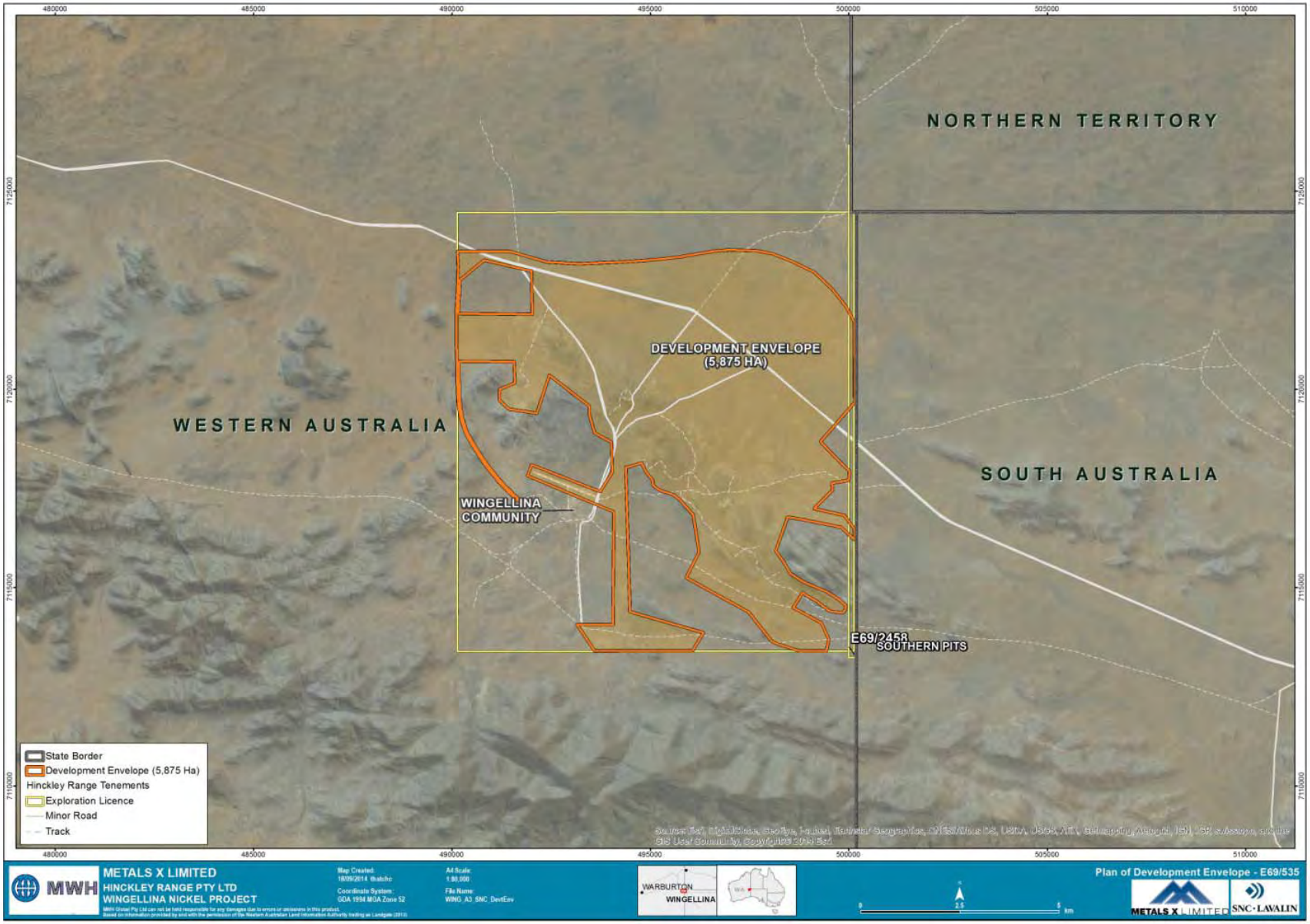

Figure 5.1 Wingellina Nickel Project development envelope – mining area (excluding borefield and pipeline)

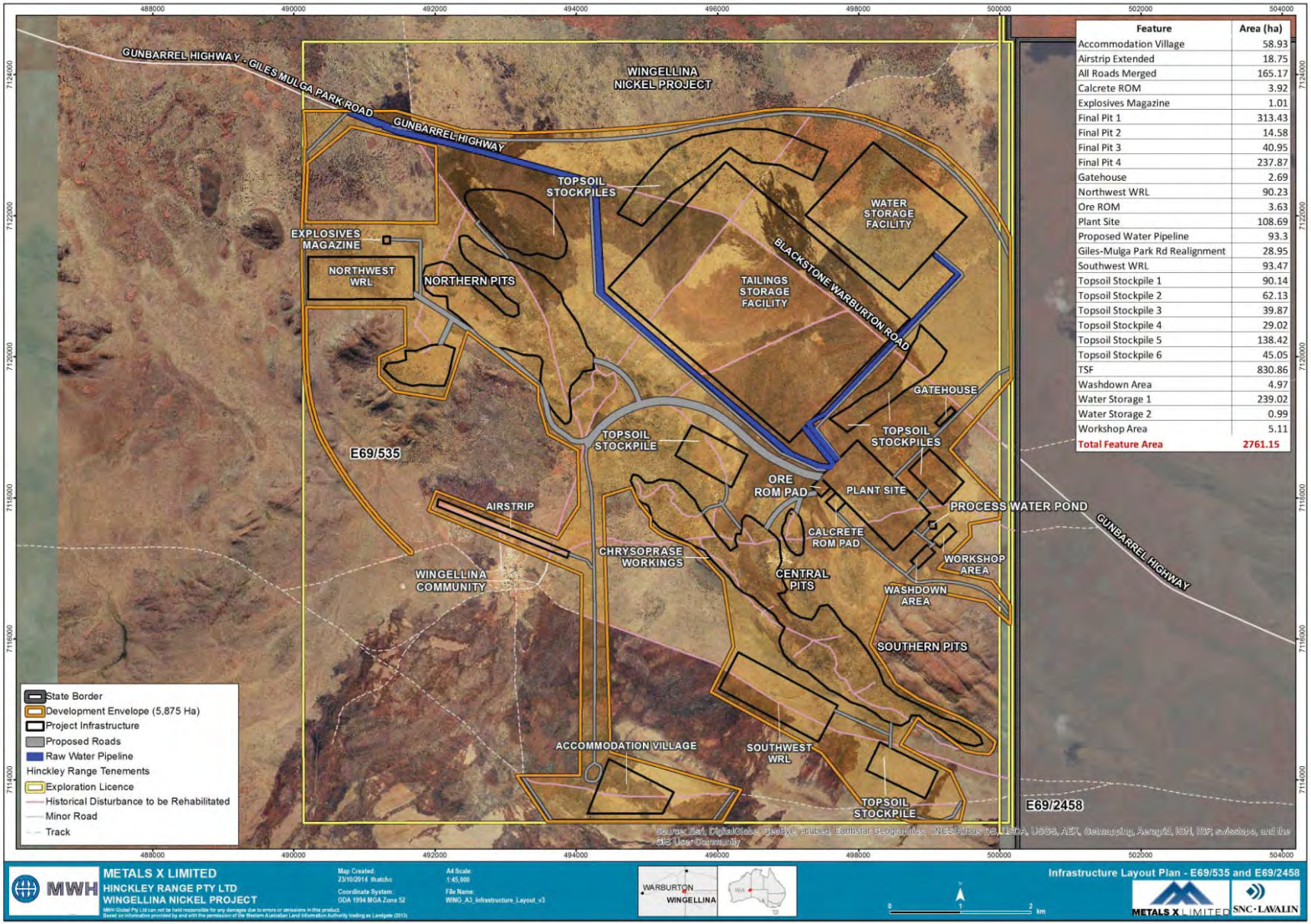

Figure 5.2 **Layout and disturbance footprint of the proposed Wingellina Nickel Project mining area**

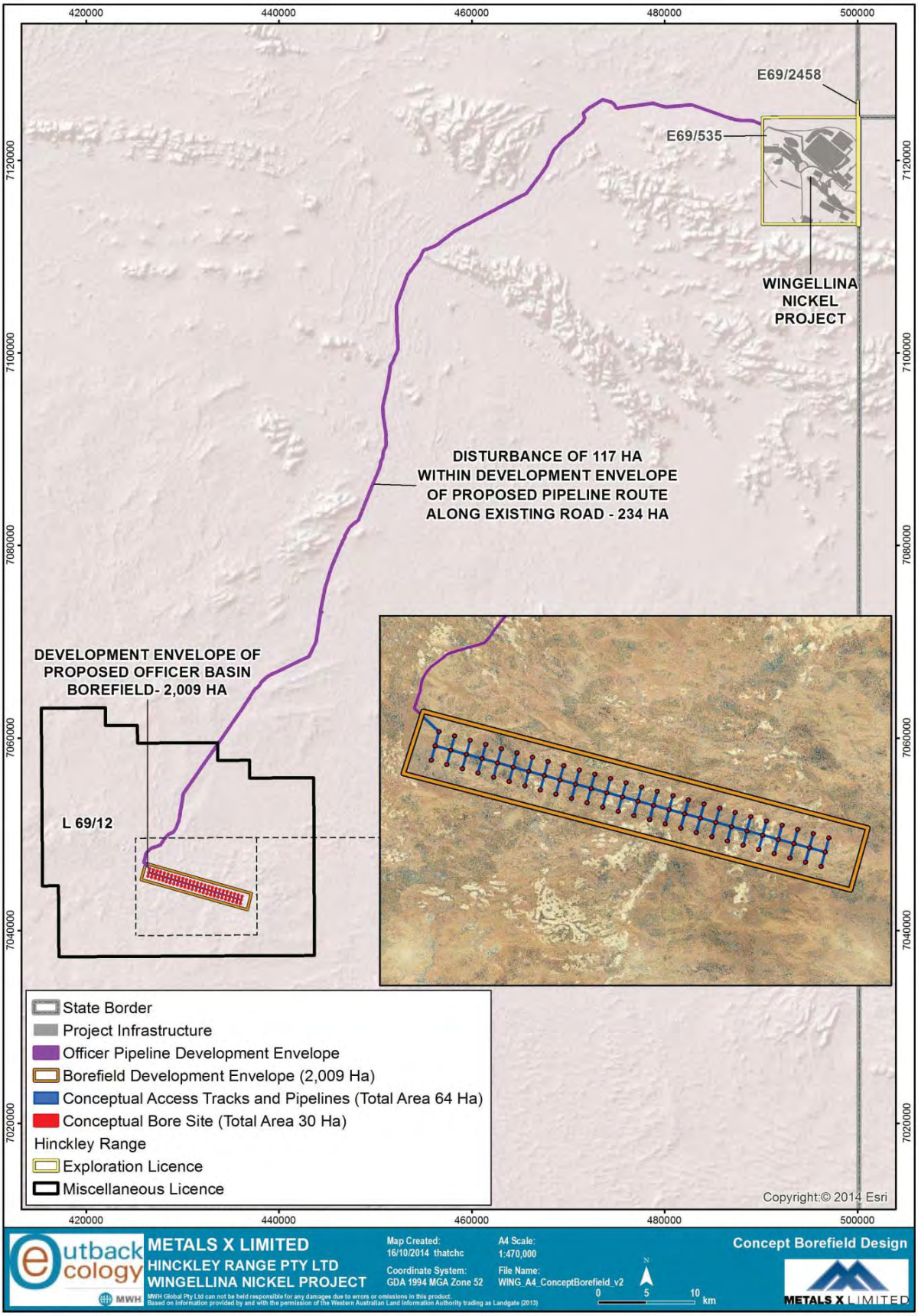

Figure 5.3 Wingellina Nickel Project development envelope - Officer Basin borefield and pipeline

5.2 Project History

The first deposits of nickeliferous limonites in weathered ultramafic rocks of the Giles Complex were noted by South Australian government geologists in the Mount Davies area, in the far northwest of SA in 1953. This led to the discovery in 1956 of nickeliferous limonites at Wingellina by Southwestern Mining Ltd, a wholly owned subsidiary of International Nickel Company of Canada Ltd (Inco), who held the exploration tenure. Inco initially interpreted the nickeliferous limonite outcrops as a very large gossan which may reflect an underlying sulphide deposit. Exploration continued sporadically over the following 18 years, mainly between 1955 and 1960, and later between 1965 and 1970 under a joint venture between Southwest Mining and Nickel Mines of Australia Limited. The many phases of drilling and geological evaluation concluded that the nickeliferous limonite deposits were formed by the oxidation of nickel-bearing silicate minerals within the dunite hosts of the Wingellina layered intrusive complex.

In 1971 Inco applied to excise the project area from a wider area proposed for classification as an Aboriginal Reserve. This application was unsuccessful and the exploration and mining title rights were lost. The ore reserves remained dormant for the next 30 years until E69/535 was granted to Hinckley Range in 1995. A land access agreement was reached in 2001 between Hinckley Range (by then 100% owned by Acclaim Exploration NL (Acclaim)) and the Traditional Owners to undertake exploration across the tenement.

A considerable amount of exploration work was completed by Acclaim in the period 2001 to 2004.

In March 2005 Metals X entered into an agreement with Acclaim to earn an 80% interest in Hinckley Range by free-carrying Acclaim to the completion of a Definitive Feasibility Study (DFS). In late February 2006, Metals X acquired all interests in the Project area from Acclaim, by taking a 100% interest in Hinckley Range Pty Ltd.

A landmark mining agreement for the Wingellina project was signed on 16 July 2010 with the Traditional Owners of the Yarnangu Ngaanyatjarra Lands through their representative bodies. The agreement provides the right to mine and develop infrastructure within the agreement area subject to regulatory approvals and the grant of a mining lease.

In September 2012 Metals X signed a memorandum of understanding (MOU) with Samsung C&T Corporation which provides the basis for the parties to collaborate to complete a DFS and move the Wingellina Nickel-Cobalt project into production. Under the MOU, Samsung C&T will provide its technical expertise in engineering, feasibility studies and construction to assist Metals X in completing the study.

In June 2013, the Board of Metals X announced a postponement to engineering works associated with the Project DFS as a result of the depressed nickel market but indicated it would progress other elements of the Project including the Public Environmental Review.

5.2.1 Mineral Resources

Hinckley Range has been undertaking detailed investigations in support of the Project since mid-2005. This has involved a significant amount of on-ground work including environmental research, resource drilling, and evaluation and engineering feasibility studies, resulting in the completion of Identified Mineral Resource and Reserve estimates. The resource drilling for the Wingellina deposit has defined a body containing approximately 1.8 million tonnes (Mt) of nickel (Ni) metal and 139,000 tonnes (t) of cobalt (Co), giving the Project national economic significance (Table 5.2).

Table 5.2 Wingellina Nickel Project - Identified Mineral Resource

Total Identified Mineral Resource Estimate – 0.5% Ni (cut-off)				
Class	**Million Tonnes**	**Ni**	**Co**	**Fe_2O_3**
Measured	68.847	1.00	0.078	48.71
Indicated	98.623	0.97	0.075	46.39
Inferred	15.727	0.97	0.069	42.73
Grand Total	183.197	0.98	0.076	46.95

5.3 Project Description

5.3.1 Mine Design

Detailed pit designs were developed for the first 20 years of mine operation by Coffey Mining (2008) as part of the Pre-feasibility Study (PFS) for the Project. A total of 20 pits were designed, however the majority of the mill feed is contained within five pits. The aggregated resource (all pits) for the first 20 years comprises some 85 Mt of mill feed at 1.08% Ni and 0.088% Co, and 42 Mt of waste equating to an average stripping ratio of ore to waste of 2:1.

At the end of 20 years, the pit optimisation shell is estimated to contain a further 86.2 Mt at 0.87% Ni and 0.065% Co (Measured and Inferred). The Phase 1 feasibility schedule was detailed for the first 20 years of operation, while the remaining ore was scheduled at average grade over the subsequent 19 years (Coffey Mining, 2008). Conversion of a further 15 Mt of material in the inferred category to indicated status is expected to extend the life of the mine by a further 3.5 years. A summary of the materials breakdown for each pit is provided in Table 5.3 and models of the pit shells for the starter pits in the Northern, Central and Southern areas are shown in Figure 5.4, Figure 5.5 and Figure 5.6.

Table 5.3 Summary of material breakdown by pit (Coffey Mining, 2008)

Pit	Pit Identifier	Total Material	Waste	Strip Ratio	Mill Feed					
					Tonnes	Grade				
						Ni	Co	Fe2O3	Al2O3	Mgo
		[Mt]	[Mt]	[w:o]	[Mt]	[%]	[%]	[%]	[%]	[%]
South										
1	11	26.6	7.5	0.4	19.1	1.07%	0.083%	50.7%	11.39%	2.14%
2	12	17.4	7.0	0.7	10.4	1.02%	0.078%	51.0%	10.37%	1.69%
3	13	0.2	0.1	0.4	0.2	1.24%	0.088%	60.0%	11.73%	2.47%
4	14	1.6	1.0	1.6	0.6	0.95%	0.060%	48.4%	7.75%	1.95%
5	15	0.7	0.2	0.3	0.5	1.02%	0.098%	46.7%	7.24%	2.59%
Sub Total		46.4	15.7	0.5	30.7	1.05%	0.081%	50.77%	10.91%	1.99%
Central										
1	21	5.7	1.8	0.5	3.9	1.05%	0.097%	52.2%	7.32%	2.71%
2	22	7.6	1.6	0.3	6.0	1.25%	0.097%	41.8%	8.69%	5.04%
3	23	2.9	0.4	0.2	2.5	1.17%	0.090%	48.3%	10.70%	3.78%
4	24	2.1	0.2	0.1	1.9	1.31%	0.064%	42.3%	10.57%	3.06%
5	25	2.3	1.3	1.2	1.0	1.07%	0.092%	57.1%	11.14%	1.50%
6	26	2.0	0.7	0.6	1.3	1.14%	0.060%	42.0%	2.59%	3.09%
7	27	0.7	0.4	1.3	0.3	1.23%	0.071%	47.3%	16.19%	3.70%
8	28	0.1	0.0	0.5	0.1	1.17%	0.046%	11.5%	2.86%	2.39%
Sub Total		23.5	6.5	0.4	17.0	1.18%	0.089%	46.10%	8.66%	3.70%
North										
1	31	33.7	12.5	0.6	21.2	1.10%	0.101%	54.3%	9.34%	2.28%
2	32	1.4	0.5	0.5	0.9	1.20%	0.066%	42.5%	6.29%	4.08%
3	33	11.9	3.9	0.5	8.0	1.00%	0.075%	57.9%	10.91%	1.41%
4	34	4.4	1.1	0.3	3.3	0.99%	0.107%	52.3%	6.87%	2.12%
5	35	0.6	0.1	0.1	0.5	0.98%	0.083%	40.8%	6.04%	5.47%
6	36	1.8	0.5	0.4	1.3	1.03%	0.054%	46.7%	6.74%	4.72%
7	37	3.4	1.3	0.6	2.1	1.04%	0.088%	53.8%	17.51%	1.28%
Sub Total		57.1	19.8	0.5	37.3	1.06%	0.093%	54.14%	9.70%	2.20%
Grand Total		127.0	42.0	0.5	85.0	1.08%	0.088%	51.31%	9.93%	2.42%

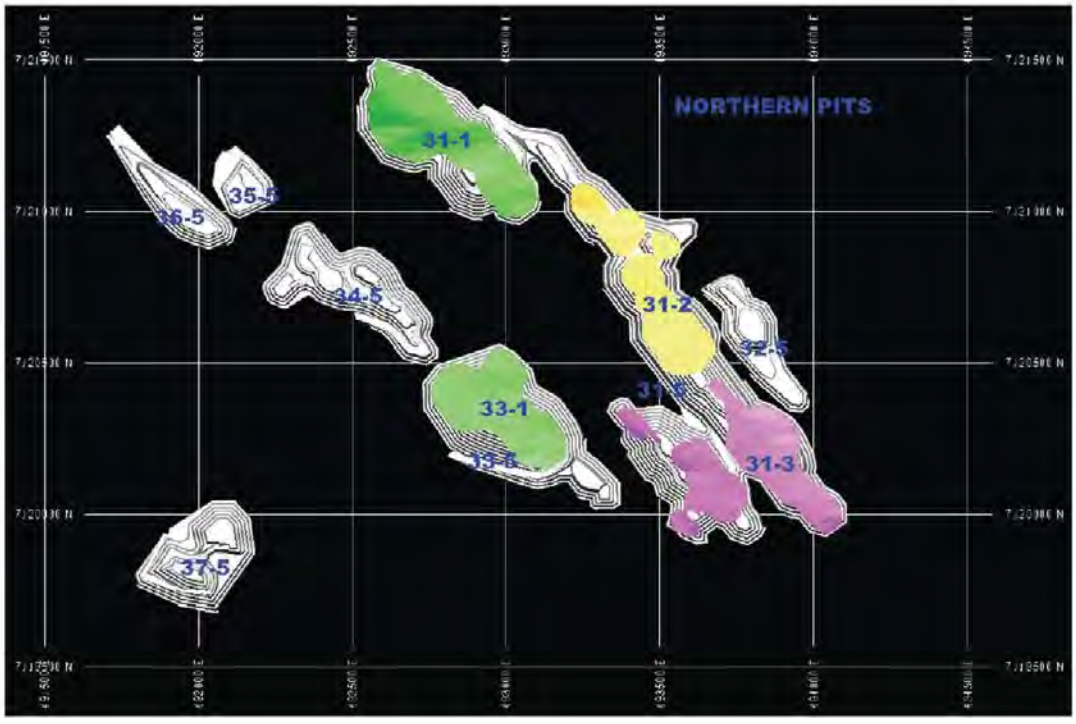

Figure 5.4 Starter pits for the Northern Pit Area (Coffey Mining, 2008)

Note: Refer to Table 5.3 for Pit Identifier Numbers.

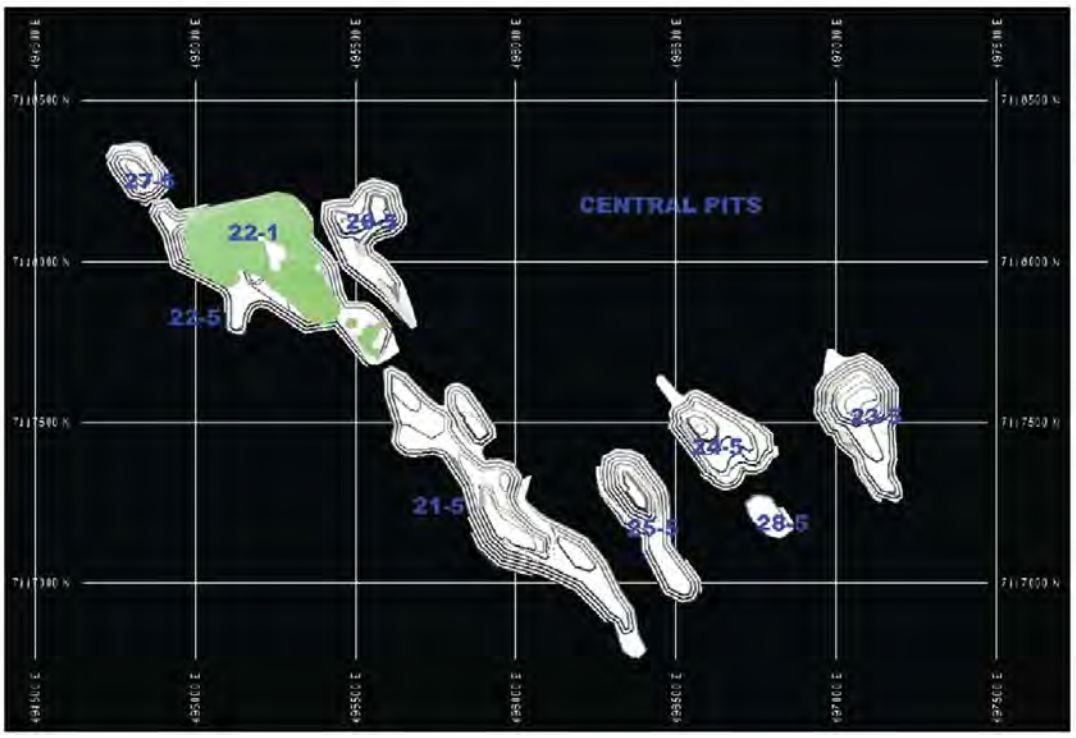

Figure 5.5 Starter pits for the Central Pit Area (Coffey Mining, 2008)

Note: Refer to Table 5.3 for Pit Identifier Numbers.

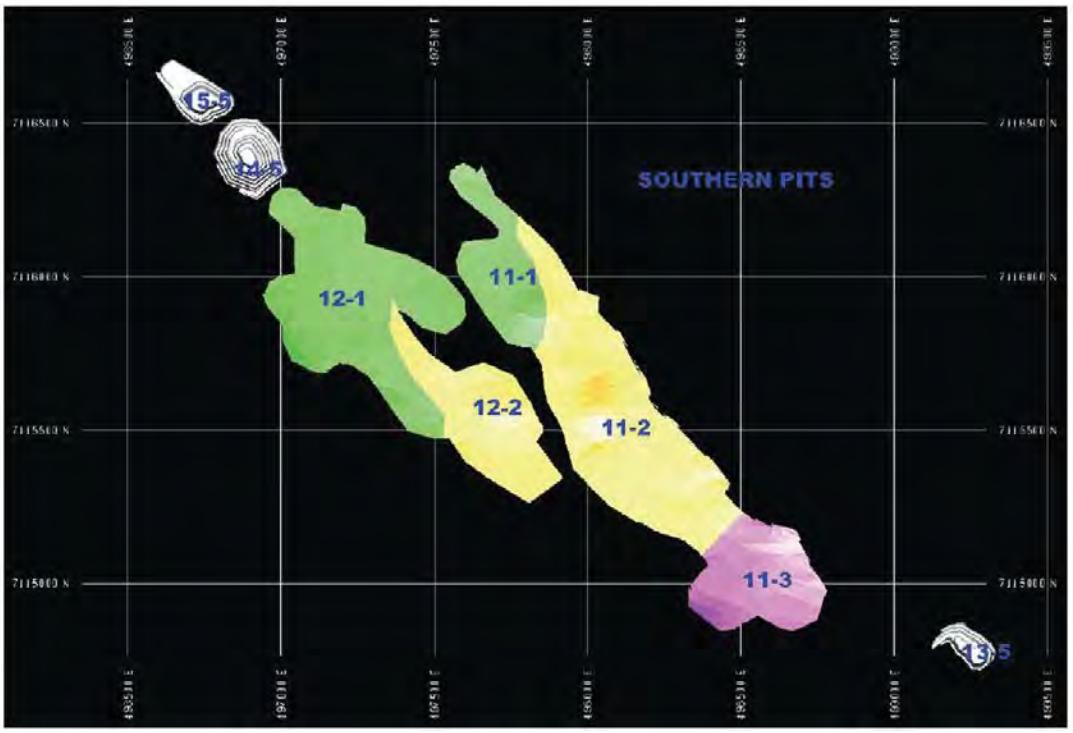

Figure 5.6 Starter pits for the Southern Pit Area (Coffey Mining, 2008)

Note: Refer to Table 5.3 for Pit Identifier Numbers.

5.3.2 Mining Operations

Ore will be extracted using conventional open pit mining methods, using load and haul equipment to freely excavate material. The nickeliferous limonite ores are able to be excavated primarily without blasting due to their highly weathered nature. Excavators will be used to free dig the ore which will then be loaded into haul trucks for delivery to the ore ROM Pad for stockpiling. It is estimated that up to 10% of the total volume of excavated material will require blasting. Limited blasting may be required within small occurrences of siliceous and calcareous cap-rock and small gabbro intrusives.

Approximately 4.3 Mtpa of ore will be transported to the ore ROM pad, using a fleet of diesel dump trucks, where it will be stockpiled in accordance with its mineralogical properties. Truck conversion to LPG is being considered for improved energy use and emissions intensity.

Waste rock will be used where possible in civil construction works (bulk earthworks, flood diversion bunds, fill platforms, abandonment bunds) to reduce overall waste rock stockpiling requirements. Where practicable mine voids will be backfilled with waste rock. Any surplus waste material will be placed into two waste rock landforms (Figure 5.2). Suitable rock armouring material will be selectively placed in the vicinity of landforms and surfaces which require armouring. The ultimate footprint of the two proposed waste landforms will be subject to final design and the practicality of backfilling open pits within the mining sequence. The total area of the two waste landforms is expected to be no greater than 184 ha.

None of the waste rock to be excavated has acid forming potential (OES, 2014).

Rehabilitation of disturbed land will be carried out progressively. The waste rock landforms will be designed and constructed to be safe, stable and compatible with the surrounding naturally occurring landforms.

5.3.3 Mineral Processing

This section describes the processing plant and associated utilities for the Project. Details of the design basis and throughput are identified, together with a process description of each main plant area. A description of the equipment within each area is provided along with details of the associated facilities such as the utilities and reagents. A schematic representation of the major processing sections proposed to treat Wingellina ore is presented in Figure 5.7.

The process flowsheet is based on a proven hydrometallurgical route adopted at several existing operations, within Australia and globally. The flowsheet includes ore preparation without beneficiation, high pressure acid leaching (HPAL), recycle leaching, primary neutralisation, counter-current decantation, iron removal, and two stage mixed hydroxide precipitation using magnesia and lime.

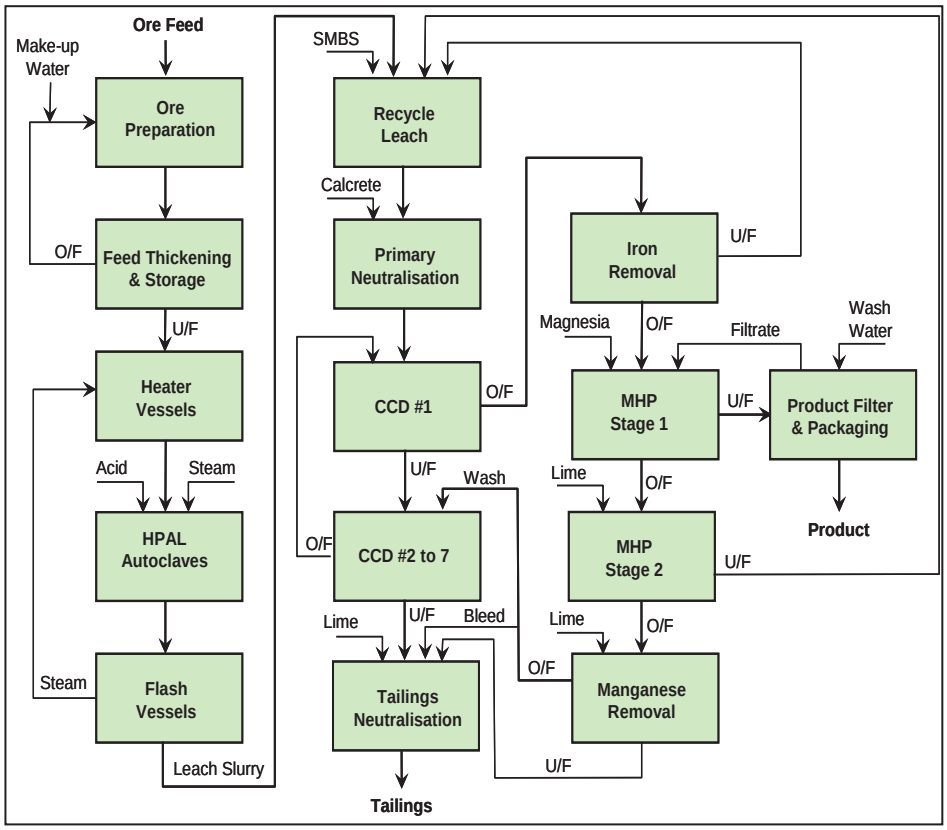

Figure 5.7 Schematic of Mineral Processing Circuit

The design specification for the high pressure acid leach (HPAL) process plant is a throughput of 4.3 Mtpa of dry ore with a maximum production capacity of about 44,000 metric tonnes of nickel and 4,000 metric tonnes of cobalt contained in a mixed hydroxide product at the maximum ore feed grade. The design plant capacity has been based on the residence time provided by the three HPAL autoclaves (5.4 m inside diameter). The key plant parameters are provided in Table 5.4**.**

The process plant is designed to operate 7,488 hours per year over a minimum 20 year life. Certain areas of the plant are anticipated to be subject to elevated temperatures and pressures, highly acidic solutions, scale and erosive particles, necessitating periodic shutdowns for maintenance purposes.

The discharge slurry from the HPAL stage is partially neutralised in a recycle leach stage using recycled underflow from subsequent precipitation stages and then further neutralised using calcrete in the primary neutralisation stage.

Pregnant leach solution (PLS) is separated from solids and recovered by conventional counter-current decantation (CCD). The PLS is passed to the iron removal (or secondary neutralisation) stage where calcrete is added to remove iron, aluminium and excess acid from solution prior to metal recovery by mixed hydroxide precipitation.

Nickel and cobalt are precipitated from solution using magnesia in the mixed hydroxide precipitation (MHP) stage.

Solution exiting the MHP Stage 1 circuit contains significant residual levels of nickel and cobalt and is treated in a scavenger stage where hydrated lime is added to raise the pH and precipitate the remaining nickel and cobalt from solution. The solids produced in the MHP Stage 2 circuit are directed to the recycle leach stage where nickel and cobalt are re-dissolved and recovered.

The overflow from the MHP Stage 2 thickener is forwarded to a manganese removal stage where hydrated lime is added to reduce the manganese level in the barren solution, which is subsequently used in the CCD circuit as wash liquor.

Table 5.4 Key parameters for the HPAL processing plant

Item	Nominal Value	Maximum Value
ROM Ore:		
Feed Tonnage	4.34 Mtpa	4.5 Mtpa
Feed Grade:		
Nickel	0.963 %	1.099 %
Cobalt	0.089 %	0.104 %
Iron	34.0 %	34.0 %
Aluminium	5.33 %	5.33 %
Magnesium	1.15 %	1.15 %
HPAL:		
Leach Feed Solids Density	43 %	46%
Nickel Extraction	95.2 %	95.2 %
Cobalt Extraction	94.2 %	94.2 %
Metal Recovery Losses:		
Nickel Recovery	96.7 %	96.7 %
Cobalt Recovery	94.6 %	94.6 %
Tailings:		
Tonnage	5.0 Mtpa	5.5 Mtpa
In-situ Density	1.0 t/m^3	1.0 t/m^3

Item	Nominal Value	Maximum Value
Metal Production:		
Nickel contained as MHP	38,519 tonnes/year	44,028 tonnes/year
Cobalt contained as MHP	3,444 tonnes/year	4,020 tonnes/year
Plant Ni Recovery	92.1%	92.1%
Plant Co Recovery	89.1%	89.1%
Water:		
Consumption	10 GL/a	12 GL/a

5.3.4 Processing Infrastructure

The processing plant will be located approximately 500 m from the ore body. Details of the major elements of the HPAL processing plant are provided in the following sections and summarised in Table 5.5.

Table 5.5 Major elements of the HPAL processing plant

Infrastructure	Details
Ore handing area	To be established adjacent to the ROM pad. Consists of dry crushing and screening plant will be fed by a front-end loader into a feed hopper.
Ore preparation area	Ore from the primary crushing stage will be fed to a low aspect semi-autogenous grinding (SAG) mill which will operate in closed-circuit with three vibrating screens, configured with 0.5 mm slot width screen panels.
HPAL feed storage tanks	Slurry will be stored in 6 HPAL feed storage tanks with 24 hour residence time.
Slurry depressurisation vessels	Slurry will be depressurised through HP, MP and LP flash vessels to atmospheric pressure by flashing off steam, which is recycled to heat the HPAL feed slurry. Slurry from the LP flash vessels will be pumped to the recycle leach tank.

Infrastructure	Details
Recycle Leach & Primary Neutralisation System	Slurry from the HPAL stage will be mixed with underflow streams generated in downstream process stages to partially neutralise the acid and to dissolve precipitates, and release nickel and cobalt into solution.
Counter Current Decantation (CCD) Circuit	The discharge slurry from the primary neutralisation stage will be fed to the CCD circuit to recover the nickel and cobalt-rich solution from the barren leached solids.
Sodium Metabisulphite (SMBS) Mixing Tank	SMBS will be delivered to site in bulk bags and mixed with raw water in a mixing tank.
Sulphur Unloading Hopper	Sulphur will be delivered to site by road and discharged into the sulphur unloading hopper.
Sulphur Feed Bin	Sulphur will be reclaimed from the stockpile by front-end loader and discharged into the sulphur feed bin before being fed and conveyed to a live stockpile located inside the sulphur melting section of the sulphuric acid plant.
Plant Air Systems	The process air package will produce 9,000 normal cubic metres per hour (Nm^3/h) of process air at a gauge pressure of 200 kPa(g) for use in the iron removal stage. The plant air compressor package will supply up to 2,100 Nm^3/h of plant air at 790 kPa for plant instrument air requirements.

5.3.4.1 Ore Treatment Plant

The ore treatment plant will consist of a ore handling area, ore preparation area, HPAL feed storage tanks, slurry depressurisation vessels, and a recycle leach and primary neutralisation System. The components of the ore treatment plant are described in Table 5.4 above.

5.3.4.2 Sulphuric Acid Plant

The purpose of the sulphuric acid plant is to provide sulphuric acid for the pressure leach area and minor plant users. The acid plant also provides high pressure saturated steam for use in the HPAL plant and for power production via turbine generators.

The design capacity of the sulphuric acid plant is 4,400 t/d, expressed as 100% strength acid.

The principal steps in the acid making process will consist of burning sulphur in air to form sulphur dioxide, combining the sulphur dioxide with oxygen to form sulphur

trioxide in the presence of a catalyst, and combining the sulphur trioxide with water to form a solution containing sulphuric acid.

The chemical reactions are:

$S + O_2 \rightarrow SO_2$

$SO2 + ½O_2 \rightarrow SO_3$

$SO_3 + H_2O \rightarrow H_2SO_4$

The oxidation and absorption steps in the manufacture of sulphuric acid from sulphur are highly exothermic. The excess heat generated at each step of the process will be recovered in a waste heat-boiler, superheater and economisers. The heat will be recovered in the form of high pressure superheated steam which will then be exported to meet process requirements. Excess steam will be used for power generation. The process will achieve a conversion of sulphur dioxide to sulphuric acid of more than 99.5%.

5.3.4.3 Calcrete Plant

The purpose of the plant is to supply up to 103 dry t/h of calcrete in slurry form for neutralisation in the primary neutralisation and iron removal stages. The calcrete plant will contain facilities for crushing, milling and slurry storage.

5.3.4.4 Lime Slaking Plant

Quicklime for the lime slaking process will be delivered to site and discharged into a storage silo designed to provide four days of buffer storage capacity. The bin will be ventilated such that any dust generated will be collected by a dust collector and returned to the bin.

The lime slaking facilities will be supplied as a vendor package.

5.3.5 Tailings Storage Facility (TSF)

The proposed TSF location is approximately 500 m to the northwest of the processing plant (see Figure 5.3). The final design height of the TSF will not exceed that of the North Hinckley range of hills, and will not be visible from either the mine village or the Wingellina Community (OES, 2012e).

Geotechnical testing was undertaken within the proposed TSF footprint by Australian Tailings Consultants (ATC) in 2008. Results indicated sandy clay to depths between 0.6 and 1.0 m which allows surface treatment of the TSF footprint to be limited to topsoil stripping and local compaction of natural material. The sandy clay material is likely to inhibit seepage which over time will be further reduced by the impermeable nature of the tailings. Given the very low permeability of the naturally available material ($1x10^{-6}$m/s) an artificial liner is not required (ATC, 2010).

An option analysis was undertaken in 2008 by ATC, subsequent to 2008, Hinckley Range have confirmed an available water resource and assessed the rheology of

the tailings. This additional information has resulted in the potential to present a paddock style TSF as the preferred option.

A four cell TSF layout is proposed, to limit the rate of rise of the tailings and provide the facility to rotate deposition between cells and allow fallow cells to dry and consolidate for an extended period prior to embankment raising. Unthickened tailings will be discharged from a spigotted ring main around a perimeter containment embankment.

The design outcomes are detailed in Table 5.6.

Table 5.6 Key Parameters of a Four Cell Paddock Style TSF

Cell	Footprint Area (ha)1	Tailings Storage Capacity (Mm3)	Max Embankment Height (m)	Min Tailings thickness (m)	Embankment Rate of Rise (m/year)	Water Storage Capacity (Mm3)
C1	193	21.76	17	9	3.55	3.469
C2	199	27.60	20	11	3.30	3.438
C3	192	24.93	21	11	3.83	3.221
C4	186	19.53	19	8	4.43	3.169
Total	**770**	**93.84**				

1- Includes embankment footprint constructed by downstream raising.

Earthworks for construction of each TSF cell will be staged, with an initial starter embankment (Stage 1) constructed from material won from the cell impoundment followed by four subsequent embankment raises of approximately 3 m height. The embankments will have 1.5H to 1V upstream batters, 3.75H to1V downstream batters (15˚ slope) and 8 m wide crests. It is anticipated upstream construction methods for embankment rising will be used, depending on the achievable strength gain on the tailings beaches by evaporative drying.

A staged approach to clearing and topsoil stripping for each consecutive cell construction is proposed. It is envisaged that initial cell (stage 1) construction stages would comprise embankments up to 6 m high and that subsequent construction stages (2 to 6) would be of 3 m height intervals. Upstream and/ or centreline construction methods will be used if sufficient strength gain is achieved at the beach adjacent to the embankments.

Assuming deposition into cell 1 and 2 is alternated until both cells are full, clearing would be required as per the following sequence;

- Start up: Cell 1;
- Year 2: Cell 2;
- Year 10: Cell 3; and
- Year 11: Cell 4.

Test results (which considered 40% solids content) indicate that the initial settled density will be about 0.62 tonnes/m3 with around 11% of the water contained in the slurry rapidly released as bleed water. Initial consolidation is expected to occur immediately after deposition of a thin layer of tailings, as bleed water is released from the slurry. As the deposition area will vary as tailings build up, evaporative consolidation has the potential to increase the tailings density of each deposited layer to 1.44 tonnes/m3 over a period of several weeks at which point the moisture content of the tailings would have reduced to approximately 25% and the tailings would have gained considerable strength (ATC, 2014).

As the active beach area changes every few days, the thin layers of freshly deposited tailings will be subject to evaporative drying with consequent increase in density and increase shear strength.

The anticipated TDS of the decant / bleed water is approximately 25,000 mg/L which is likely to generate a partial salt crust on drier parts of the tailings beach (a salt crust formed during laboratory testing to the extent that a weight of salt correction was required for density evaluation) (ATC, 2008). The relatively high plasticity of the tailings will also contribute to the formation of wide desiccation cracks on the tailings beach, which will serve to trap and collect dust.

The tailings are significantly finer than inferred from the mass balance study completed by ATC in 2008 which renders them less prone to dust generation than sandy silt tailings would be. In addition to having higher moisture retention, saltation effects common in silty or fine sandy soils are less pronounced in partially saturated clay like soils which exhibit a higher degree of cohesion and have higher matric suction forces binding the soil particles together.

Stormwater diversion drains will be constructed around the TSF perimeter to prevent scour of the perimeter embankment as a result of run off channelling from the hills to the west.

A separate water storage facility (WSF) will be constructed adjacent to the TSF. The WSF will be divided into multiple cells and have a holding capacity for a 1:100 year 72 hour rainfall event. One of the cells within this feature will be utilised as a return water pond; the supernatant water recovered from the decant pond will be directed to this return water pond. Any water collected from the key cut-off trench, and any seepage recovery systems will also be directed to the return water pond. The WSF has a surface area of approximately 239 ha; a minimum of two cells will be constructed initially; additional cells will be constructed on an as needed basis.

Metallurgical testing to date has only identified one significant potential contaminant in the form of hexavalent chromium. Tailings material will be neutralised prior to discharge to the TSF and treated during processing with sodium metabisulphate (SMBS) to prevent the formation of or remove hexavalent chromium. SMBS converts the hexavalent chromium back to the trivalent state, facilitating the formation of a non-bioavailable precipitate. Other soluble metal salts expected in the tailings liquid together with their approximate concentrations are (ATC, 2008):

- Magnesium (5,300 mg/L);
- Calcium (550 mg/L); and

- Manganese (14 mg/L).

5.3.6 Drainage controls

Drainage controls have been designed to a concept level based on a comprehensive hydrological and hydraulic assessment that addressed the following (Rockwater 2011a):

- Identification of catchment areas and natural water courses likely to impact the pits and mining infrastructure;
- Hydrological analyses to estimate peak flows of 2, 5, 10, 20, 50 and 100 year average recurrence interval (ARI) rainfall events from all catchment areas that are likely to adversely impact the Stage 1 mine pits, landforms and infrastructure locations; and
- Surface water hydraulic analyses at critical locations and sections where natural water courses approach the pits and infrastructure.

Pits will be protected by a levee/drain system, with approximate levee heights of one metre, lengths ranging from 350 – 2000 m, drain bed widths ranging from 1 – 4 m and drain depths ranging from 0.6 – 2.0 m (Rockwater 2011). These designs represent the minimum requirement to contain a 1 in 100 year ARI peak flow from the relevant catchment or series of relevant catchments. Excess flow will run over the natural surface, alongside the drains. Conceptual design details for position, length, width and gradient of drains and levees are provided in Appendix G.

Roads will be constructed to enable sheet flow and eliminate drainage shadow effects. Approximately 13 road crossings will require culverts and floodways. Almost all of the waterways at the proposed road crossings appear to be in the form of wide sheet flows with no defined channels and probably minimal flow velocity (Rockwater 2011a). Culverts of 450 mm in diameter will be installed to transmit normal annual flows, and floodways with scour protection will be installed to accommodate larger than 1 in 100 year ARI peak flows.

Sedimentation basins will be installed at strategic locations to minimise sediment transport into catchments.

Process plant run-off and run-off from the sulphur handling area will be captured and diverted to a process plant containment pond. Any storm water runoff from the process plant site boundary will collected and diverted to the containment pond. Reclaimed water will be returned as process water.

5.3.7 Roads

Existing access roads to the mine site will require upgrading to accommodate quad or triple road trains.

The expected road requirements for the Project include:

- Process plant internal roads – 8.2 km;

- Mulga Park Road re-alignment – 15 km;
- Access from process plant to camp – 12.6 km;
- Service corridor to camp – 8 km;
- Calcrete transport road – 7.5 km;
- Access to explosives magazine – 0.5 km;
- Access to airstrip – 0.5 km; and
- Access to TSF – 2.6 km.

5.3.8 Power Generation

Electrical power for the Project will be generated in a cogeneration plant using steam produced in the sulphuric acid plant, and natural gas. The power plant design consists of two 22-MW extraction steam turbine generators and one 20-MW gas fired turbine generator with heat recovery steam generation. The estimated gas consumption rate is 5.7 terajoules (TJ) per day under normal operation, and approximately 13 TJ/day during acid plant outages. The processing plant is designed to operate at 50% capacity during acid plant outages.

Natural gas will be delivered by road. The most likely supply point is the Mereenie Gas Field in the Northern Territory. The preferred supply point will depend on commercial negotiation.

High pressure steam will be produced from two sources. The major source of high pressure steam will be from waste heat boilers in the sulphuric acid plant. The secondary source of high pressure steam will be from auxiliary boilers that produce supplementary steam into the same header for the high pressure steam distribution system.

The power station is designed with consideration of the following main operating scenarios:

- Supply of 42.5 MW of power during normal plant operations, using 110 t/h of high pressure steam imported from the sulphuric acid plant and approximately 20 t/h of high pressure steam produced by the auxiliary boilers; and
- Supply of 27.5 MW of power and 70 t/h of high pressure steam for process use to maintain a 50% of normal process operation during HPAL processing plant outages.

The plant configuration consists of;

- Two 22 MW extraction steam turbine generators;
- One 20 MW low nitrogen oxide (NO_x) with heat recovery steam generation unit (HRSG); and
- Two 60 tph low NOx package boilers.

For emergency conditions and the start-up of the power station, two 2.5 MW diesel powered generators will be located within the power station complex.

The estimated power requirements for the Project at maximum design capacity are summarised in Table 5.7.

Table 5.7 Summary of Power Usage Requirements for the Wingellina Project

Project Area	Connected Power (MW)	Absorbed Power (MW)
Process Plant	31.2	19.9
Process Services	15.4	13.7
Water, Services and Utilities	7.2	4.4
Infrastructure	3.4	2.3
Total (ex- distribution losses)	57.0	40.3
Total (inc- distribution losses)		**42.5**

The power station complex will contain the Main High Voltage Distribution Room from which feeder lines to all areas of the facility will originate. High voltage distribution from the power station main switchboard will be via 11 kV cable. For major load centres within the process plant area, the cables will connect with step down transformers for local distribution.

5.3.9 Accommodation Village

A 400 man permanent accommodation village will provide accommodation for FIFO workers while they live on-site. The footprint of the accommodation village will be approximately 23 ha.

5.3.10 Airstrip

The existing Wingellina airstrip will be used for the Project, after upgrades, including re-sheeting and lengthening the runway, new facilities and access roads. The upgraded airstrip will be 30 ha in area.

5.3.11 Other Infrastructure

Other Project infrastructure required for the mine operations includes:

- Workshops and washdown facilities;
- Hardstand areas;
- Administration buildings;
- Laboratory;
- Explosive storage magazine;
- Waste landfill;
- Fuel storage;
- Septic waste treatment; and
- Communications systems.

5.4 Construction

It is estimated that construction of the Project will take approximately two and a half years, consistent with other recently completed lateritic nickel projects in Western Australia.

Up to 1500 workers will be required for the construction phase of the Project.

5.5 Operation

An economic analysis of the Project indicates that with a mill throughput of approximately 4.3 Mtpa, the Project will have a life of mine in excess of 40 years. Base case pit optimisation indicates a total of approximately 1,500 kilotonnes (kt) of recovered Ni and 110 kt of recovered Co is achievable over the life of the mine. This will result in approximately 179 Mt of waste rock from the pits with a stripping ratio of 1:0.5 (Coffey Mining, 2008).

Mining is planned to commence in the Central area and the currently designed pits will be completed by approximately year 14. Mining of the Northern pits is planned to commence in year 2 and be completed in approximately year 19. The southern pits are not scheduled to contribute materially until year 7 and would be completed by approximately year 20. The average total material extracted (ore and waste combined), once a steady state mill capacity of approximately 4.3 Mtpa is reached, is estimated at 6 Mtpa for the first 20 years. The average grades achieved over the life of mine are expected to range from 1.33% Ni and 0.12% Co in year 1 to 0.87% Ni and 0.07% Co in years 21 to 39.

5.5.1 Final Product

The final mixed nickel and cobalt hydroxide concentrate product will be will be transported to overseas markets, via road and rail to the Port of Darwin or the Port of Adelaide. The transport route is expected to follow existing road networks. A

preferred transport route will be selected based on the outcomes of the DFS. Transport routes for the final product are expected to be the same as inbound reagents.

5.5.2 Workforce

The total workforce requirement for the operational phase of the Project is estimated at 450 personnel consisting of general personnel, equipment operator personnel and maintenance personnel.

Non-local employees are planned to be employed on a site based contract, working on a two week on, one week off, or similar FIFO roster arrangement depending on market forces at the time. Employees will be provided with air transport to and from the site, and will be housed in an accommodation village at the site.

The Project plan includes maximisation of training, employment and participation of local aboriginal people. The intended aboriginal employment structure includes adoption of flexible working conditions and opportunities to reside either in the company accommodation facility or local communities during working roster cycles.

5.5.3 Water Supply and Distribution

5.5.3.1 Water Supply

Approximately 12 GL/yr of water is estimated to be required for Project construction and operations. The raw water design requirement for the processing plant is approximately 1,200 m^3/hour.

Water abstracted from mining areas will be utilised by the processing plant. Preliminary modelling indicates the total volume of water to be abstracted from pits would be up to 0.5 GL/a (Rockwater 2011). Development of a water production borefield is a key requirement of the Project to supply the majority of raw water for processing.

Bore water will be sourced from groundwater reserves in the Officer Basin, located approximately 100 km to the south-west of the Project. Hinckley Range secured water exploration rights and commenced groundwater exploration drilling in this area in December 2010. This exploration programme was continued during July to November 2012, resulting in the installation of three monitoring bores and two production bores. Test pumping and modelling of the installed bores was completed by Rockwater in 2012 (Appendix G4).

Using average aquifer parameters obtained from pumping tests, a groundwater flow model was created to assess two borefield configurations to supply the Project's raw water requirements. The modelling results suggest that both borefield configurations would be capable of supplying 12GL/a for predicted life of mine. The first configuration requiring about 76 bores along a 19km strike of the aquifer , whereas the second configuration would require 52 bores positioned along the aquifer strike over 41 km (Rockwater 2012).

Various sensitivity analyses were undertaken to inform the conclusions of the modelling study with specific yield values set to half and double the base-case. The model was also re-run halving and doubling the hydraulic conductivity. These results showed that:

- Doubling the specific yield increased the time taken to reach 180 m drawdown, the inferred depth of the aquifer (Rockwater, 2012), to approximately 35 years;
- Doubling the hydraulic conductivity increased time to reach 180 m drawdown to approximately 37 years; and
- A pipeline and associated service route will be required to pump the water approximately 100 km from the Officer Basin borefield to the mine site.

5.5.3.2 Raw Water

An indicative water balance for the Project is presented in Table 5.8. The nominal raw water requirement for the Project has been modelled at approximately 1,189 m^3/h (10.4 GL/a, based on 8760 operating hours/year). Where possible, reclaim water will be recycled for process use to minimise raw water consumption.

Table 5.8 Indicative water balance for the Wingellina Project

Area	Nominal		Maximum	
	m^3/h	ML/d	m^3/h	ML/d
Supply:				
Raw Water (from borefield)	1,189	28.5	1,380	33.1
Recycle Streams:				
Tailings Return Water	201	4.8	201	4.8
Consumers:				
Process Plant	623	12.6	720	17.3
RO Plant	271	6.5	320	7.6
Cooling Tower Make Up	295	7.1	340	8.1

5.5.3.3 Recycled Water

In addition the borefield supply, process water will be derived from tailings reclaim, storm water reclaim, cooling tower blowdown, boiler blowdown and water treatment plant effluent. These streams will be directed to the process water pond for reuse in the process.

5.5.3.4 Reverse Osmosis Water

Reverse osmosis (RO) water will be required for acid dilution, potable water and as feed to the demineralisation plant. Potable water will be produced from two RO plants. One facility is to be located at the mine site with the second located at the accommodation village. Effluent from the RO and demineralised water packages will report to the process water pond.

The demineralised water package will nominally supply 212 m^3/h of demineralised water to the process plant. The demineralised water will feed the boilers in the sulphuric acid plant and power generation plant. Demineralised water will also be required for super heating steam, MHP filter wash and for HPAL barrier seals.

The potable water package will nominally produce 10 m^3/h of potable water for use in the process plant and the accommodation village from chlorination treatment of RO water. The design capacity will also be sufficient to provide the current town of Wingellina with a reticulated potable water source.

Cooling water for use in the process plant, acid plant and power station will be supplied by the cooling tower package. The package is specified to be capable of supplying the entire cooling water requirements for the process plant and includes a provision for cooling water treatment chemical dosing.

The fire water pumps will supply up to 40 L/s of water to the process plant via a ring main to fire hydrants. The fire water storage tank will store 700 m^3 of raw water. Distribution pumps will have back-up power connection.

CHAPTER 6

AIR QUALITY

6.0 AIR QUALITY

6.1 Assessment Approach

Project construction and operations activities have the potential to generate atmospheric wastes associated with releases of dust, greenhouse gases and emissions from the HPAL processing plant including particulates, SO_x and sulphuric acid mist.

Field measurements of ambient air quality and modelling studies were undertaken to evaluate potential impacts on air quality resulting from Project related atmospheric emissions, and inform management approaches.

6.1.1 Ambient air monitoring

A study of the existing air quality environment at Wingellina was undertaken using local and regional metrological data, deposition gauges checked monthly in the period August 2008 to April 2011, and 12 months of continuous ambient air monitoring between October 2010 and November 2011 (Air Assessments 2013; Appendix C1). Further details regarding background meteorological conditions and the monitoring approaches used are provided in Appendix C1.

6.1.2 Dispersion Modelling

Predictive modelling was undertaken to determine the potential impacts of plant emissions and fugitive dust on air quality. Two modelling platforms were used (Appendix C1):

- The California Puff (CALPUFF) model - an advanced non-steady-state meteorological and air quality modelling system recommended by the US EPA as the preferred model for assessing long-range transport of pollutants and their impacts or for near-field applications involving complex meteorological conditions. The CALPUFF model was used for modelling fugitive particulate dispersion; and
- The Air Pollution Model (TAPM) - developed by the CSIRO to estimate the spread and impact of air pollution in a variety of settings. TAPM was used for modelling emissions from the HPAL processing plant.

Plant emissions modelling took into account the proposed 60 m stack associated with the HPAL processing plant. The modelling approach was consistent with the Department of Environment *Air Quality Modelling Guidance Notes* (Department of Environment 2006). Inputs to the CALPUFF and TAPM models relied on the following data sources:

- Emission estimates from the HPAL processing plant based on best estimates from similar plants operating elsewhere;
- Fugitive particulate estimates calculated from emission factors, plans of the site and proposed operational data. Conservative assumptions were used to derive

these estimates, for example with respect to the size of exposed areas and the moisture content of the surface substrates; and

- Use of on-site meteorological data from an air quality grade weather station at Wingellina.

The modelling was used to predict concentrations and rates of deposition of particulates associated with emissions from the mining and plant operations. These were then compared to national standards (NEPM) to determine potential impacts. The modelling methodologies are further described in Appendix C1.

6.1.3 Greenhouse gas emissions

Greenhouse gas emissions were estimated for the whole of the operations (mine to port) for the Project for the first 20 year mine life (Greenbase 2011; Appendix C2), providing an indication of average annual emissions at full production. The methods and emission factors provided by the *National Greenhouse and Energy Reporting (Measurement) Determination 2008* were used to develop emissions estimates, with the exception of clearing and rehabilitation emissions which were estimated using the National Carbon Accounting Toolbox.

Activities taken into account included:

- Ore processing;
- Electricity production;
- Sulphur transport;
- Mixed hydroxide precipitate (MHP) transport;
- Calcrete mining and transport operations;
- Other materials transport; and
- Ancillary activities (clearing, diesel generator and pumping for water supply).

6.1.4 Air Quality Goals

The key Goals for the management of air quality associated with the Project are:

- To ensure that atmospheric emissions do not impact on environmental values, or the health, welfare and amenity of the population and land uses; and
- To use all reasonable and practicable measures to minimise airborne dust.

Air quality goals derived from relevant National Environmental Protection Measure (NEPM) standards have been adopted for the Project (Table 6.1). Further to the NEPM standards, total suspended particulate (TPS) concentrations consistent with the *Environmental Protection (Kwinana) (Atmospheric Wastes) Policy 1999* (Kwinana EPP) have been adopted. For residential areas this is a 24-hour standard of 90 µg/m^3 (desirable not to be exceeded) and a limit (never to be exceeded) of 150 µg/m^3. With respect to sulphuric acid mist, the Californian Office of

Environmental Health and Hazard Assessment (OEHHA) limit of 100 µg/m^3 over a 1-hour averaging period has been adopted.

Table 6.1 National Environmental Protection Measure - Air Quality Standards and Goals

Pollutant	Averaging Period	Maximum Concentration		Goal
		(ppm)	(µg/m^3)	Maximum allowable exceedances
Carbon Monoxide	8-hour	9.0	11,240	1 day a year
Nitrogen Dioxide	1-hour 1-year	0.12 0.03	246 62	1 day a year None
Photochemical Oxidants (as ozone)	1-hour 4-hours	0.10 0.08	214 171	1 day a year 1 day a year
Sulphur Dioxide	1-hour 1-day 1-year	0.20 0.08 0.02	570 228 60	1 day a year 1 day a year None
Lead	1-year	-	0.5	None
Particles as PM_{10}	1-day	-	50	5 days a year
Advisory Reporting Standards and Goal				
Particles as $PM_{2.5}$	1-day 1-year	- -	25 µg/m^3 8 µg/m^3	Goal is to gather sufficient data nationally to facilitate a review of the advisory reporting standard as part of the review of this measure scheduled to commence in 2005.

6.2 Existing Environment

6.2.1 Meteorology

Meteorological measurements were available from the Giles Meteorological Office (BoM station 013017) located approximately 130 km to the NNW of the Project area, and from an air quality grade meteorological station installed and operated at the Project site since September 2008.

The regional climate, described by the Bureau of Meteorology (BoM) as follows, is broadly representative of the climatic conditions experienced at Wingellina:

"dry, with hot summers and mild winters. Annual average rainfall is very low at 283 mm (Giles) with on average 48 days of rainfall, with this falling during the warmer months of the year.

The climate of the region is strongly influenced by a band of high pressure known as the sub-tropical ridge. For most of the year this ridge is located to the south allowing east to southeast winds to prevail. Occasionally during the cooler months the ridge moves north, allowing remnants of cold fronts to pass over the region. While most fronts bring little rain to Giles they are sometimes linked to cloud bands to the north-west which can produce significant rainfall. However, the highest rainfall occurs in the warmer months of November to March, when a trough of low pressure extends southwards from the heat low in the tropics, and tropical lows associated with the monsoon trough move southward into the region.

January is the hottest month, with an average maximum temperature of 37.2 °C.

By contrast winters are mild, with July average maximum and minimum temperatures being 19.9 °C and 6.8 °C respectively. Cold wet days with maxima below 15.0 °C occur about once every winter on average. The lowest maximum temperature recorded was 9.0 °C on 1 August 1975. Frost days, that is, when overnight temperatures fall below 2.0 °C, occurs about twice a month in a typical winter. Such nights occur on clear nights following a day of cool southerly winds. While ground temperatures are generally below zero under these conditions, it is rare to see a ground frost, as the air is so dry. The lowest temperature recorded at Giles was –1.6 °C and occurred on 23 June 1981.

The wettest months are November to March, with February being the wettest month with an average rainfall of 48.5 mm on five days. The heavier rainfall during these warmer months is caused by the periodic southward movement of the monsoon trough, and on occasion a rain depression from an ex-tropical cyclone. The highest daily rainfall, 271.2 mm, occurred on 22 February 1974, when a slow moving tropical low interacted with an upper level trough. The highest annual total was 843.4 mm in 2001, with 204mm falling in February (a rain bearing tropical depression which was formerly Tropical Cyclone [TC] Vincent) and 327 mm in December (associated with the monsoon trough).

To underscore the extreme variation of the rainfall in the region, the lowest annual total was a mere 38 mm, and occurred in 1961." http://www.bom.gov.au/climate/averages/tables/cw_013017.shtml .

The prevailing winds at Wingellina are predominantly from the northeast to southeast (Appendix C1). Winds are milder and more evenly distributed during the winter months.

6.2.2 Ambient Concentrations

Particulate concentrations in the Wingellina area were collected using:

- Depositional dust gauges from August 2008 to April 2011, measured on a monthly basis; and
- A Tapered Elemental Oscillating Microbalance (TEOM) continuous monitor to measure Particulate Matter less than 10 Microns (PM_{10}) concentrations in the period 20 October 2010 to 14 November 2011.

6.2.2.1 Dust Deposition

Depositional dust gauges were installed at eight locations in the Wingellina area (Figure 6.1) summarised as follows:

- In the existing Wingellina township (two stations were installed, however one station was repeatedly vandalised in the early stages of the monitoring program and subsequently abandoned);
- Downwind of the proposed TSF location;
- Downwind of any proposed major waste landform; and
- Downwind of the proposed plant location.

The dust depositional measurements were analysed for average insoluble content and total insoluble content. The average and monthly maximum insoluble deposition rates are presented in Table 6.2. These are comparable to the New South Wales (NSW) dust depositional guidelines that are generally adopted for assessing depositional impacts in Australia (Appendix C1). The results indicate that dust deposition levels are on average low at 0.9 g/m^2/month within the mining tenement (E68/535) and around identified sensitive receptors, which is less than the NSW maximum average criteria of 4 g/m^2/month criteria from all sources.

Table 6.2 Monthly Insoluble Deposition (g/m^2/month) at Wingellina in the period August 2008 to April 2011

Site	Easting GDA94(m)	Northing GDA94 (m)	Average	Maximum
DMS1	495,885	7,118,252	0.7	3.3
DMS2	495,562	7,117,327	1.2	9.4
DMS4	493,178	7,117,002	0.8	2.9
DMS5	494,610	7,120,039	1.3	5.8
DMS6	494,400	7,114,864	0.7	2.1
DMS7	495,952	7,121,385	0.9	3.8
DMS8	492,130	7,121,690	0.9	4.2
Average All			**0.9**	**4.5**

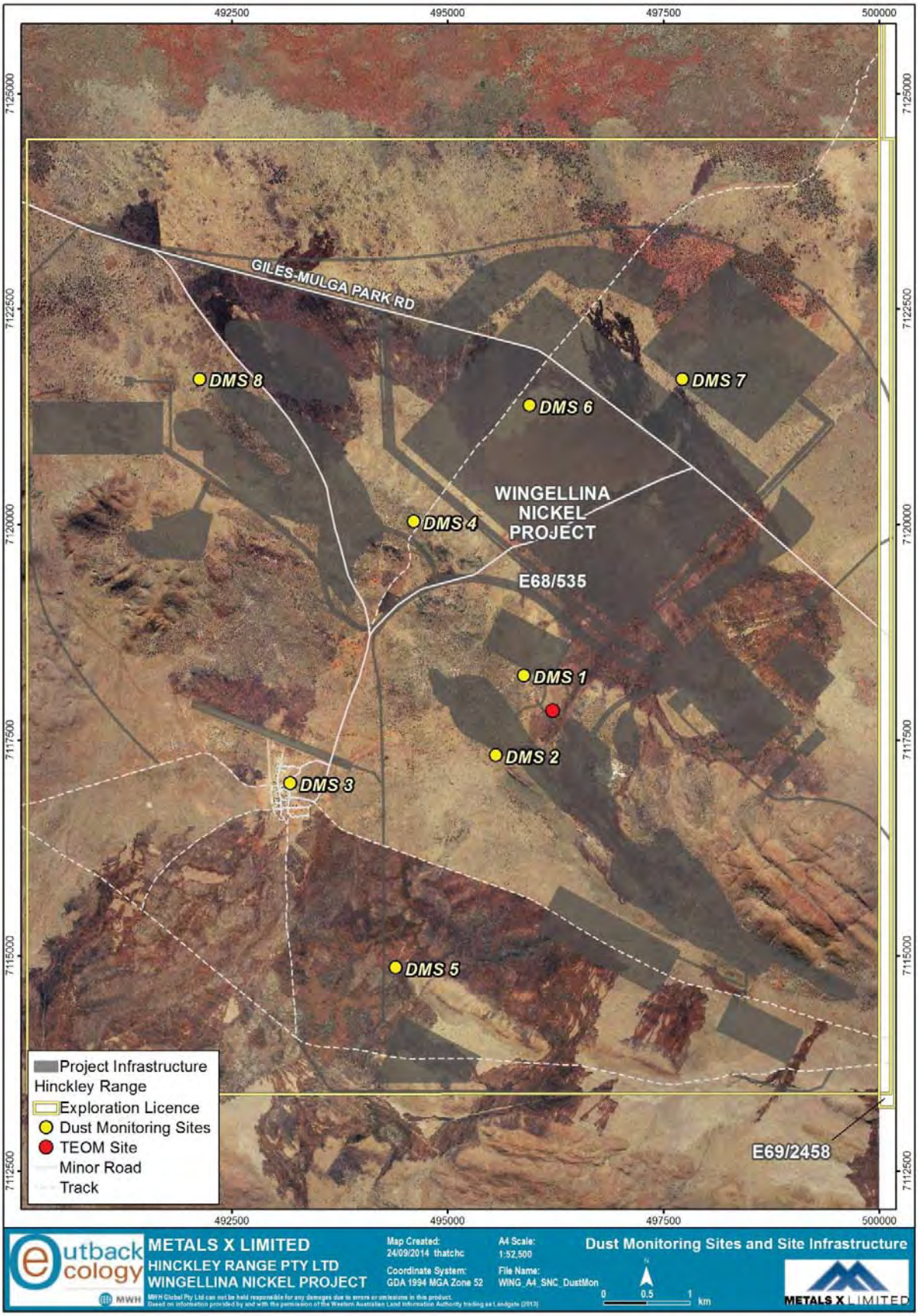

Figure 6.1 Dust Monitoring Locations within and surrounding the Wingellina Project Area

6.2.2.2 Particulate Measurements

The meteorological station and a TEOM for measuring PM_{10} were installed in open ground at a location approximately 1 km west of the proposed processing plant site and 250 m south east of the current exploration camp (52J 496221mE 7117844mS) at an elevation approximately 676 m (Figure 6.1).

Of the 9,386 hours of monitoring undertaken, 8,488 meteorological values were complete indicating a meteorological data recovery of 90%. A total of 8,901 TEOM hourly results were reported indicating a recovery of 95%.The monitoring approach complied with AS/NZS 3580.1.1:2007 - *Methods for sampling and analysis of ambient air - Guide to siting air monitoring equipment*.

The PM_{10} data was averaged over 24 hour periods (midnight to midnight). The PM_{10} levels were generally low during the period of monitoring, except in September and October 2011 (Figure 6.2). The peak in September/October 2011 was attributed to smoke generated by large fires in central Australia, as determined by an analysis of satellite imagery for that time.

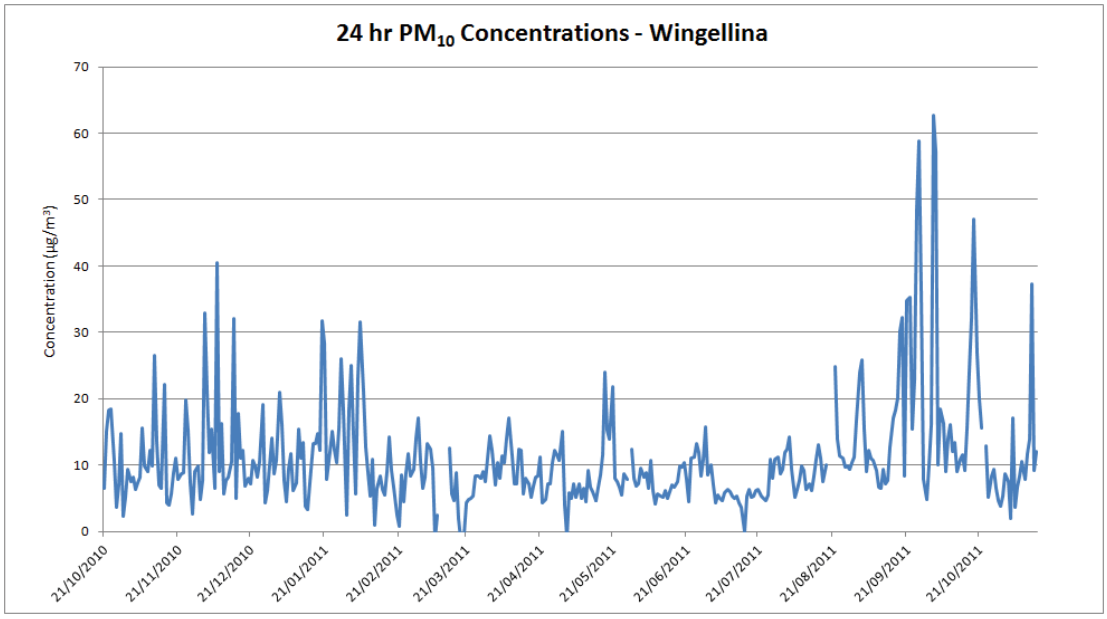

Figure 6.2 Daily Average PM_{10} Concentrations (µg/m^3)

A comparison of these findings with other reference particulate monitoring sites in Western Australia is provided in Table 6.3. The PM_{10} concentrations at Wingellina are generally low compared to other Western Australian locations. For example, the average 90th percentile concentrations are all below any of the other sites. However, high particulate concentrations may occasionally at occur at Wingellina in association with smoke generated by regional wildfires and dust storms (Appendix C1).

Table 6.3 Twenty Four hour PM_{10} Concentrations at Wingellina and other WA reference sites

	Wingellina (Nov 2010 – Oct 2011)	Duncraig (01 – 09)	South Lakes (01-09)	Collie (08-09)	Geraldton (06-09)	Kalgoorlie (06-07) BSY and HGC	Karratha (09/10)
Number of exceedances of 50 µg/m^3	3	0 - 1	0 - 3	3 – 7	4 – 14	4 – 15, 5 - 7	19
Maximum	63	40 - 67	45 - 99	80 – 86	78 – 151	-	118
99th Percentile	48	31 - 38	36 - 46	47 – 57	49 - 105	-	-
90th Percentile	19.7	22 - 26	25 - 29	31	35 - 40	23 – 37, 26 - 34	-
75th Percentile	12.5	18.4 [2]	20.6 [2]	24.6 [2]	30.8 [2]	-	23
50th Percentile	9.0	15.0 [2]	16.2 [2]	18.4 [2]	21.0 [2]	16 - 19	-
Average	11.3						

Notes:

1. All data from DEC 2009 Air Quality monitoring report (DEC 2010), except for Kalgoorlie data from DEC (2009) and Karratha data from Rio Tinto (2010). BSY is Boulder Shire Yard and HGC is Hannan's Golf Course.
2. 2009 data only.

6.2.3 Estimate of Background Levels

Based on the PM_{10} data presented in Table 6.3, a 75th percentile concentration of13 µg/m^3 was adopted as the background particulate level. This is slightly higher than the measured 75th percentile concentration to allow for some year to year variability, with a value of 11.5 µg/m^3 adopted as an annual average.

For Total Suspended Particulate (TSP) and Particulate Matter less than 2.5 Microns ($PM_{2.5}$) there was no background data available from the region. As such, TSP was conservatively estimated as twice the PM_{10} concentrations, which is typical for wind

generated dust. Based on this approach the estimated 75th percentile and average TSP concentrations at the Project area are 26 µg/m^3 and 23 µg/m^3 respectively. TEOM sampling by the DEC in a semi rural area near Caversham have recorded annual average $PM_{2.5}$ annual average concentrations of 7.7 µg/m^3 with a 75th percentile concentration of about 8.7 µg/m^3 (DEC 2010), which was adopted as the background level for the Project area in the absence of other data.

For gaseous pollutants (i.e. SO_2, sulphuric acid mist, NO_2) background levels are expected to be negligible apart from infrequent and transient events associated with wildfires, which may contribute to the formation of NO_2, ozone and particulates. Therefore for cumulative assessment of NO_2, CO and SO_2 background levels were assumed to be zero.

6.3 Sensitive receptors

Sensitive receptors for air quality relevant to the Project include:

- The Wingellina air strip (1.3km from the nearest mine pit);
- The Wingellina townsite (2.3km from the nearest mine pit); and
- The workforce accommodation camp (2.8km nearest mine pit).

6.4 Best Available Techniques

The proposed HPAL processing plant is considered to constitute a Best Available Technique (BAT) for processing nickel laterite ores. The HPAL process includes a 4,400 tonne per day sulphuric acid plant, which is identified as the primary source for SO_2, SO_3 and sulphuric acid mist emissions.

There is little published information on the performance of operating HPAL processing plants with respect to gaseous emissions. In reviewing the BAT for sulphuric acid production, reference was made to the European Sulphuric Acid Association BAT for pollution prevention and control (ESA, 2000). ESA advocate the integration of pollution prevention within process design for all new plants.

The Wingellina process will manufacture sulphuric acid through the direct combustion of sulphur. A summary of SO_2 emissions associated with different sulphuric acid manufacturing technologies is provided in Table 6.4. The most efficient process to generate sulphuric acid from this technique is the “double contact – double absorption” process, which also has a low SO_2 emission level. Emission levels can be further reduced with the addition of caesium catalyst (ESA, 2000). Consistent with industry leading practice, the double absorption plus caesium catalyst technology is proposed to be adopted of the Project.

Table 6.4 Process technologies for reducing emissions of SO_2 (ESA, 2000)

Sulphuric acid manufacturing technology	Emission Level referring to 11% SO_2 and 1,000 t/day = 100,000 Nm^3/h	
	mg SO_2/Nm^3 tail gas	kg SO_2/t acid (H_2SO_4 100%)
Single Absorption (+ 5th Bed)	<5,000	<10
Double Absorption (+5th Bed)	<1,000	<2.5
Single Absorption (+ caesium catalyst in last bed)	<4,500	<9
Double Absorption (+ caesium catalyst in last bed)	<900	<2.3
Wingellina predicted emission levels		<2

6.4.1 Comparative Assessment of Predicted Emission Intensity

Based on predicted emission parameters from Stacks and Vents at the processing plant (Table 5.1, Appendix C) the Project is expected to produce 0.055 tonne SO_2 / tonne metal. This is higher than published estimates for the Mt Keith operation (0.005 t SO_2 / t metal) but less than those for the Murrin Murrin operation (0.21 t SO_2 / t metal) (Jessup and Mudd, 2008).

6.5 Potential impacts

This section describes the potential impacts of the Project as measured against the adopted air quality objectives described in Section 6.1.2.

6.5.1 Construction Impacts

Dust/particulate emissions may be generated from a number of sources and activities during construction of the Project including:

- Wind erosion from stockpiles;
- Land clearing;
- Earthmoving activities;
- Handling and haulage/conveying of overburden; and
- Emissions from vehicles and machinery.

High dust emissions could detract from the amenity of the Project area and surrounds, interfere with the activities of the Wingellina community and potentially exceed target threshold limits for human health and wellbeing. At a localised scale

dust smothering could potentially result in vegetation health decline and reduce the quality of habitat for native fauna.

6.5.2 Operational Impacts

Atmospheric wastes may be generated from a number of sources and activities during the Project operations phase including:

- Dust/ particulates from mining, blasting, haulage and significant erosion dust sources such as the Tailings Storage Facility (TSF), waste landforms and topsoil and sub-soil stockpiles;
- Sulphur Dioxide (SO_2) and sulphuric acid mist from the HPAL processing plant;
- Oxides of Nitrogen (NO_x) from the combustion of fossil fuels; and
- Generation of CO_2 and other greenhouse gases from the combustion of fossil fuels.

The following sections describe the results of the air quality modelling used to determine the cumulative impacts associated with the operation of the mine and processing plant.

6.5.2.1 Fugitive Particulate Emissions

Results of the air quality modelling studies, including predicted particulate concentrations and depositions at the air strip, Wingellina townsite and workforce accommodation village during the year of maximum operation, are presented in Table 6.5. Contour plots for maximum 24-hour average TSP concentrations, maximum 24-hour average PM_{10} concentrations, maximum 24-hour average $PM_{2.5}$ concentrations, and annual average particulate deposition (g/m^2/month) in the Project area are presented in Figures 6.3 to 6.6 respectively. In all cases particulate levels are predicted to comply with the Project air quality goals. In summary:

- Taking into account background levels, the particulate concentrations from the mining and tailings area are predicted to below the criteria at the nearest residential sites (Wingellina townsite and the accommodation village);
- Modelled PM_{10} concentrations are up to 64% of the 24-hour NEPM standard at the Wingellina townsite with modelled $PM_{2.5}$ concentrations at 39% and 79% of the 24-hour and annual average reporting standard respectively. Note the $PM_{2.5}$ reporting standards are designed to facilitate the collection of data and are not health standards as per the other NEPM standards. The majority of the annual $PM_{2.5}$ concentrations are from background particulates with only relatively small contributions from the operations; and
- Particulate levels at the proposed accommodation village are predicted to be lower than at the Wingellina townsite, due to the greater distance from the operations and a more southern location that is less exposed to prevailing winds. Modelled maximum 24-hour PM_{10} levels are 46% of the NEPM standard with 24-hour and annual $PM_{2.5}$ concentrations at 39% and 74% of their respective reporting standards.

Table 6.5 Predicted particulate levels associated with the operations phase of the Wingellina Nickel Project

Pollutant	Averaging period	Air quality goal criteria value	Units	Back-ground Value	Predicted Value (Including background)			Percentage of Criteria (%)		
					Air Strip	Wingellina townsite	Accom. Village	Air Strip	Wingellina townsite	Accom. Village
(1)TSP	24-hr (max)	90	µg/m^3	26	63	60	45	70	67	50
(2)PM_{10}	24-hr (max)	50	µg/m^3	13	33	32	23	66	64	46
	24-hr (5th)	-		12	31	28	21	-	-	-
(3)$PM_{2.5}$	24-hr (max)	25	µg/m^3	6.5	11.3	9.7	8.4	45	39	39
	Annual Ave	8		5.5	6.4	6.3	5.9	80	79	74
(4) Dust Deposition	Monthly	4	g/m^2/ month	0.9	1.8	1.6	1.3	45	40	33

Referenced air quality goals criteria values:

(1) *Environmental Protection (Kwinana) (Atmospheric Wastes) Regulations 1992*
(2) Ambient Air Quality NEPM 1998 (NEPC, 1998)
(3) Ambient Air Quality NEPM advisory reporting Standard 2005 (NEPC, 2005)
(4) NSW maximum criteria (DEC NSW, 2005)

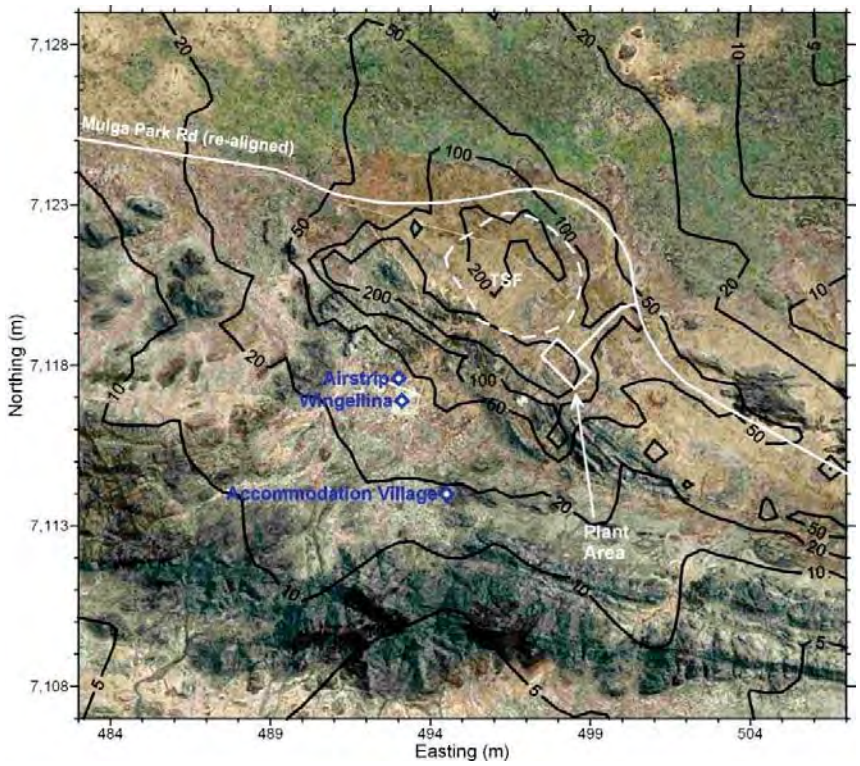

Figure 6.3 Predicted maximum 24-hour average TSP concentrations (µg/m^3) - excluding background concentrations

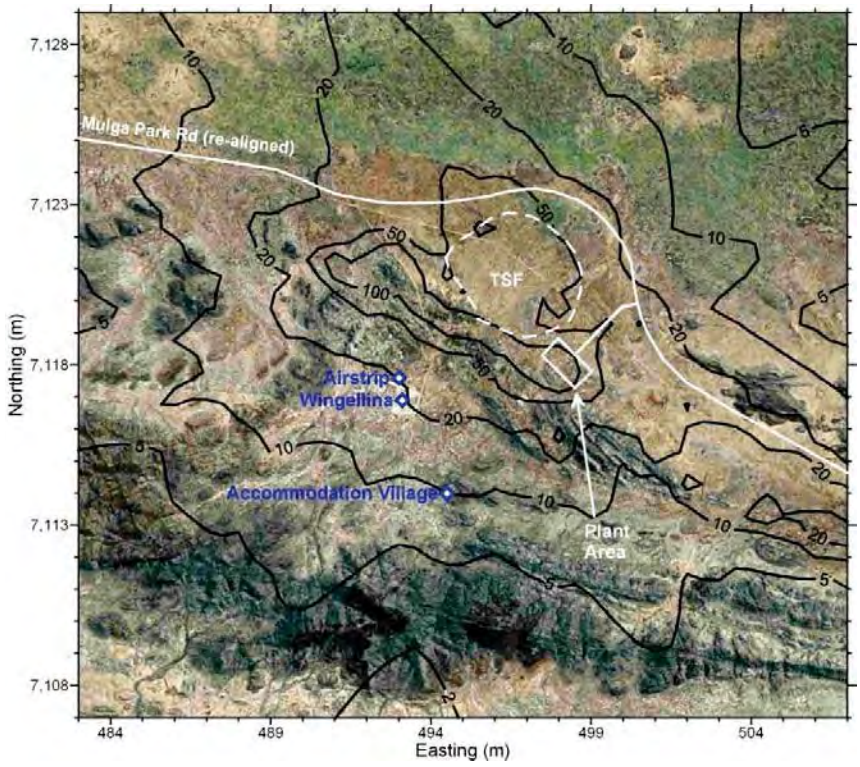

Figure 6.4 Predicted maximum 24-hour average PM_{10} concentrations (µg/m^3) - excluding background concentrations

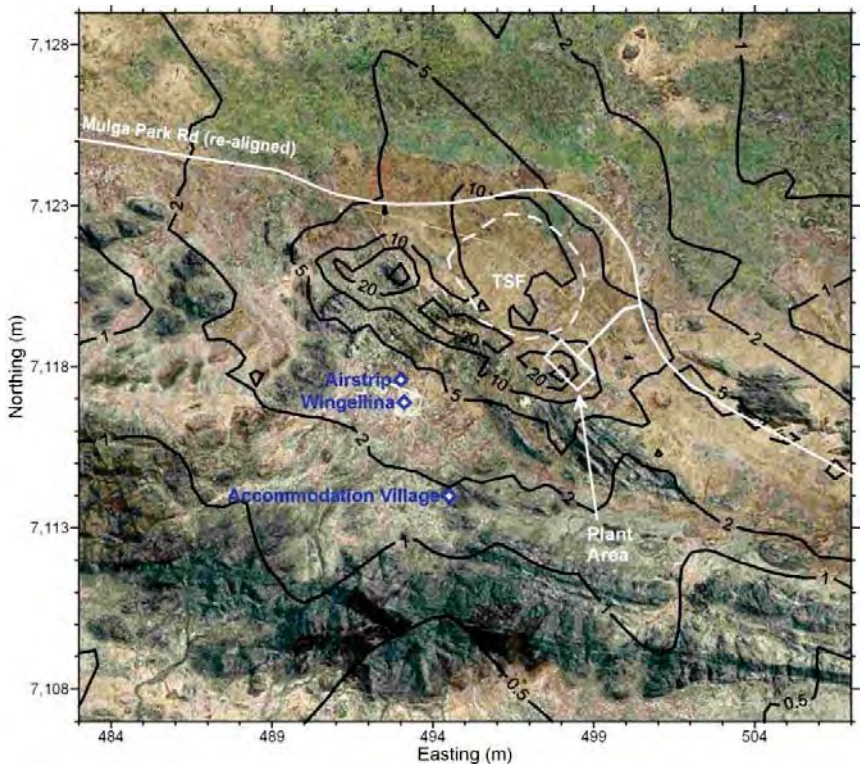

Figure 6.5 Predicted maximum 24-hour average $PM_{2.5}$ concentrations (µg/m^3) - excluding background concentrations

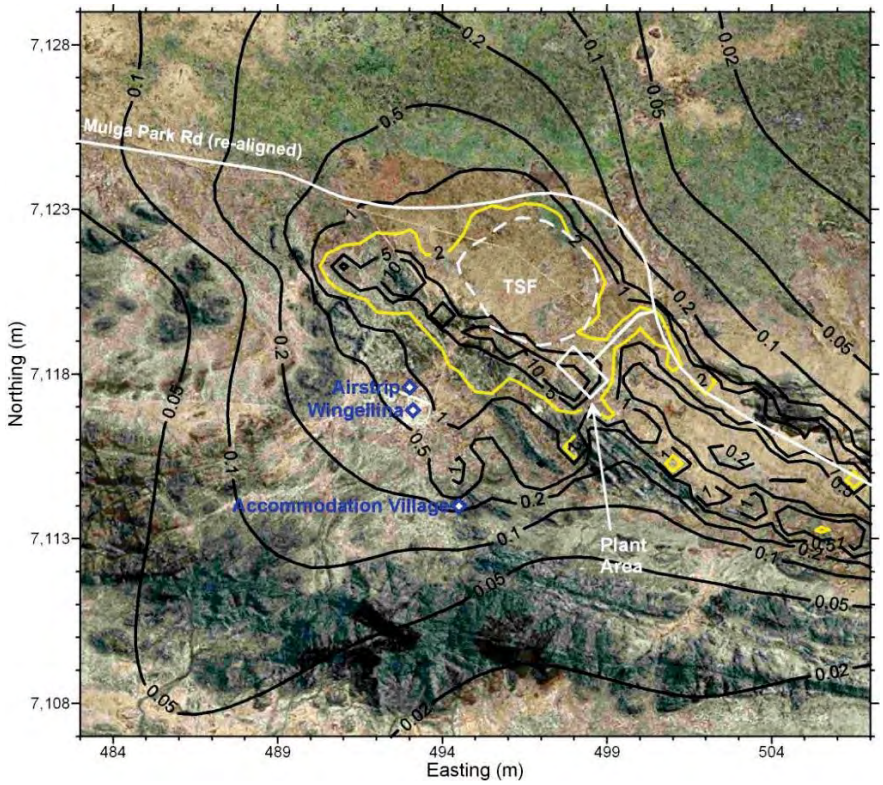

Figure 6.6 Predicted annual average particulate deposition (g/m^2/month) expressed on a monthly basis.

Note: The yellow line depicts the 2 g/m^2/month criterion.

6.5.2.2 Air Emissions

Concentrations of atmospheric emissions associated with the operation of the HPAL processing plant were predicted for three cases (Table 6.6):

- Normal operation with the acid plant operating, which is estimated to occur for 74% of the time when the plant operates;
- Normal operation with the acid plant offline (anticipated to occur for 26% of the plant operating time); and
- Non routine operation with an acid plant start up, anticipated to occur for 2 to 3 hours for up to 5 times per year.

The modelling results predict that concentrations of SO_2, NO_2 and sulphuric acid mist at the Accommodation Village and Wingellina townsite will meet the Project air quality goals under all operating conditions.

Table 6.6 Predicted Concentrations of atmospheric emissions from the operation of the HPAL processing plant (including background levels)

Source	Averaging Period	Criteria	Concentration (µg/m^3)			Percentage of Criteria (%)		
			Any Location	Wingellina	Accom. Village	Any Location	Wingellina	Accom. Village
Case 1 - Normal Operation with Acid Plant Operating (74% of operating time)								
NO_2	1-hr (max)	-(2)	7	4.4	4.4	-	-	-
	1 hr (2nd)	246	5	4	4	2.0	1.6	1.6
	Annual Ave	62	2.2	2.03	2.02	3.5	3.3	3.3
SO_2	1-hr (max)	-	403	240	230	-	-	-
	1 hr (2nd)	570	305	190	180	54	33	32
	24-hr (max)	-	118	35	50	-	-	-
	24 hr (2nd)	228	111	25	45	49	11	20
	Annual Ave	57	9.5	1.9	2.5	17	3.3	4.3
PM_{10}	24 hr (max)	50	13.16	13.02	13.03	26	26	26
Sulphuric acid mist	1hr (max)	120	15	9	7	13	7.5	6
Case 2 - Normal Operation with Acid Plant Offline (26% of operating time)								
NO_2	1-hr (max)	-	8	4	7	-	-	-
	1 hr (2nd)	246	5	3	4	2.0	1.2	1.6
	Annual Ave	62	0.3	0.05	0.04	0.5	0.08	0.06
SO_2	1-hr (max)	-	Negl	Negl	Negl	-	-	-
	1 hr (2nd)	570	Negl	Negl	Negl	0	0	0
	24-hr (max)	-	Negl	Negl	Negl	-	-	-
	24 hr (2nd)	228	Negl	Negl	Negl	0	0	0
	Annual Ave	57	Negl	Negl	Negl	0	0	0
PM_{10}	24hr (max)	50	13.7	13.15	13.17	27	26	26

Source	Averaging Period	Criteria	Concentration (µg/m^3)			Percentage of Criteria (%)		
			Any Location	Wingellina	Accom. Village	Any Location	Wingellina	Accom. Village
Sulphuric acid mist	1hr (max)	120	0	0	0	0	0	0
Case 3 - Non Normal – Start Up of Acid Plant (2 to 3 hours duration)								
NO_2	1-hr (max)	-	59	16	15	-	-	-
	1 hr (2nd)	246	36	14	14	15	5.7	5.7
	Annual Ave	62	NA	NA	NA	-	-	-
SO_2	1-hr (max)	-	660	240	400	-	-	-
	1 hr (2nd)	570	417	230	300	73	40	53
	24-hr (max)	-	NA$^{(1)}$	NA	NA	NA	NA	NA
	24 hr (2nd)	228	NA	NA	NA	NA	NA	NA
	Annual Ave	57	NA	NA	NA	NA	NA	NA
PM_{10}	24hr (max)	50	13.7	13.08	13.15	27	26	26
Sulphuric acid mist	1hr (max)	120	0	0	0	0	0	0

Notes:

1. NA is not applicable. The 24-hour and annual average concentrations not predicted for the acid plant start up as start up only occurs for 2 to 3 hours, 5 times per year.
2. The NEPM 1-hour NO_2 and SO_2 and 24-hour SO_2 standards allow for no more than one exceedance and therefore should be compared to the second highest prediction. This is in line with the Department of Environment and Conservations (DEC's) modelling guidance "For NEPM pollutants, results should be presented for both maximum concentrations and concentrations at the allowed exceedance level (e.g. for SO_2, 2nd highest 1-hour average on a day different to that on which the highest occurred)." (DEC 2006). For 24-hour PM_{10}, the DEC requires the predicted maximums to be presented.
3. Background levels of SO_2 and sulphuric acid are taken as zero; whilst for NO_2 the background levels are taken as 2µg/m^3 and 24-hour PM_{10} as 13µg/m^3.
4. Negl is negligible.

6.5.2.3 Greenhouse Gases

Project GHG emissions estimates for the first 20 years of mine operations for major Project activities are provided in Table 6.7. The total estimated GHG emissions for the first 20 years of operation are 9.5 million tonnes of CO_2 equivalent. This equates to an annual average emission, during normal operations, of about 500,000 tonnes CO_2-e. As such the Project is expected to be subject to the requirements of the *National Greenhouse and Energy Reporting Act 2007* (Cmth) (NGERS Act).

Table 6.7 Average GHG emissions for major activities associated with the Wingellina Nickel Project

Activities	Average kt CO_2-e
Ore Processing	303.3
Electricity Produced	135.3
Sulphur Transport	21.5
Ni-Co Ore Mining	13.2
MHP Transport	11.8
Calcrete Operations	4.9
Miscellaneous	5.0
Other Transport	4.3
Total	**499.3**

Source: (Greenbase, 2011)

Based on this assessment the forecast greenhouse gas emissions intensity of the Project during normal operations is approximately 0.12 tonnes CO2-e per tonne of milled ore, or 11.6 tonnes CO2-e per tonne of metal produced. These figures are comparable to similar nickel mining and processing plants operating in Western Australia including:

- The Murrin Murrin mine operated by Minara Resources: – reported energy use of 212 GJ/tonne of metal packaged in FY2012/13 (Glencore 2013); has equivalent greenhouse gas emissions intensity of approximately 11 tonnes CO2-equiv per tonne of metal packaged assuming that the predominant fuel consumed in ore processing is natural gas with an emissions factor of 51.33 kg CO2-equiv per GJ;
- The Ravensthorpe Nickel Mine operated by First Quantum Minerals Pty Ltd: - reported greenhouse gas emissions intensity of approximately 6 to 9 tonnes CO2-equiv per tonne of metal packaged, or 0.08 to 0.10 tonnes CO2-e per tonne of milled ore, in the period 2012 to 2013 (First Quantum 2013); and
- Hinckley Range will explore opportunities to reduce greenhouse gas emissions intensity over the life of the Project.

6.6 Management and Mitigation Measures

6.6.1 Management Objectives

Project construction and operations activities will be subject to an Air Quality Management Plan with the following objectives (Appendix B):

- To ensure that atmospheric emissions do not impact on environmental values, or the health, welfare and amenity of the population and land uses; and
- To use all reasonable and practicable measures to minimise airborne dust.

The Air Quality Management Plan includes monitoring and management measures and identifies air quality goals and targets for the project during construction and operational phases.

The remainder of this section discusses the proposed management measures specific to the design, construction and operational phases of the Project.

6.6.2 Design

Detailed engineering work to be undertaken during the DFS will include adequate engineering controls for dust management and dust suppression on all plant and equipment, including stockpiles and design of the Tailings Storage Facility (TSF) and Water Storage Facility (WSF).

The basis of design for the Acid Plant will reference to Best Available Techniques (BAT) for pollution prevention and control (ESA 2000) by integrating pollution prevention in process design to achieve project air quality goals for SO_2 emissions (refer to Section 6.4).

6.6.3 Construction

The following management measures will be implemented during the construction phase of the Project to minimise impacts on air quality:

- Water will be applied to roads and working surfaces as required to minimise dust generation;
- Controlled vehicle speeds on unsealed roads;
- Management and contouring of stockpiles in order to reduce erosion;
- Monitoring and reporting of dust levels;
- A community complaints register addressing air quality will be maintained; and
- Ensure the implementation of progressive clearing and rehabilitation to minimise exposed soil.

6.6.4 Operation

The following management measures will be implemented during the operations phase of the project to minimise impacts on air quality:

- Water will be applied to haul roads and working surfaces and stockpiles as required to minimise dust generation;
- Controlled vehicle speeds on unsealed roads;
- Blasting activities will be scheduled to coincide with favourable weather conditions wherever possible;
- Consideration will be given to sealing high usage roads, such as access roads, servicing mining operations;
- Maintain material moisture levels to reduce generation of dust during all crushing and screening operations;
- A maintenance plan be developed to ensure regular maintenance on plant and equipment, focussed around the point sources of emissions;
- Stack and continuous monitoring systems on the acid plant for particulates and sulphur dioxide (SO_2);
- Annual reporting of emissions from the Project following NPI guidelines for all substances exceeding thresholds;
- Compliance with the NGERS Act;
- Monitoring and reporting of dust levels;
- A community complaints register addressing air quality will be maintained; and
- Ensure the implementation of progressive clearing and rehabilitation to minimise exposed soil.

6.7 Predicted Environmental Outcomes

Based on air quality modelling results and the implementation of management measures described in the Air Quality Management Plan, the Project is not expected to result in significant emissions of dust/particulates or atmospheric wastes associated with the operation of the HPAL processing plant. Concentrations of particulates, SO_2, NO_2 and sulphuric acid mist at all identified sensitive receptors are predicted to meet Project air quality goals under all operating conditions.

Subject to the proposed mitigation and management measures, it is considered that the Project can be managed to meet the EPA's objective "*to maintain air quality for the protection of the environment and human health and amenity".*

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CHAPTER 7

HUMAN HEALTH

7.0 HUMAN HEALTH

This chapter describes potential human health impacts associated with the construction and operation of the Project.

Health is influenced by a variety of factors referred to as health determinants. These may be broadly categorised into social and economic environment determinants, physical environment determinants and factors related to an individual's characteristics and behaviours (WHO, 2014). The ability of an individual to control the determinants of their health is dictated by the context of their lives. For human populations in remote locations it may be difficult to change or resist issues such as poverty, poor nutrition, limited access to health services and poor housing standards. Wingellina is one of the most remote Aboriginal communities in Australia and as such it is difficult to attract and retain staff in health and education. Travelling to other communities within the region to seek health services is common, particularly when there is no resident nurse or medical service available in Wingellina.

The Irrunytju Community, otherwise referred to as the Wingellina Community, resides in the Wingellina township and is the principal sensitive receiver population. The Irrunytju Community has expressed expectations of positive benefits arising from the Project, particularly with respect to potential employment and training opportunities at the mine and business opportunities related to servicing the Project. The community is also aware of the need to mitigate and manage potentially negative impacts, including the need to ensure that Aboriginal heritage, culture and the physical environment are respected and protected.

7.1 Assessment Approach

Potential health impacts resulting from the Project were assessed through two main studies, the Health Impact Assessment, which included a Health Risk Assessment (SNC, 2015; Appendix D1). These studies were undertaken in accordance with the *Health Impact Assessment Guidelines* (enHealth, 2001) and *Guidelines for Assessment Human Health Risks from Environmental Hazards* (enHealth, 2012).

The Health Impact Assessment (HIA) involved a risk based evaluation of seven health determinant categories, referred to as the baseline risks, currently affecting the Wingellina Township (Irrunytju Community). These included:

- The natural environment;
- Transport;
- People and Community Wellbeing;
- Lifestyle;
- Sustainability;
- Social Environment; and
- Community Services.

The baseline risks were then compared against the likely Project-induced impacts and benefits resulting from the construction and operations phases of the Project. Risk management recommendations and outcomes were made, with aspects subject to medium and high risks carried forward from the Health Risk Assessment (HRA) (SNC, 2015) and further assessed.

The HIA relied upon technical studies completed for the Project to date, in particular:

- The Air Quality Impact Assessment (Air Assessments, 2013);
- The Noise and Vibration Impact Assessment (Lloyd George Acoustics, 2014); and.
- The Social Impact Management Plan (URS, 2012).

Environmental health risks and benefits were rated on the basis of likelihood and consequence as described in Table 7.1.

Table 7.1 Risk Matrix used in the Wingellina Project Health Risk Assessment

Likelihood	Consequences					
	Negligible	Minor	Moderate	Major	Massive	Catastrophic
Certain	Low	Medium	High	Extreme	Extreme	Extreme
Likely	Low	Low	Medium	High	Extreme	Extreme
Possible	Very Low	Low	Low	Medium	High	Extreme
Unlikely	Very Low	Very Low	Low	Low	Medium	High
Rare	Very Low	Very Low	Very Low	Low	Low	Medium

The HIA relied on the outcomes of more broad ranging consultation undertaken for the Project, such as those resulting from the preparation of the Social Impact Management Plan (SIMP). The outcomes of consultation with the Wingellina Community for the SIMP were considered relevant, given that key issues related to health, the existing social environment, Wingellina's surrounding physical environment and expectations for improvement associated with the Project were explicitly addressed.

Following the identification of key risks, mitigation and management measures were recommended to either reduce the risk of negative impacts or maximise the opportunity for positive outcomes as a result of the Project. Mitigation measures were categorised according to the determinants of health as identified in Section 7.1 above. Table 7.2 was used to determine the predicted residual risk post implementation of relevant

management measure. Only those residual risks classified as medium or high assessed further. Note that no extreme risks were identified in the assessment.

Table 7.2 Risk Mitigation/Management Criteria used in the Wingellina Project Health Impact Assessment

Risk Rating	Risk Mitigation/ Management Criteria
Extreme	Potentially unacceptable: modification of proposal required.
High	Major mitigation/management (including offsets) may be required – Assessment required of health hazards.
Medium	Substantial mitigation/management may be required –assessment of health hazards required.
Low	Some mitigation/management may be required – No detailed assessment of health hazards required but addressed with routine controls.
Very Low	No further assessment required.

The supporting HRA concentrated on two key environmental risks, these being namely air quality, and noise and vibration impacts. The HRA applied a five-step methodology addressing issue identification, hazard identification, dose-response assessment, exposure assessment and risk characterisation.

7.1.1 The Community Profile

The existing Wingellina township (or Irrunytju Community) is typical of a remote, desert Aboriginal settlement and is the closest existing resident population to the Project site. The nearest open pit associated with the Project is proposed to be located approximately 2.3 kilometres from the edge of the township. The Project site is located on land within the Determined Ngaanyatjarra Lands under Native Title Claim (WC04/03). The Irrunytju Aboriginal Community is located at the former Wingellina exploration camp.

Wingellina's population ranges from 60 to 100 people, including 60 people considered to be permanent residents and an additional 40 people who are occasionally resident in the community (URS 2012).

The 2006 and 2011 Census Population data for the Ngaanyatjarraku Shire, which covers 12 remote Ngaanyatjarra Lands communities including Wingellina, identifies that the population is relatively young. The median age was 30 years in 2006 (URS 2012) and 28 years in 2011 (ABS, 2011). At the time of the 2011 census, approximately one-third of Ngaanyatjarraku's population was under the age of 20.

With a young median age, and a large portion of the population comprising children, including 144 persons in the Ngaanyatjarraku Shire aged five and under, it is presumed that the Wingellina Township would have a similar population trend and include a relatively high proportion of the population aged under19 years.

The vast majority of the Aboriginal population within the Ngaanyatjarraku Shire speak a language other than English and education levels are generally low due to the lack of school readiness, transient nature of families, sporting events rostered on school days and the difficulty in retaining staff in the health and education sectors.

The community's socio-economic profile can be attributed to a number of existing issues such as the remote location, poor living conditions, limited access to essential social services and lack of infrastructure. Low levels of income (below poverty line), limited employment opportunities and inadequate access to health and education services demonstrate a population that is very disadvantaged and vulnerable.

During the 2012 consultations with the Irrunytju Aboriginal community, the majority of housing in Wingellina was observed to be in need of repair, with most of the infrastructure considered reasonably old and/or in poor condition (URS, 2012). A number of key issues exist which affect general well-being and health of the community:

- An existing water supply that is problematic (out of the three available bores, one had been contaminated) with water pumped via mains power to an elevated storage tank on a 12m stand;
- A potable water reticulation system that does not meet current standards, specifically environmental health standards;
- Inefficient effluent disposal; and
- Infrastructure exhibiting neglect and in a poor condition.

7.2 Existing Health Profile

The Shire of Ngaanyatjarraku recognises that the Irrunytju Community is located on a very wind-swept and elevated site. The township, as a result of wind erosion, has become a barren landscape. Dusty housing allotments and bare, open spaces give rise to windblown dust. Localised windblown dust from around the townsite is known to cause an excess of eye, chest and nasal complaints throughout community members (URS, 2012).

Other key existing health conditions resulting from a number of issues such as low socio-economic factors and remote location include poor nutrition, physical inactivity and high rates of smoking. These factors are contributing to the chronic diseases amongst the community such as diabetes, chronic renal disease, cardiovascular disease and respiratory diseases (URS 2012). Mental health issues were also identified as a problem in for the Ngaanyatjarra Lands (URS, 2012). It was also noted by URS (2012) that respiratory disease is aggravated by the lack of sealed roads throughout most communities in the Ngaanyatjarraku Shire.

Health data relating specifically to this population is difficult to obtain due to a number of factors such as the transitory nature of the population, the straddling of three jurisdictions where some services are obtained in South Australia or Northern Territory and the remote location which prevents regular access to some health services.

7.3 Existing Natural Environment

The Ngaanyatjarra Shire notes that the Wingellina Township is located on a very wind-swept, elevated site. Degradation of land through bushfires and camel grazing, with the addition of unsealed road surfaces and bare allotments has increased potential for localised wind erosion to occur. Background ambient deposition monitoring outside of the townsite has recorded low levels of dust (Air Assessments, 2013).

Air Quality

Section 6.2.3 provides the background air quality data noting that the existing air quality has a dominance of total suspended particulate in the form of windblown dust and on occasion an elevated PM10 level (which is normally low) due to bushfires in local and regional areas. For gaseous pollutants (oxides of sulphur, sulphuric acid mist, oxides of nitrogen) background levels are expected to be negligible apart from infrequent higher levels arising from bush fires that may contribute to formation of nitrogen dioxide, ozone and particulates.

Noise and vibration, lighting and amenity

The background noise limits are low in the existing environment (35dB) with the main sources of noise in the immediate vicinity of the Wingellina Township being the existing airstrip to the north of the township and the manned exploration camp associated with the proposed mine. The nearest township to Wingellina is the Kalka community (approximately 16 km away). No other known sources of noise occur in this area.

Existing light sources are low, with the townships at Wingellina and Kalka the main sources of artificial light in the proximity of the Project. Apart from the existing townships of Wingellina and Kalka, there are no other built structures.

The topography of the land, with rocky outcrops and typical desert vegetation (sandplains supporting low open woodlands and grasslands) provide a high level of visual amenity.

Hydrology and Hydrogeology

A description of the existing surface water and groundwater resources in the Project area in provided in Section 10.2. The Project is located in the northern part of the Warburton drainage basin, a large internally draining basin of about 340,000 km2 encompassing the southern Gibson Desert and northern Great Victoria Desert in central Australia. The proposed mining area intersects several sub-catchment areas defined by the Hinckley Range and Wingellina Hills, and a small range of hills running in a north-westerly direction between the two. The sub-catchments include a series of poorly defined, ephemeral drainages. There are no significant creeks or water bodies within the area. The broader region includes a series of groundwater basins, consisting of including the Amadeus Basin, Canning Basin, the Musgrave Complex, the Officer Basin and the Gunbarrel Basin.

The Ngaanyatjarra Shire reports a field of three bores all within 2 km of the Wingellina Township, which currently provide an adequate supply of water within the community. It is reported that water is connected to all residents and community facilities with the

existing water flow from the three bores (two in use) that are sufficient for community housing and personal needs. Hinckley Range representatives have also noted that potable water is available via bottled water to the Wingellina township, possibly supplementing or replacing the need for potable bore water.

Soils

The soils in Wingellina exhibit a large degree of variation with soil textures ranging from sandy loam to light clay and majority of soils are partially dispersive (Outback Ecology, 2008a). Variable levels of a number of metals are present in the soils of the Project area and the Wingellina township. Levels of Chromium (Cr), Copper (Cu), Lead (Pb), Nickel (Ni) and Zinc (Zn) were consistently detected at a reportable level (Outback Ecology 2008a) with recent (August 2014) soil sampling at eight sample locations around the mine and existing Wingellina Township verifying these initial findings.

Flora and Fauna

Descriptions of the vegetation, flora and fauna of the Project area are provided in Chapters 11 and 12. The native flora and fauna is important to Aboriginal culture, connecting them to 'Country', dreamtime and traditional sources of food.

7.4 Existing Transport

The remoteness of the community presents issues for personal travel. Despite this many of the people of Wingellina are well-travelled and have visited many of the local communities and regional centres around Wingellina. Residents of communities within the Ngaanyatjarra Lands are very mobile, travelling between towns frequently and at all hours of the day and night.

There is no public transport service available to community members such as a bus service to other communities or air services to major centres and as a result, people are generally reliant on personal vehicles for travel.

7.5 Existing Social Environment

The social environment encompasses a number of factors such as housing conditions, employment status, income and education. The community profile in Section 7.2 describes the social environment and current living conditions for this disadvantaged population. The other determinants of health that are considered in the HIA include people and community wellbeing, lifestyle and community services. These health determinants are very much related to the social environment.

The community is essentially "at the end of the line" for many services. In terms of service provision, Wingellina is on par with other communities in remote Australia. Road and infrastructure maintenance is generally lacking and the SIMP reports that the police infrequently visit the settlement, unless there is a serious offence to investigate.

It was noted in the SIMP that the existing water supply is problematic (subject to contamination at times) and water reticulation infrastructure did not meet current drinking water quality standards.

Additionally, inefficient effluent disposal also was raised as an important issue by residents, with poor quality of major infrastructure and housing conditions apparent due to neglect and lack of maintenance over time.

The remote location of this population also has a detrimental impact on high costs of living with limitations to accessing fresh food and affordable goods. High transportation costs and long distances often place further pressure on the community as most individuals are on low incomes relying on 'Centrelink' payments reducing the affordability of food, clothing, household goods, electricity and other requirements such as gas and petrol.

There are a number of Community facilities that provide a pivotal level of service including the Wingellina Store, Ngaanyatjarra Media Centre, School and Health Clinic. There are also a number of facilities that are no longer used due to disrepair or lack of maintenance including the Workshop, Community Hall, Football Oval and Community Church.

Cultural activities are critical to the identity and way of life for Aboriginal people. Hunting, gathering bush products, hosting people from other communities, travelling on culture and lore business and participating in ceremonies are cultural activities of significance for the people of Wingellina, and very important to their community.

7.6 Summary of existing risks and benefits

The following Table 7.3 provides a summary of the existing levels of risk faced by the community across the seven categories of the determinants of health considered by the HIA, as determined by the technical papers completed for the Project. Positive (+ve) refers to the current benefits to health as determined through consultation with the community in the SIMP interview process.

Table 7.3 Summary of existing health risks and benefits applicable to the Wingellina township

Health determinant category	Health determinants	Positive or negative	Level of existing risk/benefit
The natural environment	Air quality (including dust and exposure to background levels of nickel)	-ve	Medium
	Contaminated land: soil and groundwater	-ve	Low
	Water quality: drinking, recycled, recreational, wastewater	-ve	Low
	Vibration	NA	Nil
	Noise, odour, light	-ve	Very Low
	Natural resources	+ve	Low
	Green space	+ve	Medium
	Waste disposal/management	-ve	Very Low

Health determinant category	Health determinants	Positive or negative	Level of existing risk/benefit
Transport	Access to transport	-ve	Medium
People and community wellbeing	Community structure	+ve	Medium
	Social contacts	+ve	Medium
	Community participation	+ve	Medium
	Crime & antisocial behaviour	-ve	Low
	Discrimination	-ve	Very Low
	Safe environments	-ve	Medium
	Social networks	+ve	Medium
	Feelings of trust	+ve	Medium
Lifestyle	Exercise patterns	-ve	Medium
	Recreation choices	-ve	Medium
	Access to and use of leisure facilities	-ve	Low
	Access to nutritional food	-ve	Medium
	Risk behaviours	-ve	Low
	Communicable diseases	-ve	Low
Sustainability	Disturbance of ecosystems or natural environments (biodiversity)	+ve	Low
	Support for local businesses	-ve	Medium
	Effect on future generations	-ve	Low
Social environment	Family structure & relationships	+ve	Medium
	Housing conditions	-ve	High
	Employment status	-ve	High
	Income	-ve	High
	Education	-ve	High
Community services	Leisure facilities	-ve	Low
	Health services	-ve	Medium
	Police	-ve	Low
	Transport	-ve	Medium
	Local community facilities & organisations	-ve	Low
	Emergency services	-ve	Medium
	Schools and child care services	-ve	Low

7.7 Project Impact Assessment

Project-induced impacts, as predicted through the risk assessment process, have been summarised and potential health outcomes discussed in Table 7.4. Both the identified risks and benefits to health have been identified and discussed.

Table 7.4 Summary of potential Project-induced health risks associated with the Wingellina Nickel Project

Health determinant	Potential Project-induced risks	Potential health outcome	Risk level
The natural environment	**Reduced air quality** Air contaminants of concern are limited to nickel dust (as found in particulate matter ($PM_{2.5}$ and PM_{10}) and windblown dust) and oxides of nitrogen (NOx), sulphur dioxide (SO_2) and oxides of sulphur (SOx) and sulphuric acid mist as generated from the HPAL plant. Emissions of particulate matter (windblown dust) generated from a number of sources include: • Operations (excavations, truck haulage, crushing, loading); • Vehicle movement (haulage of crushed material, light vehicles and general offsite haulage); and • Wind erosion (stockpiles, tailings, beach areas, and ROM pad areas).	**Increased risk of respiratory ailments** Health outcomes resulting from increased air pollutants may have some negative health impacts for the community, particularly vulnerable persons who show a greater susceptibility to respiratory illnesses, asthma and chronic lung diseases. Health impacts resulting from air pollutants, such as particulate matter and gaseous emissions are closely related to particle size. Whilst there will be an increase in the numbers of heavy vehicles movements, it is considered there is a low heath risk impact due to the negligible background level of existing $PM_{2.5}$. For PM_{10} and larger suspended particles carried in windblown dust the Project is predicted to contribute to existing levels of dust. The HRA assessed depositional dust data recorded over an approximate 29-month period to determine the cumulative impact resulting from air emissions (background levels + project-induced). Nickel concentrations in PM_{10} were analysed and predicted levels modelled using the baseline results. This analysis determined that during the operational phase, the Project would be less than the 0.003ug/m^3 annual average nickel exposure guideline, protective of health.	While all air pollutants arising from the Project's operation are predicted to be below relevant air quality criteria such as the WHO Air Quality Guidelines, the risk rating for air quality impacts is **medium (-ve).**

Health determinant	Potential Project-induced risks	Potential health outcome	Risk level
		The Air Quality assessment used predictive models to determine the Project's gaseous emissions of NOx, SOx, SO_2, and sulphuric acid mist. Health studies indicate that a proportion of people with asthma experience changes in pulmonary function and respiratory symptoms after periods of exposure to SO_2 in as short as 10 minutes (WHO, 2005). The predictive model showed the Project would contribute levels of SO_2, NOx and sulphuric acid mist in quantities that are within WHO and NEPM Air Quality criteria based on levels that are protective of health. The mitigation measures to be in place during construction and operational phases are discussed further in Section 7.8.	
	Increased noise and vibration Noise and vibration will be generated from construction activities, particularly air blasting and the movement of heavy traffic. Operational noise would be limited to mining activities, operation of heavy machinery and noise associated with heavy vehicle movement. The results of the noise assessment show that the noise emissions during operation of the Project (at maximum capacity and during noise enhancing meteorological conditions), complies with the assigned noise criteria under the Western Australian *Environmental Protection (Noise) Regulations 1997*,	**Stress and reduced amenity** Exposure to higher noise and vibration levels (particularly air blasts and use of heavy machinery) over a long-term period may induce stress and anxiety for some individuals (depending on vibration perception and noise threshold levels). Other health impacts may include sleep disturbance, reduced school performance and impacts to cardiovascular health. There is no additional data available to suggest the noise and vibration impacts of the Project during operational phases (to include airblasting and ground-borne vibration) will be a significant cause	The overall risk rating for noise and vibration impacts is **low (-ve).**

Health determinant	Potential Project-induced risks	Potential health outcome	Risk level
	at all noise sensitive premises. It is noted however that whilst compliant, the noise levels are close to the criterion at the Wingellina Township.	of unacceptable health impacts to the population located within the Wingellina Township or the future employee population to be located at the mine accommodation.	
	Increased light spill and light emissions Due to the immediate proximity of the Project to the proposed Giles to Mulga Park Road diversion the Project will dominate the southern view shed, partially to completely reducing the visual line of sight to background environmental features. The Project will be a dominant visual feature from the Surveyor Generals' Corner, which is a non-residential location. The findings showed that low landforms largely obstruct the view of the plant from the existing Wingellina Township however the top of the 60m tower (as part of the HPAL plant) would be visible to the Wingellina Township with a slight halo predicted to exist above the hills. The operational safety lighting of the plant during night-time hours has the potential to cause nuisance impacts (minor) at the Wingellina Township.	**Loss of amenity** Light pollution can be considered in two different forms, the first being annoying, nuisance type impacts which affect an otherwise natural setting or low-light setting or in the second form as excessive light leading to discomfort and adverse health effects. Those health impacts may include sleep disturbance or excessive glare causing unsafe driving conditions for motorists.	The impacts were assessed as being very **low (-ve)** acknowledging some minor nuisance impacts.
	Contamination from spills to groundwater and surface water It is noted that local groundwater is potable; hence it is important to rule out the potential for groundwater	**Contamination of drinking water** Contaminated groundwater may have serious health impacts for populations reliant on potable groundwater sources. While the Wingellina	The risk rating for ground and surface water contamination is

Health determinant	Potential Project-induced risks	Potential health outcome	Risk level
	contamination via the Tailings Storage Facility. As described above, the tailings will contain some chemicals of concern and metals which, if leached into the groundwater may cause risks to the health of the Wingellina Community and Accommodation camp. A low potential to contaminate ground and surface waters and soil exists, particularly during the process of piping, storage and handling of tailings or from potential spills. The existing water table is also sufficiently located within a range of 38 to 58 metres below ground level further making groundwater contamination a very low possibility.	community does access bore water as a source of potable water, it is very unlikely any impacts from the mine will negatively affect current water supplies or quality of water given the separation distance between the mine (nearest pit) and the Wingellina Township and depth of water table from ground surface.	**very low (-ve)**. An improvement to the current drinking water reticulation system alters the risk rating from **very low to medium (+ve).**

Health determinant	Potential Project-induced risks	Potential health outcome	Risk level
Transportation	**Increased heavy vehicles on unsealed roads, close to the community** Concerns were raised by the community regarding the potential for increased traffic movements, leading to generation of more windblown dust, heavy traffic noise and the potential for more accidents with other road (motorists and pedestrian) users. Other impacts have been captured in the air quality and noise and vibration impact assessment sections.	**Generation of dust, conflicts with heavy vehicles and pedestrian/other road users** Given that roads in the Project area are unsealed, there is a concern that level of dust will create an increased health and environmental (flora and fauna) risk. There is also concern that given the Irrunytju Community is highly mobile, travelling between towns frequently and at all hours of day and night, together with an increase in heavy vehicles using same routes, there is a risk a higher rate of accidents will occur. There is also an indirect health risk associated with an increase in transport to and from the township with the potential for 'grog running' and increased transport making illegal drugs and alcohol more accessible to Wingellina. As a positive impact, more frequent use of roads increases surveillance and reporting of breakdowns and stranded motorists when vehicles breakdown in isolated stretches of road.	The health risk rating for traffic and transport is **medium (-ve) to low (+ve).**
Sustainability - Biodiversity	**Clearing of vegetation and loss of fauna, increased weed, feral animal numbers, increased bush fire risks** The potential impacts of the Project to terrestrial fauna and flora could be expected to be associated with: • Loss of fauna and habitat due to vegetation	**Reduced flora and fauna for traditional hunting and gathering** The health outcomes of vegetation loss and potential habitat clearance will be broadly negative and with limited positive impacts. Losses among some native terrestrial (vertebrate and invertebrate) species may occur, however it is noted existing	The health risk rating for biodiversity is **low (-ve).**

Health determinant	Potential Project-induced risks	Potential health outcome	Risk level
	clearing and topsoil removal; • Alterations to surface hydrology; • Effects of noise and dust; • Potential to introduce weeds and increase populations of exotic species; • Secondary impacts due to increased traffic and off-road vehicles access; and • Increased risk of fire.	stresses on populations exist through feral animal (camel, wild dogs and cats) and weed species (Buffel grass) is already impacting native species numbers. A decrease in native species may decrease availability of food sourced through hunting and gathering methods. An increase in feral animals may increase the general food stock for the Wingellina Township with rabbit numbers and other opportunistic animals increasing in numbers. A decrease in wild cat and wild dog numbers through forced culls may also improve general health and hygiene in the Wingellina Township through reducing potential animal bites, opportunistic feeding on rubbish and excrement left by feral animals.	
People and Community Wellbeing	**Relationship between mine and community** Metals X will need to consider and make decisions upon the level of interaction between the mine, its workers and the community; and how this impacts upon relationships of trust. A key concern for community elders is the illegal transfer of alcohol and drugs. Given the existing community's limited previous involvement with external parties coming into their land, the management and strengthening of relationships will need to receive priority.	**Nutrition and indirect access to drugs and alcohol via mine employees** Two main health determinant areas were highlighted, including People and Community Wellbeing, and Lifestyle. The concerns broadly related to the mine indirectly encouraging the accessibility of alcohol and drugs, with increased traffic into and out of Wingellina generating the potential increased "grog running" and marijuana drug dealing. The other concern is access to higher incomes resulting from potential employment or payments from the Indigenous Land Use	Providing issues such as management of nutrition and drugs and alcohol occurs in the community, the overall benefits are positive. The health risk rating is

Health determinant	Potential Project-induced risks	Potential health outcome	Risk level
	Irrunytju Aboriginal Community has a strong attachment to 'Country' and access to their land and sacred sites is culturally important. Maintaining access to heritage site and culturally significant areas will be a critical factor for the community, with particular importance to places such as the cemetery.	Agreement which leads to poorer nutrition as community members can afford to purchase more highly processed food rather than consuming traditional foods for their main diet.	therefore **medium (+ve).**
Social Environment	**Improved employment status, income and access to training and education** Currently the level of income at Wingellina is low, access to training and employment are limited. In the Wingellina Project Agreement, undertakings have been made to provide employment, training and business opportunities. MetalsX will attempt to source employees locally. In the majority of cases, there will be a positive 'knock-on' effect for socio-economic factors through the improvement of the social environment and related soft-infrastructure. With a 30 to 40 year life of mine (LoM) there is potential for future generations to realise benefits in training, employment and improved income.	**Empowering community, improved standards of living and improved health outcomes** Improved income for community members that can capitalise on new business opportunities, employment and training can empower not only those directly benefiting from more income, but this can have wider benefits for existing and future generations leading to better standards of living and improved health indicators.	The overall health risk rating is therefore **medium (+ve).**

Health determinant	Potential Project-induced risks	Potential health outcome	Risk level
Community Services	**Improved community facilities, better access to recreational, education and health services** One of the key issues raised during consultation was the lack of services and support for the community's youth. Similarly, the attraction and retention of staff for education and health services. It is assumed that for most socio-economic health determinants, the Project will actually deliver benefits by investment into the existing community infrastructure (or potentially develop new infrastructure if relocated). Additionally, issues such as water quality and waste disposal within the community may improve as a result of the Project.	**Supporting youth and empowering the community, improved standards of living and improved health outcomes** There may be feasible opportunities for Metals X to support youth development through a number of ways, including encouraging employees to volunteer time and expertise as coaches and mentors to community, hosting events such as sporting carnivals or simple provision of recreational equipment. There may be other avenues for Metals X to support health and education services which could be determined upon the Project's approval and further consultation with the community. It is noted that the Wingellina Project Agreement proposes the construction of a public swimming pool, changing facilities and outdoor multipurpose sports court with night-lighting.	The overall health risk rating is therefore **medium (+ve).**

7.8 Management and Mitigation Measures

The project presents a number of opportunities to make a positive contribution to the existing social environment through investment into community infrastructure, potential training and development programs, youth mentoring and employment for job-ready individuals. Where the Project may induce negative impacts, a number of management measures have been recommended to reduce impacts.

Table 7.5 (above) proves a summary of key mitigation measures to be implemented by the Proponent. These measures are not exhaustive, but provide critical measures to reduce health impacts and enhance the predicted health benefits and outcomes.

Table 7.5 Recommended management measures for human health and residual health risk ratings

Health Aspect/ Impact	Key Management Measures	Residual risk/ benefit rating
Air Quality	Air Quality Management Plan which includes and an air quality monitoring schedule in line with routine and non-routine maintenance events such as start-up and shut down of HPAL plant and at-boundary monitoring of dust from ROM and TSF areas. Included in the Air Quality Management Plan will be an appropriate dust management plan (DMP) to include monitoring for PM_{10} and Nickel dust using hi-volume air samplers (HVAS). The location of HVAS to include representative sensitive receiver locations. Dust sampling regime and analysis would be carried out in accordance with the relevant Australian Standards and EPA approved methodology so that results are compared against the existing WA health guidelines. Dust suppression measures on unsealed roads, stockpiles, Tailings Storage Facility (TSF) and Run of Mine (ROM) areas. A continuous emissions monitoring system (CEMS) will be operated to monitor stack emissions. Soil stockpiles to be covered and exposed soils reseeded/revegetation where possible. Complaints register and response process for managing emission as described in the Air Quality Management Plan (Appendix B).	**Low – Medium (-ve).**

Health Aspect/ Impact	Key Management Measures	Residual risk/ benefit rating
Noise and Vibration	Construction Noise and Vibration Management Plan. Operational Noise and Vibration Management Plan (no air-blasting or noisy activities during Aboriginal cultural events such as funerals).	**Low to Very Low (-ve).**
Soils and Water	Construction Soil and Water Management Plan with Spill Management procedures and management of chemical storage areas and refuelling locations according to relevant safety and environmental protection legislation. Mine design to include levees at pits, contained drainage to avoid contamination of existing surface water and groundwater and stockpiles away from streamlines. Waste disposal areas constructed outside of known drainage lines with contained drainage discharging into sediment sump. Groundwater monitoring bores and routine groundwater monitoring program.	**Very Low (-ve).**
Visual Amenity (light)	Design measures to reduce light spill and appropriate location of infrastructure to minimise light emissions on sensitive receivers. Constructions measure such as light shields to minimise illumination levels.	**Very Low (-ve).**
Flora and Fauna	Minimising clearing footprint and complete clearing in progressive manner to reduce bare soils (subject to wind erosion and dust generation). Vehicle access to be within cleared footprint to reduce impacts on flora, reduce spread of weeds and control any potential fire sources. Construction Environmental Management Plan to include Flora and Fauna Management Plan.	**Low (-ve).**
Waste management	Construction and Operational Waste Management Plan which include hierarchy of waste (avoid, reduce, reuse and recycle). Waste to be handled and disposed of appropriately during construction and operational phases.	**Very Low (±ve).**
Access to transport	Traffic Management Plan. Traffic Control measures to avoid conflict with pedestrian, motorists and other road users.	**Low (-ve).**

Health Aspect/ Impact	Key Management Measures	Residual risk/ benefit rating
	Road safety campaign to educate primary and secondary students. Project transport routes to avoid existing township.	
Feelings of trust	Early and ongoing consultation with Aboriginal stakeholders to actively engage with the community to protect cultural values, sites and places through cultural awareness training delivered by senior Ngaanyatjarra Lands people. Emphasis should be placed on all employees to be 'good neighbours', employees (construction and operations) to be aware of and not enter heritage exclusion zones. Formation of the Implementation and Review Committee acting as a forum to consult with Ngaanyatjarra Lands People and maintain good relationship with the Irrunytju Community from the outset ensure success during all stages of the Project. Undertake all of the relevant SIMP recommendations.	**Low (±ve).**
Recreation facilities	Wingellina Project Agreement to include investment in improved community facilities. This would also include mechanisms for coordination and communication with State and Federal departments and local councils to fund infrastructure improvements beyond the Project investments.	**Low to Medium (+ve).**
Support for local businesses	Implement all relevant SIMP recommendations including: • Preparing a Contracting and Procuring Strategy aimed at the Ngaanyatjarra Lands people; • Work with Ngaanyatjarra Lands businesses and develop a Communications Strategy that inform the Ngaanyatjarra Lands people about business development opportunities; and • Prepare and Implement Aboriginal Employment Strategy.	**Low to Medium (+ve).**
Income Training and Education	Prepare and Implement Aboriginal Employment Strategy that enables the employment of suitably qualified Ngaanyatjarra Lands people and includes flexible work practices that encourage Aboriginal participation. Establishing and supporting traineeships for youth and identification of all levels of skills required,	**High (+ve).**

Health Aspect/ Impact	Key Management Measures	Residual risk/ benefit rating
Job creation	including low-level skills such as seed collection and fencing. Mentor and support school students and improve work-readiness.	
Housing, infrastructure and access to health services	Investment by proponent to improve housing and community infrastructure, including health facilities. Proponent to sponsoring training in building repairs and maintenance to help local community maintain their own houses where relevant. Encouraging the community/proponent to fund through compensation payments and Wingellina Project Agreement new facilities or improvement to existing structures. Coordination and communication with state and federal government department and local councils (as noted in the SIMP) to facilitate combined efforts to improve current infrastructure.	**Low (+ve).**

7.9 Predicted Outcomes

The Project is expected to have a positive impact on the overall health of the existing Irrunytju Community compared to existing health and socio-economic conditions.

With the implementation of the key management measures outlined in Table 7.5, it is considered that the Project can be managed to meet the EPA's objective "*To ensure that human health is not adversely affected*."

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CHAPTER 8

HERITAGE

8.0 ABORIGINAL HERITAGE

8.1 Assessment Approach

The heritage values of the Project area were determined through a series of archaeological and ethnographic surveys undertaken between 2001 and 2007:

- Ngaanyatjarra Council (2001) Ethnographic survey of E69/535 (Appendix E1);
- Ngaanyatjarra Council (2006) a series of Work Program Clearances on E69/535 (Appendix E2); and
- Artefaxion (2008) Archaeological survey of E69/535 (Appendix E3).

These surveys were undertaken in accordance with EPA Guidance Statement No. 41 Assessment of Aboriginal Heritage (EPA, 2004).

8.1.1 Survey Approach

As part of the ethnographic surveys completed in July 2001 and October 2006, the Traditional Owners in company with anthropologists from the Ngaanyatjarra Council identified several areas of ethnographic importance in the proposed mining area. A survey for Aboriginal archaeological sites was also conducted on tenement E69/535 in 2007 (Artefaxion, 2008). The investigation was undertaken in consultation with local Traditional Owners and was conducted by a qualified archaeologist from Artefaxion.

Archaeological surveys of the borefield, gas-pipeline corridor and any other areas subject to the Project not already surveyed will be undertaken once the final disturbance footprints are finalised following the DFS. Any future surveys will be undertaken by suitably qualified archaeologists in accordance with EPA Guidance Statement No. 41 Assessment of Aboriginal Heritage (EPA, 2004).

8.2 Existing Environment

8.2.1 Aboriginal Community

The Project is situated within the Shire of Ngaanyatjarraku. There are ten established Aboriginal communities within the Shire of Ngaanyatjarraku, Warburton being the largest with approximately 400 people. Other communities include Kalka, Pipalyatjara, Blackstone, Jamieson and Giles.

The Wingellina Aboriginal community is located within the Project area, at the site of the historic Wingellina exploration camp, and has a population size of 60 to 100 people. The Aboriginal people still maintain many of their traditional activities such as ceremonies, hunting and gathering bush tucker. The majority of the town's residents are Pitjantjatjara speakers.

8.2.2 Ethnographic Sites

As part of the ethnographic survey completed in July 2001, nine Aboriginal heritage exclusion zones were delineated by the Traditional Owners within tenement E69/535 (Figure 8.1). One additional Aboriginal heritage exclusion zone was delineated in the October 2006 survey. These areas are subject to restricted access, including the exclusion of any exploration or development activities, and collectively span approximately 13.5 km^2 (12 %) of the tenement.

8.2.3 Archaeological Sites

The archaeological survey completed in 2007 identified 35 archaeological sites within tenement E69/535 comprising a variety of artefact scatters, quarries or knapping areas and sites containing grindstones and stone structures (Artefaxion, 2008).

8.3 Potential Impacts

During the construction and operation phases of the Project, there is potential for the Project workforce to enter ethnographic exclusion zones and/or damage or remove archaeological artefacts.

Two archaeological sites, located to the north of the central pits, are located within the proposed Project disturbance footprint (Figure 8.1).

Figure 8.1 Wingellina Nickel Project Aboriginal heritage exclusion zones

8.4 Management and Mitigation Measures

8.4.1 Management Objective

The protection and management of aboriginal heritage in relation to the Project is specifically addressed in the mining agreement between Hinckley Range and the Traditional Owners and granted Native Title holders of the Wingellina Project area through their representative bodies; the Yarnangu Ngaanyatjarraku Parna Aboriginal Corporation, the Ngaanyatjarra Land Council (Aboriginal Corporation), and the Ngaanyatjarra Council (Aboriginal Corporation).

This agreement commits Hinckley Range to the following measures, as a minimum:

1. Establishment of Aboriginal Heritage exclusion zones;
2. Development of a cultural heritage management plan;
3. Establishment of a panel of Heritage Monitors;
4. Continued support for an Aboriginal Liaison officer; and
5. Cultural awareness training of Company Personnel.

All project construction and operations activities will be subject to a Cultural Heritage Management Plan (Appendix B), with the objective of ensuring that historical and cultural associations are not adversely affected by the Project.

8.4.2 Protection of heritage values

The Cultural Heritage Management Plan includes monitoring and management measures addressing the restriction of access to Aboriginal heritage exclusion zones, disturbance to archaeological sites and an ongoing process of community engagement.

The Project will be subject to a Contracting and Procurement Policy that requires consideration of the cultural concerns of the Ngaanyatjarra Lands People in the delivery of goods and services to the Wingellina Nickel Project.

Signage and exclusion barriers to guide avoidance of ethnographic heritage exclusion zones will be installed prior to ground disturbance activities and maintained over the operational life of the Project. Members of the Ngaanyatjarra Lands People will be engaged to act as heritage monitors during the implementation of ground disturbance activities.

A register of heritage sites will be kept and maintained and cultural awareness training will form part of the induction program for all Project workforce personnel. Cultural awareness induction and education programs will be delivered in concert with senior Ngaanyatjarra Lands People.

Under the terms of the agreement between Hinckley Range and the Ngaanyatjarra parties, the company will only apply to move sites when absolutely necessary, and then only after consultation with the Ngaanyatjarra parties. Approval to disturb the

two archaeological sites located within the proposed disturbance footprint will be sought under Section 18 of the *Aboriginal Heritage Act 1972* prior to any ground disturbance in these areas.

Measures to prevent indirect impacts to heritage exclusion zones and archaeological sites (e.g. from dust, surface water diversion drainage) will be included in relevant Project EMPs for these factors.

The Mine Closure Plan will include provisions for the protection of heritage values following mine closure.

8.5 Predicted Environmental Outcome

The proposed Project layout has taken due consideration of the ethnographic and archaeological values of the Wingellina area. Ten ethnographic exclusion zones within tenement E69/535 have been identified in consultation with the Traditional Owners. A variety of measures will be used to ensure that these areas are protected from disturbance, as described in the Cultural Heritage Management Plan.

Two of the 35 archaeological sites identified within tenement E69/535 are located within the proposed Project disturbance footprint to the north of the central mine pits. Approval to disturb these sites will be sought under the *Aboriginal Heritage Act 1972* prior to any ground disturbance in these areas.

CHAPTER 9

AMENITY

9.0 AMENITY

9.1 Noise and Vibration

9.1.1 Assessment Approach

Construction and operations activities associated with the Project will involve the generation of noise and vibrations, which have the potential to adversely affect environmental values and the acoustic amenity and health standards of nearby residents and mine workers.

The assessment of environmental noise was informed by EPAEAG 13 Environmental Assessment Guideline for Consideration of environmental impacts from noise (EPA 2014) and included the following elements:

- Determination of ambient noise;
- Prediction of noise levels and adjustments to predicted noise levels, as related to construction and operations activities;
- Comparison with noise criteria; and
- Evaluation of noise reduction measures.

Ambient noise monitoring in the Project area was conducted in September 2014, along with point source noise measurements of existing equipment within the Wingellina townsite including the existing Power Plant. This data provided a basis for determining if the noise impacts associated with the Project would significantly contribute to the noise. i.e. the noise from the Project when combined with the existing ambient noise, does not result in the assigned levels under the Regulations being exceeded.

Noise and vibration impacts on sensitive receptors were predicted using SoundPLAN 7.2 computer modelling (with the CONCAWE algorithms selected), which takes into account the influence of wind and atmospheric stability. This model included:

- Meteorological Information;
- Topographical data;
- Site layouts;
- Ground absorption characteristics;
- Source sound power levels; and
- Ambient sound measurements.

This predictive modelling was completed by Lloyd George Acoustics (2014) (Appendix F1) for the following proposed operational activities:

- Noise from mobile plant during the construction phase of the Project;
- Noise from mobile plant and processing plant during full operation; and

- Airblast and ground-borne vibration from blasting.

Predictive noise levels associated with the mining, processing and transportation operations were then compared against the assigned noise levels prescribed in Regulation 8 of the *Environmental Protection (Noise) Regulations 1997*. The modelling results included predicted noise or ground-borne vibration levels at specific receiver locations and noise level contours superimposed onto maps of the Project area and immediate surrounds (Appendix F1).

The worst-case operational scenario was considered in the noise modelling, with all plant operating simultaneously and the wind blowing toward the Wingellina townsite. It was also assumed the noise sources were split between open pits and the Run of Mine (ROM)/plant area.

9.1.1.1 Airblast Assessment

Both confined and unconfined blasting was considered in the assessment of airblast levels to the nearest noise sensitive premises. This included the Wingellina township, Kalka community, and proposed workforce accommodation areas. The noise impact assessment assumed a maximum charge mass of 26 kg per hole (confined) and 10 kg (unconfined), which is considered typical for mining operations of this size (Appendix F1). Results of this assessment were compared to levels prescribed in Regulation 11 of the *Environmental Protection (Noise) Regulations 1997*.

9.1.1.2 Ground Vibration Assessment

For ground vibration, it was assumed that the blasting conditions are for 'free-face average rock' formation. In the absence of specific blast vibration measurements at the Project site, a scaled distance site law was used to provide a conservative estimate for vibration level predictions (Appendix F1). This was then compared to relevant vibration levels specified in Australian Standard (AS) 2187.2-2006 *Explosives – Storage and use (Use of explosives)*.

9.1.2 Existing Environment

The nearest noise sensitive receptors to the Project are the proposed permanent accommodation village and existing communities at Wingellina, Kalka and Pipalyatjara. The Wingellina Township is located within 3 km from the ore body and the Kalka and Pipalyatjara communities are approximately 15 to 20 km to the southeast of the Project area in South Australia (Figure 9.1). The Kalka and Pipalyatjara communities are separated by the Tomkinson Range.

Potentially noise sensitive fauna are known from the Project area including five bat species identified during field surveys, none of which have elevated conservation significance (Outback Ecology, 2009). Suitable habitat for these species is widespread outside the Project area (refer to Chapter 12).

In the vicinity of the proposed mining area there is an airstrip (within 235m of the closest house) and a minimum manned exploration camp. No other significant sources of noise occur in the Project locality.

9.1.3 Impacts

9.1.3.1 Construction Impacts

Under Regulation 13 of the *Environmental Protection (Noise) Regulations 1997*, the prescribed noise levels do not apply to a construction site for work carried out between 7am and 7pm on any day excepting Sundays and public holidays, provided that:

- Construction work is carried out in accordance with control of environmental noise practices set out in Section 6 of AS 2436-1981 *Guide to Noise Control on Construction, Maintenance and Demolition Sites*;
- The equipment used is the quietest reasonably available; and
- A noise management plan for the construction site is prepared, approved by the Chief Executive Officer (CEO) of the Department of Environment Regulation (DER) or Local Government Authority and adhered to during construction.

Noise emissions from the Project have the potential to impact upon the Wingellina community during construction with worst case predicted noise of 43 dB L_{A10}. This is an acceptable level under the *Environmental Protection (Noise) Regulations 1997*.

Figure 9.1 Sensitive Receptors

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9.1.3.2 Airblast

Based on the distance between the mine site and the surrounding receptors, assuming 26 kg of explosive per hole and confined blasting, the predicted airblast levels are presented in Table 9.1. These are all below the minimum levels prescribed (115 $dBL_{Linear\ peak}$) for Sunday and Public Holidays under Regulation 11 of the *Environmental Protection (Noise) Regulations 1997.*

Table 9.1 Predicted airblast levels

Receiver Location	Predicted Airblast Level ($L_{Linear\ peak}$dB)
Wingellina Townsite	100
Kalka Community	74
Accommodation Village	100

9.1.3.3 Ground Vibration

At the closest receiver, Wingellina Townsite, the predicted ground vibration peak particle velocity level is 0.22 mm/s (Table 9.2). AS 2187.2-2006 *Explosives - Storage and use - Use of explosives* states that for a sensitive site with blasting lasting longer than 12 months or 20 blasts, a level of 5 mm/s for 95% of blasts and a maximum level of 10 mm/s is acceptable. Therefore, the anticipated ground vibration levels associated with the Project are considered to be acceptable.

Table 9.2 Predicted ground vibration levels

Receiver Location	Predicted Ground Vibration Level mm/s
Wingellina Townsite	0.22
Kalka Community	0.00
Accommodation Village	0.08

9.1.3.4 Operational Impacts

The predicted noise levels at sensitive receptors are less than 35 LA10dB in all cases (Table 9.3). The results are also depicted graphically in Figure 9.2. Based on a worse case modelling output (with all machinery in all pits working simultaneously 1m above the surface and wind blowing from the mining operations toward the receiver), the anticipated noise levels at sensitive receptors during the operational phase of the Project are considered to be acceptable.

Table 9.3 Predicted noise levels

Sensitive Receiver	Predicted Noise Level (L_{A10}dB)
Wingellina Townsite	34
Kalka Community	8
Accommodation Village	30 - 34

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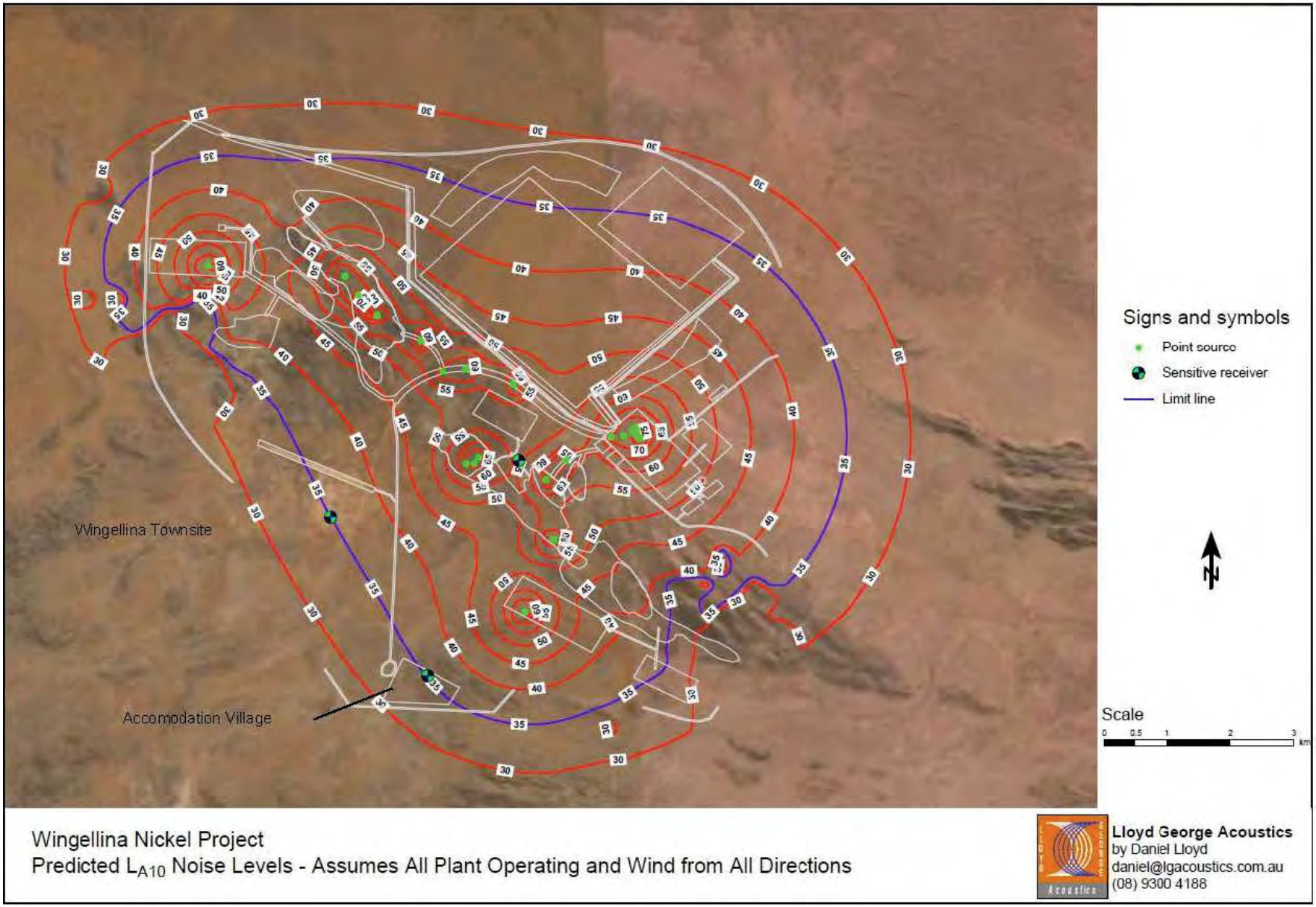
Figure 9.2 Predicted noise level contours associated with Project operations



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During operations there is the potential for noise emissions to cause behavioural changes in noise sensitive fauna, particularly bats. However, any impacts to bats and other fauna from noise are likely to be minimal, localised and reversible (Appendix I1).

Aircraft noise from take off and landing have been estimated based on sound power levels for a BAe146 aircraft, (Aust Standard 2021-2000). This represents the closest class of aircraft likely to be used for the mine operational purposes. It is anticipated about 3 to 5 additional flights per week would be needed for mine operations. The airfield would only be operational during daylight hours, as per current operational restrictions.

Noise from takeoff will be around 83 dB(A) max and landing around 75 dB(A) max. Table D1 (AS2021-2000) indicates this noise level would be conditionally acceptable for airfields with less than 20 flights per day.

9.1.4 Management and Mitigation Measures

Project construction and operations activities will be subject to a Noise and Vibration Management Plan with the following objectives (Appendix B):

- Ensure that noise emissions, both individually and cumulatively, meet appropriate criteria and do not adversely impact on the social surroundings;
- Ensure design and procurement processes incorporate measures for minimising noise emissions during construction and operations;
- Ensure that all reasonable and practicable measures are undertaken during construction and operations to minimise noise emissions; and
- Ensure that noise impact complies with the requirements of the *Environmental Protection (Noise) Regulations 1997*.

The Noise and Vibration Management Plan includes monitoring and management measures that address noise from the mine, processing plant and power station to demonstrate compliance with assigned noise levels and reduce impact on sensitive receptors.

Based on the findings of the noise modelling study for the Project, predicted noise levels are expected to be below prescribed standards, noting the modelled noise levels at Wingellina are influenced by noise sources at the closest pit (2.3km NW of the town). As the predicted noise levels at the Wingellina townsite are close to the threshold criterion for a sensitive receptor under the *Environmental Protection (Noise) Regulations 1997*, noise monitoring will be undertaken at this location and other noise sensitive receptors, in accordance with the Noise and Vibration Management Plan.

In addition regular maintenance of all plant is recommended, with specific attention to ensuring noise power levels do not increase over time

In the event noise levels are exceeded then the hours of operation at the nearest pit will be reviewed, reducing this to a day time only mining operation in this location.

9.1.5 Predicted Environmental Outcome

The Project is expected to comply with all standards prescribed in the *Environmental Protection (Noise) Regulations 1997*.

Subject to the proposed mitigation and management measures, it is considered that the Project can be managed to meet the EPA's objective "*to ensure that impacts to amenity are reduced as low as reasonably practicable".*

9.2 Light

9.2.1 Assessment Approach

A surface model, plant model and lighting model were brought together in Microstation v8i to provide a basis for the evaluation of the impact of light emissions on visual amenity. Viewing locations were selected to be consistent with the Visual Impact Assessment (Appendix F2). Each viewpoint was taken at 2.0 m above ground level.

For the purpose of this assessment, the primary light source is the HPAL processing plant. It contains an overwhelming majority of the lighting, structures up to a max height of 60m, and has the greatest potential for causing visual impacts. Other components of the project, such as the TSF and Topsoil Storage Areas, may be visible during daylight hours but the artificial lighting for these will be negligible. For the purposes of the assessment lighting was adjusted so that a common configuration could be used at all locations for comparative purposes.

Three lighting scenarios were developed for each location and rendered images developed for to enable visual comparison.

- No lights on the proposed plant with low ambient light. This simulates a moon lit night so that the surrounding landforms can be seen and reflects the current undeveloped situation;
- Full lights on with low ambient light, to give the most realistic final lighting scenario and to show the difference between the vista pre and post plant; and
- Full lights on with no ambient light to represent a dark night (worst case) scenario to show the maximum extent of any impact.

9.2.2 Existing Environment

No significant industrial development exists in the Wingellina locality or surrounding region. Small townsites and support infrastructure, including roads, are spread throughout the region. Some exploration has occurred in the region in the past. Therefore, no regionally significant sources of light currently exist, however street lighting is installed in the local Aboriginal communities of the region.

9.2.3 Impacts

The aspects of the environment with the potential to be impacted by light emissions from the Project are:

- Fauna; and
- Social amenity.

9.2.3.1 Construction Impacts

Light emissions from the Project have the potential to impact upon the visual amenity of three local communities (Wingellina, Kalka and Pipalyatjara) and light-sensitive fauna.

Construction at Wingellina may be undertaken on a 24-hour basis. Night lighting will be required for safety and security purposes. Artificial lighting has the potential to cause obtrusive light spill and reduce the night amenity.

The main light receptor relevant for the Project is the Wingellina Township, located one kilometre from the Wingellina airstrip and three kilometres from the ore body (Figure 9.1).

Construction lighting is unlikely to impact upon the Wingellina community. While construction activities may occur on a 24 hour basis, the main construction area will be obscured by a ridge line. Lighting from construction of the TSF and processing plant is expected to be shielded by the ridge line. Lighting emissions from the construction of roads will be negligible and this construction is likely to occur during daylight hours only.

The Project has less potential to impact on the visual amenity of the Kalka community and Pipalyatjara communities located approximately 15 to 20 km south-east of the Project in SA (Figure 9.1). The Hinckley Ranges lies between Pipalyatjara and the Project, acting as a visual barrier. Consequently, impacts from light emissions on the community are not expected. The Project will be visible from the Kalka community, but the visual impact will be minimal given the separation distance of approximately 20 kilometres.

9.2.3.2 Operation Impacts

Light emissions from night operations are expected to be visible from the Wingellina townsite. However, light impacts will not be severe, as the main Project infrastructure will be on the other side of the ridge out of the direct sight of the community and only a light halo is expected at this location. The light halo is also expected to be softened by existing ambient light from existing streetlights within the townsite.

The only infrastructure that will be directly visible at night from the Wingellina townsite will be the airstrip and accommodation village.

Lighting from the Project operations is expected to have minimal or no impact on the Pipalyatjara and Kalka communities, as the Hinckley Range will act as a visual barrier.

Potential impacts during operations could include behavioural changes in light sensitive fauna, particularly bats. Bat habitat occurs in the Project area but is also extensive in the surrounding landscape. None of the bat species recorded in the Project area have restricted distributions or a particular reliance on the habitat of the Project area (refer to Chapter 12). As such, no significant impacts of light emissions on bat species are expected.

9.2.4 Management and Mitigation Measures

9.2.4.1 Management Objectives

The objective for managing light emissions from the Project is to ensure that light emissions do not adversely affect environmental values (including fauna) or the health, welfare and amenity of people and land use.

9.2.4.2 Management Measures

As part of Hinckley Range's best practice approach to the development of the Project, all lighting used during the construction of the Project will conform to Australian Standards and be selected to minimise the impact of light emissions on fauna and local communities. Measures to minimise light emissions will include:

- Directing light towards construction and operations areas;
- Installing light shields;
- Using minimal illumination levels to light up areas; and
- Flights servicing the Project will only operate during the day.

9.2.5 Predicted Outcomes

Lighting from the Project is not expected to result in significant impacts to fauna or the visual amenity of the Kalka and Pipalyatjara. Minor light impacts on the Wingellina community will be associated with light spill (halo) from the HPAL processing plant; however this will be attenuated natural barriers and the influence of l street lighting at the townsite. Implementation of mitigation measures, such as directional lighting, will further minimise any impact. For these reasons the Project is considered to be consistent with the EPA's objective "*to ensure that impacts to amenity are reduced as low as reasonably practicable".*

CHAPTER 10

HYDROLOGICAL PROCESS

10.0 HYDROLOGICAL PROCESS

10.1 Assessment approach

Groundwater exploration, monitoring and modelling studies for the Project were completed by Rockwater Pty Ltd between 2010 and 2014. The purpose of these studies was to define the groundwater resource within the Project area, determine how the Project would affect groundwater quality and levels, and evaluate water supply options in the Officer Basin. The groundwater investigations included:

- Broad-scale hydrological assessment of the Wingellina Mine (Rockwater 2010a) (Appendix G1);
- Wingellina Nickel Laterite Deposit Dewatering Assessment Results of Permeability Testing (Rockwater 2010b) (Appendix G2);
- Wingellina Nickel Project Permeability Testing and Numerical Modelling of Mine Dewatering Rates (Rockwater 2011) (Appendix G3);
- Wingellina Nickel Project Central Officer Basin Groundwater Investigations 2010 to 2012 - Bore Completion, Test Pumping and Flow Modelling (Rockwater 2012) (Appendix G4);
- Wingellina Nickel Laterite Project Assessment of Final Void Water Levels and Salinity (Rockwater 2014) (Appendix G5); and
- Wingellina Nickel Project Surface Water Management Assessment (Rockwater 2011b) (Appendix G6).

10.2 Existing environment

10.2.1 Climate

The regional climate is classified as desert: hot (persistently dry) under the modified Köppen classification system (Stern et al. 2000). It is characterised by hot summers and mild winters. Further discussion of the regional climate is provided in Section 6.2.1.

The nearest Bureau of Meteorology (BOM) weather station is the Giles Meteorological Office, located approximately 130 km to the northwest. Long-term, mean annual rainfall at Giles is approximately 285 mm, but is highly variable between years and over longer time scales. Annual pan evaporation is estimated to be 3,300 mm to 3,400 mm and typically exceeds rainfall in all months of the year. These conditions provide limited opportunity for surface flows and groundwater recharge.

The majority of rainfall is typically received during summer, largely due to the movement of low pressure troughs and tropical lows associated with monsoon troughs moving into the region from the north. Winters are mild and associated with a high pressure subtropical ridge (BoM 2014).

10.2.2 Surface water

The Project is located in the northern part of the Warburton drainage basin, a large internally draining basin of about 340,000 km^2 encompassing the southern Gibson Desert and northern Great Victoria Desert in central Australia. Due to the region's arid climate, predominant low relief and extensive cover of aeolian sand, surface water only flows transiently after large rainfall events (Appendix G1).

The proposed mining area intersects several sub-catchment areas defined by the Hinckley Range and Wingellina Hills, and a small range of hills running in a north-westerly direction between the two (Figure 10.1). The sub-catchments include a series of poorly defined, ephemeral drainages. There are no significant creeks or water bodies within the area.

Tenement L69/12, which includes the proposed borefield area, occurs in a broad valley that is largely obscured by small dunes. A weakly defined, north - south ridge of about 500 mAHD elevation occurs to the west of the tenement. There are no significant creeks or water bodies within the area.

10.2.3 Regional groundwater characterisation

The broader region includes a series of groundwater basins including the Amadeus Basin, Canning Basin, the Musgrave Complex, the Officer Basin and the Gunbarrel Basin (Figure 10.2). The strata of these groundwater basins are summarised in Table 10.1.

The proposed mining area is located in the Musgrave Complex.

It is proposed that process water will be sourced from a borefield in the Central Officer Basin, located approximately 100 km to the southwest of the proposed mining area, and piped to the mine site (Figure 5.3). The Central Officer Basin contains strata of Late Proterozoic age and is overlain by the Gunbarrel Basin (Rockwater, 2008).

Table 10.1 Strata of the groundwater basins of the greater Wingellina area

Groundwater Basin	Strata
Amadeus Basin	Neoproterozoic and minor Phanerozoic rocks.
Canning Basin	Phanerozoic sediments. The Cobb Depression is a sub-basin of Permian age feeding into the Canning Basin.
Musgrave Complex	Mesoproterozoic basement of sedimentary and volcanic rocks subject to intrusions of mafic – ultramafic dykes and granitoids, and swarms of dolerite dykes. Localised groundwater supplies may be obtainable from the fractured and weathered profile in the basement rocks. Greater potential for groundwater supplies may be associated with palaeochannels and calcrete.

Groundwater Basin	Strata
Officer Basin	A large intracratonic basin that extends for 1,500 km from the eastern flanks of the Pilbara and Yilgarn cratons to the central west of South Australia. In Western Australia, the fill of the Officer Basin is of Neoproterozoic to Early Cambrian age (ca. 850 to 500 Ma) sedimentary rocks.
Gunbarrel Basin	Phanerozoic rocks over concealed Neoproterozoic Officer Basin. Cambrian and younger (i.e. Palaeozoic-age) strata occurring to the south of the Musgrave Complex.

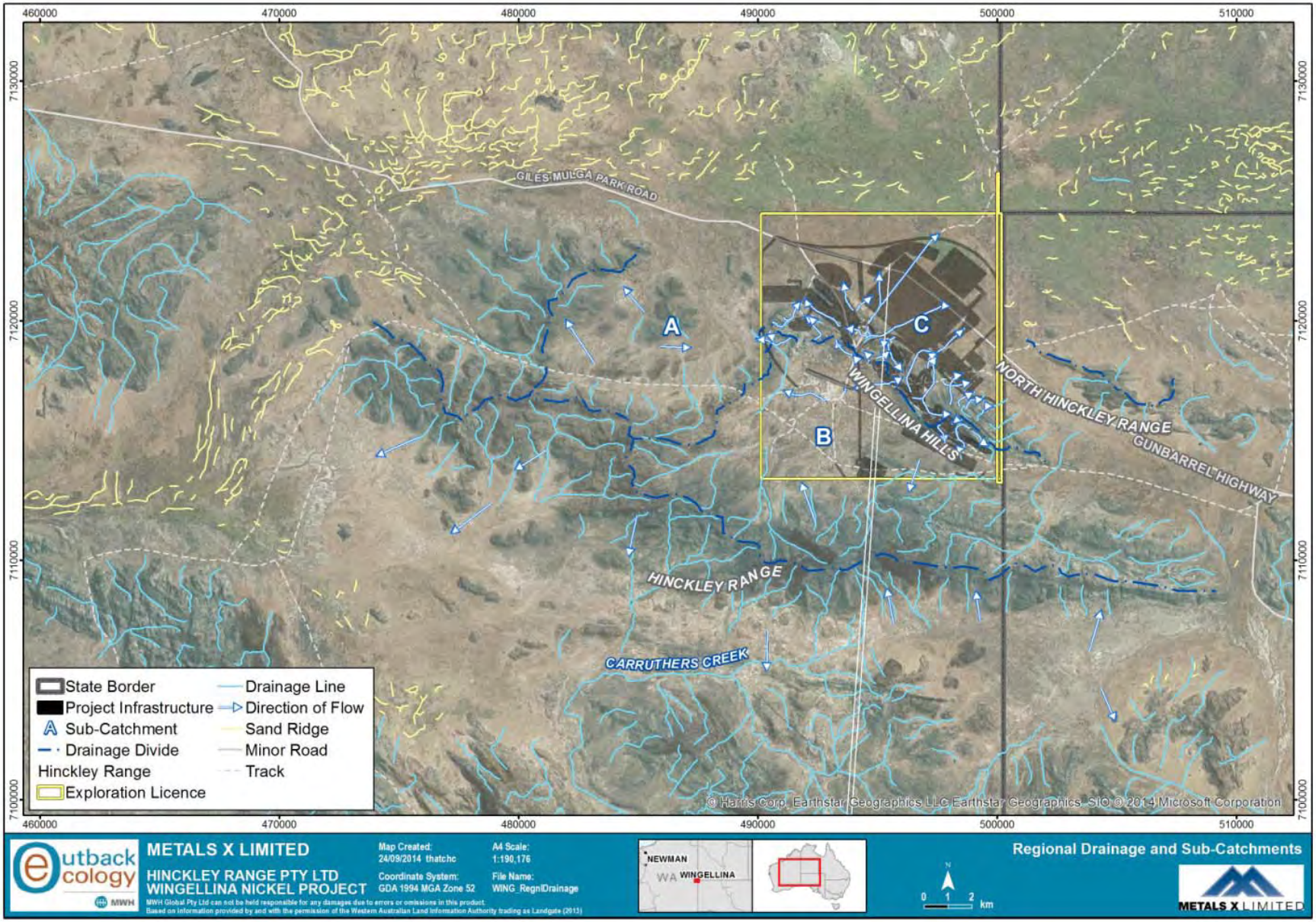

Figure 10.1 Regional drainage and sub-catchments within the proposed mining area (Rockwater 2010)

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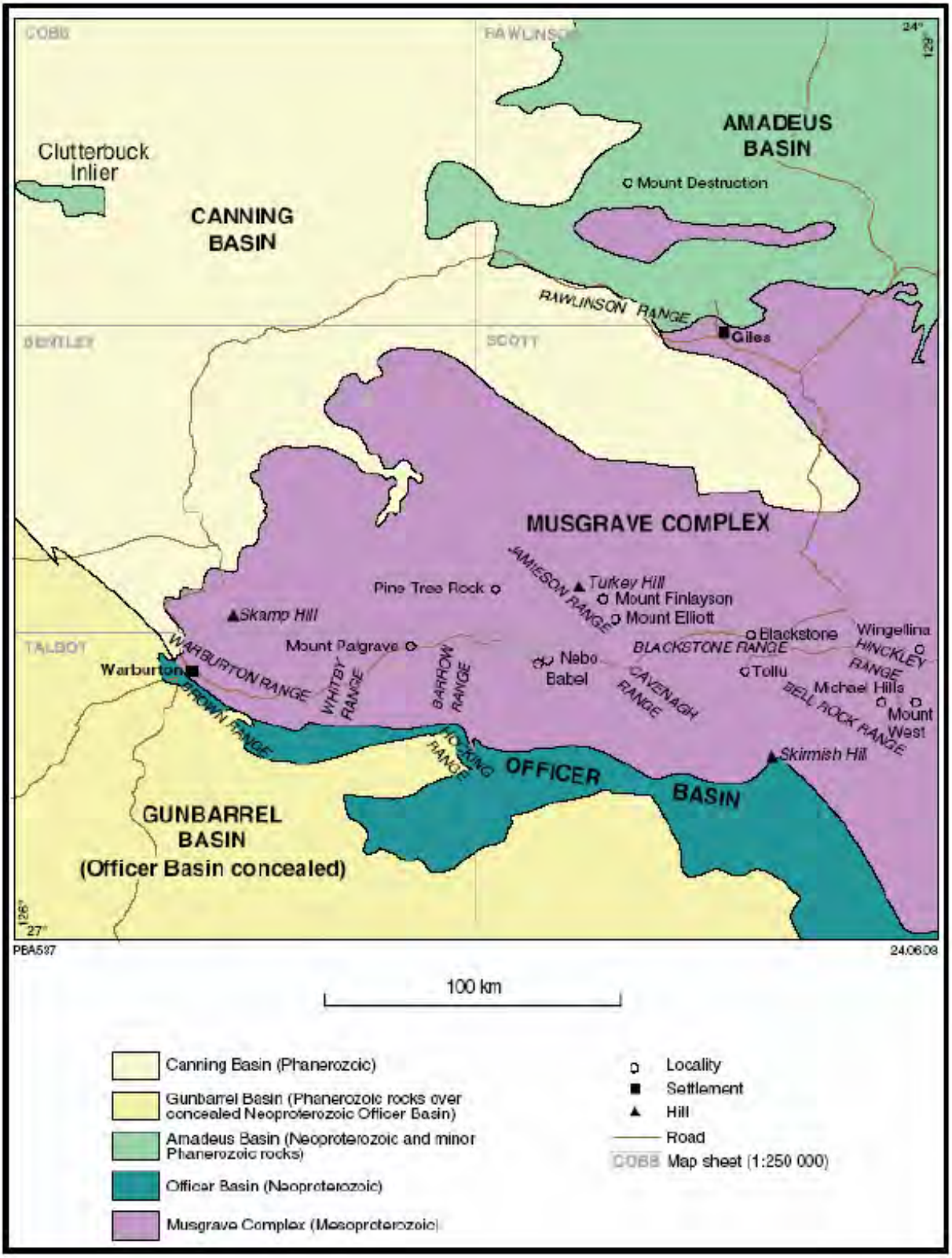

Figure 10.2 Musgrave complex and surrounding sedimentary basins

10.2.4 Mine site

10.2.4.1 Hydrostratigraphy

The bedrock at Wingellina is dominantly composed of differentiated mafic–ultramafic intrusions of Mesoproterozoic age that strike to the northwest and dip steeply to the southwest (Appendix G3). The idealised sequence within each intrusion comprises a thick basal unit of dunite overlain by a thin unit of pyroxenite, which is in turn overlain by a thick unit of gabbro. Chemical weathering of the dunite (90% olivine) has produced a basal zone of magnesite and/or chalcedonic silica which is overlain by a variably thick zone of nickeliferous goethite, referred to as limonite ore (ie. zone of mineralisation). The gabbroic rocks are relatively resistant to erosion, so that these typically crop-out and form strike-ridges in the landscape. An overview of the cross sectional bedrock geology is presented in Figure 10.3.

Groundwater in the proposed mining area is considered to be associated with bedrock fractures or discontinuities (Coffey 2008). Higher permeability may also be associated with fault zones (Appendix G3).

10.2.4.2 Groundwater levels and quality

The water table elevation ranges from about 645 mAHDat the south-eastern end of the Wingellina deposit to about 625 mAHD at the north-western end (Appendix G3). Depending on the water table elevation, and more specifically the surface topography, the depth to water varies from about 18 to 55 m below ground level (mbgl) (Appendix G3). There is a steep rise in water table elevation along the south-western margin of the Wingellina ore body, attributed to the presence of a low-permeability fault that has the effect of restricting the regional flow of groundwater from the southwest to the northeast. Although mapping is not available, it is likely that several other faults occur within the ore-body area.

Groundwater quality is relatively consistent in the proposed mining area, with the greatest variability observed in the groundwater from Inco Bore which exhibits elevated salinity, alkaline pH and low DO levels. This bore is located at the town's landfill site and the water quality is likely to be the result of nutrient enrichment by seepage from the landfill (Appendix l2).

Groundwater salinity proximal to the ore body is predominantly brackish, ranging from approximately 4,000 mg/L to 41,000 mg/L and averaging about 11,000 mg/L (Appendix G3). Monitoring of electrical conductivity (EC) indicates that the salinity varies slightly throughout the year, possibly becoming fresher after major rainfall events. Results of water quality testing in 2008 indicated slight variation in pH which ranged from circum-neutral to alkaline (pH 6.8 – 8.7). The dissolved oxygen (DO) of the groundwater was low, ranging from 0.7 to 4.74 ppm, which is often the case with deep aquifers (Outback Ecology 2008c; Appendix I2).

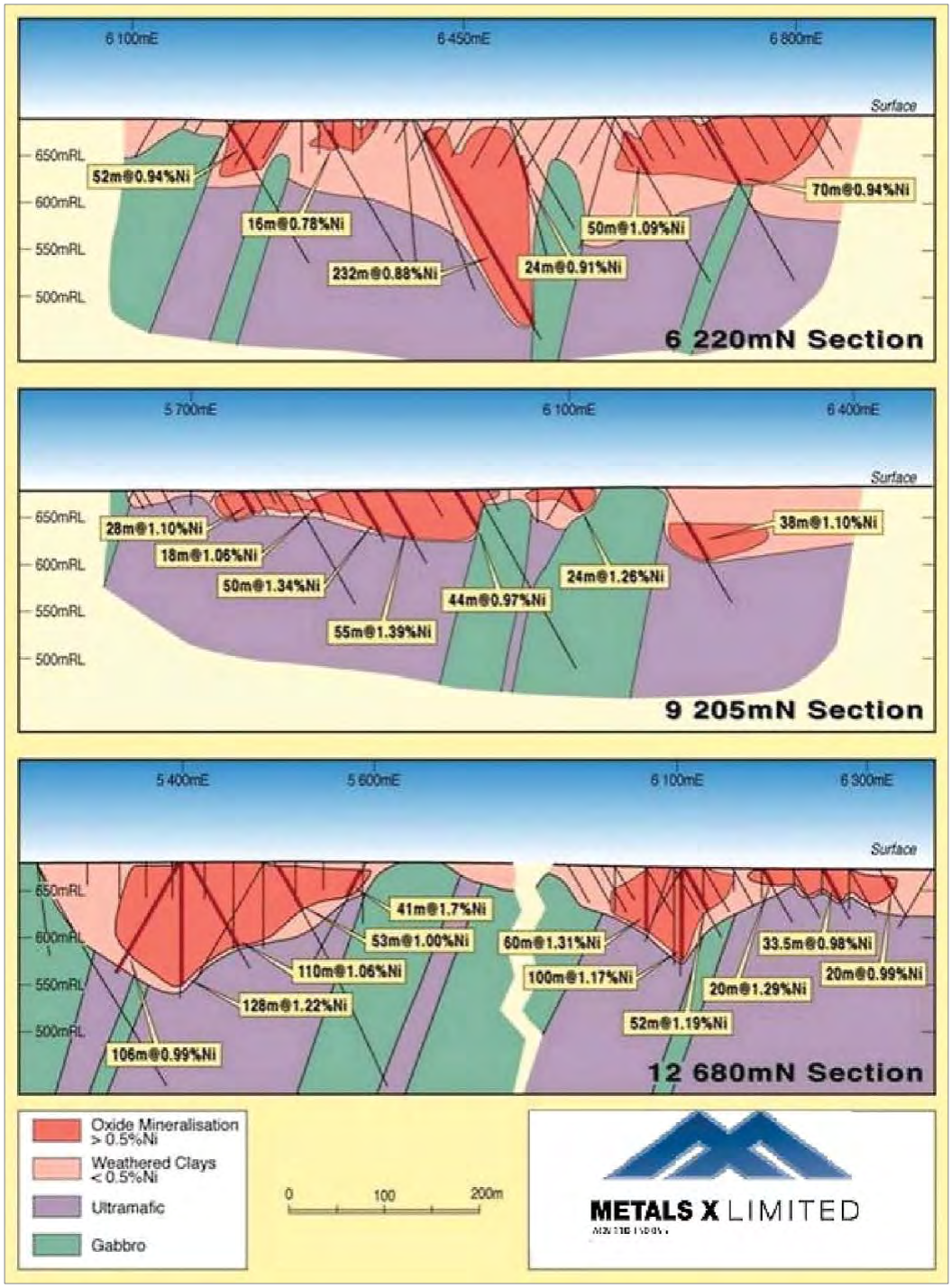

Figure: 10.3 Geological cross-section - detailing typical bedrock geology under the mine.

The moderate salinity of the groundwater suggests that recharge occurs by the direct infiltration of rainfall. However, water levels do not appear to vary seasonally, despite a marked peak in rainfall during the summer months. This suggests that the recharge rate is likely to be low, or that the aquifer is permeable and able to recover fairly quickly following recharge events (Appendix G3).

10.2.4.3 Aquifer parameters

Slug and falling head tests indicate the following hydraulic conductivities for major rock types (Appendix G3):

- 0.01 m/d for the fresh mafic/ultramafic bedrock (5 bores drilled);
- 2.0 m/d for fractured gabbro (1 bore drilled);
- 0.005 m/d for silcrete and clay (1 bore drilled);
- 0.05 m/d for sediments in the area of the proposed tailings dam (2 bores drilled); and
- 0.001 m/d for the limonite ore (2 bores drilled).

10.2.5 Borefield

10.2.5.1 Hydrostratigraphy

The Officer Basin includes three main hydrostratigraphic units, listed in order of increasing depth and age as follows (Appendix G4):

- Vines Formation - sandstone and conglomerate, interbedded with minor claystone and siltstone. The conglomerate is typically dark red to brown, well to very well consolidated and matrix to framework supported, with fine to very coarse pebble sized clasts of rounded quartz, chert and volcanic rocks set in a clayey or sandy matrix. The clay content of the Vines Formation is greater at depth, near the contact with the Lungkarta Formation;
- Lungkarta Formation - red to dark red, well consolidated, strongly bimodal very fine and medium sandsized, well rounded, well sorted, quartz sandstone. Medium to large-scale cross-bedding is locally evident. Relatively high permeability and assessed to have the greatest aquifer potential; and
- Wahlgu Formation - red-brown to brownish grey, well consolidated, sandy diamictite containing a variety of sedimentary and igneous clasts which are commonly faceted and striated. Beds of mudstone and sandstone are also common. Has low permeability and acts as an aquitard or aquiclude.

The Lungkarta Formation subcrops in the central portion of tenement L69/12 along an approximately NNW to SSE axis and dips to the SSW with a gradient of approximately 5%. The proposed borefield area is proximal to the Tjuntjuntjarra Track proximal to and south of the inferred subcrop. The Vines Formation constitutes a confining layer where it overlies the Lungkarta Formation.

10.2.5.2 Groundwater levels and quality

The depth to groundwater ranges from 10 to 25 mbgl in the vicinity of the proposed borefield area (Appendix G4). The water table slopes downwards to the south and east corresponding with the overall form of the catchment.

Groundwater quality has been evaluated by Rockwater Pty Ltd (Appendix G4). The groundwater is slightly alkaline (pH 7.7 to 8.2), which probably reflects the presence of calcrete in the near surface, and perhaps also minor carbonate layers at depth within the Vines and Wahlgu Formations. Typically, the water is saline with a Total Dissolved Solids (TDS) concentration of about 1,000 to 8,000 mg/L dominated by sodium chloride. Concentrations of dissolved metals and nutrients are low (refer to Appendix G4).

10.2.5.3 Aquifer parameters

Groundwater investigations undertaken by Rockwater Pty Ltd indicate that the permeability of the Lungkarta Fm ranges from about 0.02–0.04 m/d, and the storativity from about 0.002–0.004 (Appendix G4). Given that the range and average of specific yield for fine-grained sand are about 0.01 to 0.28 and 0.21, respectively, Rockwater Pty Ltd considered that the likely specific yield of the Lungkarta Formation is about 0.2.

For resource extraction purposes, these aquifer parameters suggest that the cone of depression produced by pumping will be narrow and steep-sided nearby to production bores.

10.2.5.4 Groundwater resource characterisation

The target hydrostratigraphic unit for Project water supply is the aeolian sandstone of the Lungkarta Formation.

Groundwater investigations included the drilling of seven widely spaced exploration RC holes in tenement L69/12 in 2010 and 2011, and the installation of three monitoring bores and two production test bores in 2012.

Using average aquifer parameters obtained from pumping tests, a groundwater flow model was created to assess two conceptual borefield configurations to supply the Project's raw water requirements (Appendix G4). The modelling approach used was consistent with a Class 1 Level of Confidence model under the National Water Commission 2012 *Australian groundwater modelling guideline*. The first configuration included 76 bores along a 19 km strike of the aquifer, whereas the second configuration included 52 bores positioned along the aquifer strike over 41 km (Appendix G4). The modelling results suggest that both borefield configurations would be capable of supplying 12 GL/a for about 25 years.

Various sensitivity analyses were undertaken to inform the conclusions of the modelling study with specific yield values set to half and double the base-case. The model was also re-run halving and doubling the hydraulic conductivity. These results showed that:

- Doubling the specific yield increased the time taken to reach 180 m drawdown (ie. to the inferred base of the Lungkarta Formation) to approximately 35 years; and
- Doubling the hydraulic conductivity increased time to reach 180 m drawdown to approximately 37 years.

The modelling results indicate that the Officer Basin is capable of providing a long term water supply option for the Project.

10.3 Potential impacts

10.3.1 Construction impacts

Potential construction impacts on groundwater are related to contamination with pollutants. This can arise through:

- Spillages and infiltration of hydrocarbons through inappropriate refuelling and/or servicing;
- Discharge of nutrient laden treated wastewater; and
- Infiltration of nutrients associated with waste disposal facilities.

Potential contamination sources from servicing and refuelling include the mine workshop, vehicle wash down bays and refuelling areas. It is standard industry practice to undertake re-fuelling and routine servicing of larger plant on site through the use of a mobile bowsers and servicing facilities.

Run-off from landfill and waste disposal areas may lead to contaminated surface water discharge with a range of substances including oils and hydrocarbons, biological oxygen demand (BOD), nutrients and particulate matter.

10.4 Operational impacts

10.4.1 Mine Site

Potential operational impacts on groundwater at the proposed mining area include:

- Groundwater drawdown due to pit dewatering;
- Groundwater mounding due to seepage from the TSF;
- Contamination arising from the TSF and waste rock landforms;
- Contamination arising from the HPAL processing plant and hazardous goods storages;
- Spillages and infiltration of hydrocarbons through inappropriate refuelling and/or servicing;
- Discharge of nutrient laden treated wastewater; and
- Infiltration of nutrients associated with waste disposal facilities.

10.4.1.1 Aquifer Depletion and Mounding

In most of the pits the orebody extends below the water table. Dewatering will be required to fully access the orebody by maintaining dry pit floor conditions and improving pit wall stability. Dewatering volumes will be piped to the HPAL processing plant and used for mineral processing.

The combined effects on groundwater levels of mine pit dewatering and potential recharge derived from the TSF were evaluated using a numerical groundwater model (Rockwater 2011). The modelling approach was consistent with a Class 1 Level of Confidence model under the National Water Commission 2012 *Australian groundwater modelling guideline*. Preliminary modelling scenarios conservatively assumed the simultaneous dewatering of all pits over a 15 year period. In reality the pits will be mined successively with dewatering (and drawdown) being limited to a single pit or small group of pits at any one time; hence the preliminary modelling represents a worst case scenario. Modelling was undertaken both with and without the assumption of infiltration from the TSF.

In the case of the north-western and south-eastern pits, which are the deepest, drawdowns of up to two metres are predicted to extend up to one kilometre from the pit margins, but elsewhere the drawdowns are much more restricted. Where infiltration from the TSF and water storage facility is assumed the modelled water table height is raised by 10 m or more for approximately one kilometre from the boundary of the facilities relative to the no TSF infiltration scenario.

None of the vegetation communities at the mine site area are likely to be groundwater dependent (Outback Ecology 2011c; Appendix H3) and therefore no impacts on vegetation communities resulting from drawdown are expected. Similarly, mounding associated with the TSF is not predicted to interact with vegetation root systems and therefore no impacts on vegetation communities resulting from mounding are expected. The drawdown and mounding footprints have been modelled and are not predicted to reach the Wingellina town water supply bores (Figure 10.4).

10.4.1.2 TSF and WSF Seepage

Potential groundwater contaminants associated with liquid seepage from the TSF include magnesium, calcium and manganese. Test pits carried out within the TSF footprint for the environmental baseline study indicate sandy clay to depths between 0.6 and 1.0 m. This material will inhibit seepage and this will be further reduced by the impermeable nature of the tailings (Outback Ecology, 2014).

10.4.1.3 Process Plant and Hazardous Goods Storages

The major process reagents for the Project are:

- Sulphur 360,000 t/yr;
- Magnesia 35,000 t/yr;
- Calcrete 860,000 t/yr;
- Sodium metabisulphite (SMBS) 18,040 t/yr;
- Flocculants 2,700 t/yr; and
- Quicklime 32,000 t/yr.

Sulphur will be converted to sulphuric acid for the HPAL process. Sufficient amounts of the reagent (25,000 tonnes) will be stored on site for six days of consumption.

Diesel for mining and process plant requirements will be stored in above ground, fully bunded tank(s) with a capacity of 2,000 m^3, and meeting the AS1940 2004 requirements for hydrocarbon storage.

Engineering controls will be established to detect and contain leaks from the processing plant including double containment. The site will be licensed and maintained according to the *Dangerous Goods Safety (Storage and Handling of Non-explosives) Regulations 2007*.

10.4.1.4 Refuelling and Servicing

Potential contamination sources from servicing and refuelling include the mine workshop, vehicle wash down bays and refuelling areas. It is standard industry practice to undertake re-fuelling and routine servicing of larger plant on site through the use of a mobile bowsers and servicing facilities.

10.4.1.5 Wastewater Treatment and Waste Management

Run-off from waste disposal areas including the landfill, TSF, water storage facility (WSF) and waste water treatment plant (WWTP) may lead to discharge of water contaminated with a range of substances including oils and hydrocarbons, biological oxygen demand (BOD), nutrients and particulate matter to the surface environment. Treated wastewater and landfill leachates can contain high concentrations of nitrogen and phosphorous as well as BOD. Monitoring at Inco Bore located near to the community landfill has indicated elevated levels of nutrients in comparison with background levels (Section 8.2.1).

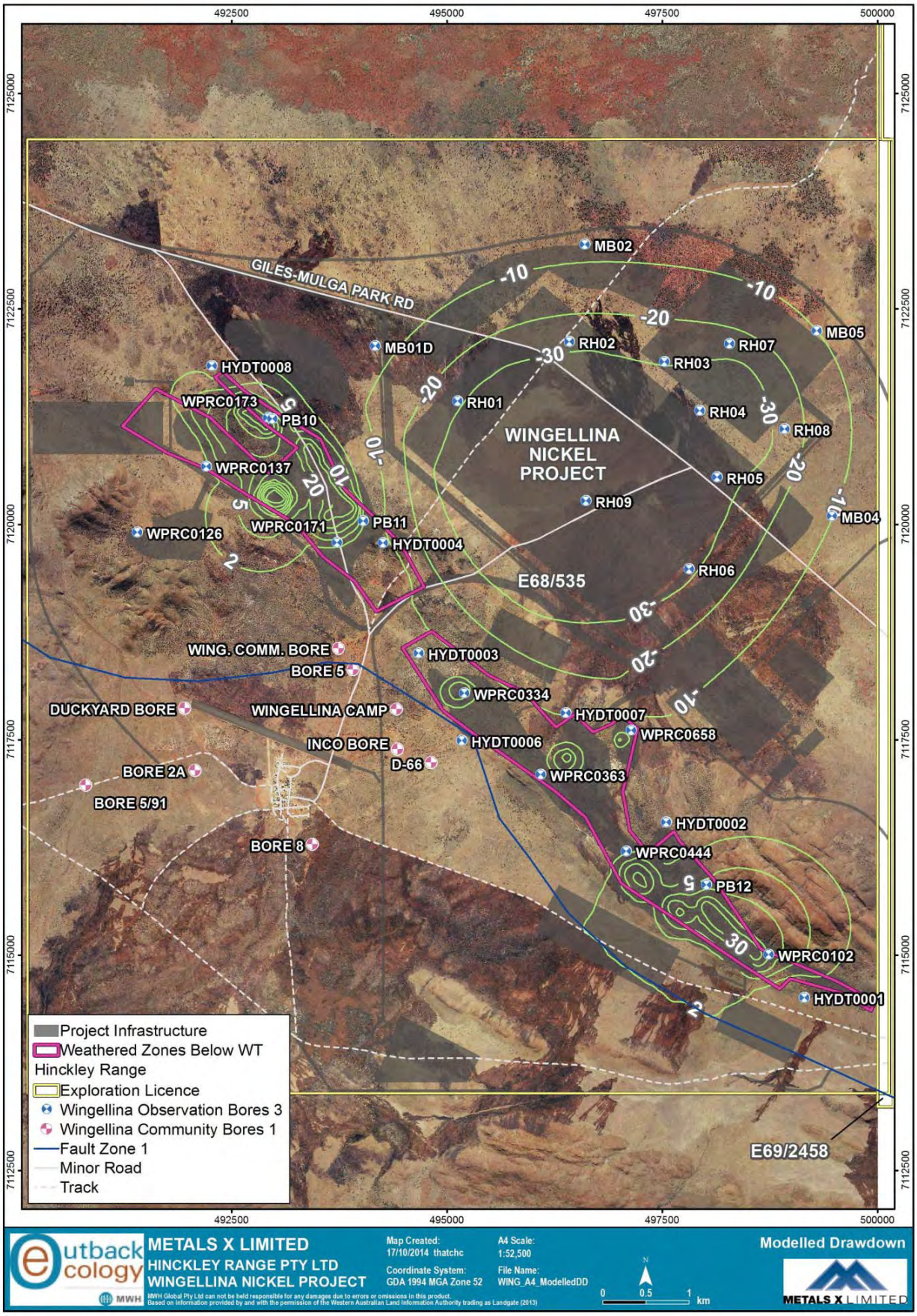

Figure 10.4 Modelled drawdown and mounding at the proposed mining area

10.4.1.6 Pit Lakes and Water Quality

The post mining landform will include pit lakes. Additional modelling was undertaken to determine groundwater inflows within the pits post mining (Rockwater 2014). The rate of groundwater inflow was assessed using the dewatering model developed by Rockwater (2011) to determine the rate of groundwater inflow during the recovery period. A water balance was also modelled including calculated evaporation losses and rainfall gains to predict water levels and salinity concentrations for 30 years of water recovery with groundwater salinity predicted to increase linearly with time reaching levels of about 18,000 mg/L TDS after 30 years (Rockwater 2014, Appendix G5).

Pit lakes are predicted to stabilise below the current regional water levels, even under conditions of high orebody permeability and high groundwater inflow. As such they will function as groundwater sinks following the cessation of dewatering. Groundwater will continue to flow towards the pits, so that any changes in water quality within the pits will not impact the regional groundwater system (Rockwater 2014, Appendix G5).

10.4.2 Borefield

Development of a water supply borefield is a key requirement of the Project as mine dewatering will not supply all the required processing water. Approximately 12 GL/yr of water are required for construction and operations of the Project. Water will be supplied primarily from the Officer Basin borefield for the following purposes;

- Dust control and wash down;
- Compaction of gravel roads and pads;
- Potable and domestic use; and
- Ore processing.

The target aquifer in the sandstone of the Lungkarta Formation, has relatively low permeability and storativity, and is confined by clay-rich strata within the overlying Vines Formation (Appendix G4). Groundwater abstraction under these conditions will result in a low sustainable yield and a cone of depression which is narrow and steep sided close to the production bore. Recharge of the aquifer is predicted to be minimal and a zone of drawdown is expected to persist within the aquifer following the cessation of abstraction activities.

10.5 Management and Mitigation Measures

10.5.1 Management Objectives

Project construction and operations activities will be subject to a Hydrological Processes Management Plan with the following objectives (Appendix B):

- Minimise the adverse effects of the abstraction and release of water on environmental, social and cultural values;

- Ensure that the mining activity does not adversely affect the quality and quantity of water available to other existing and potential groundwater users; and
- Maximise efficient water use.

The Hydrological Processes Management Plan includes monitoring and management measures that address groundwater levels, water quality, and disruption to surface water flow regimes. The Plan also addresses monitoring of groundwater abstraction during the operations phase.

10.5.2 Construction

The following management measures will be implemented during the construction phase of the Project to minimise impacts on groundwater:

- All site infrastructures will be constructed to minimise disruption to surface water flow, reduce the potential for flooding of infrastructure, and minimise the risk of groundwater contamination. A surface water management study for the proposed mining area has been completed, which includes recommendations for drainage and flood prevention structures (Appendix G6);
- Mobile servicing of vehicles will be undertaken by trained personnel using spill trays or portable bunds and in close proximity of spill cleanup kits;
- The main fuel storage, fuelling and servicing area will be bunded and lined to prevent infiltration of spills. The bund will discharge to an oily water separator;
- Wash downs will be undertaken using quick break detergents at a properly constructed wash down bay, which discharges to a sediment settlement sump/oily water separator;
- Waste disposal areas will be constructed outside of known drainage lines and with contained drainage that discharges via a sediment sump/oily water separator;
- Landfills will be constructed with the requirements of the *Environmental Protection (Rural Landfill) Regulations (2002)*; and
- Contaminated stormwater will be retained on site where practicable.

10.5.3 Operational

The following management measures will be implemented during the operational phase of the Project to minimise impacts on groundwater:

- A network of groundwater monitoring bores will be installed prior to the commencement of ground disturbing activities to enable the collection of baseline data and enable routine monitoring of groundwater levels and quality;
- Establishment of a groundwater monitoring program identifying changes to groundwater levels and analysing potential contamination from TSF, WSF, HPAL processing plant area, process ponds, waste landfill and WWTP;

- Volumes of water abstracted from the pits will be kept to the minimum required for safe mining operations;
- The volume of water abstracted from production bores will be monitored;
- Mobile servicing of vehicles will be undertaken by trained personnel using spill trays or portable bunds and in close proximity of spill cleanup kits;
- The main fuel storage, fuelling and servicing area will be bunded and lined to prevent infiltration of spills. The bund will discharge to an oily water separator;
- Wash downs will be undertaken using quick break detergents at a properly constructed wash down bay, which discharges to a sediment settlement sump/oily water separator;
- Landfills will comply with the requirements of the *Environmental Protection (Rural Landfill) Regulations (2002)*;
- Contaminated stormwater will be retained on site;
- Wastewater will be collected by a sewer and passed to an activated sludge package system;
- Tailings material will be neutralised prior to discharge to the TSF;
- Waste rock landforms will be managed to prevent groundwater contamination (discussed further in Section 13.0);
- Surface water runoff from the HPAL processing plant and sulphur handling areas will be captured and diverted to a containment pond; and
- Storage and management of chemicals and hydrocarbons will be in accordance with relevant regulatory requirements and industry guidelines

10.6 Predicted Environmental Outcome

The Project area does not include any significant creeks, water bodies or other sensitive surface water receptors.

Potential impacts to the quality and levels of groundwater at the proposed mining area during the construction and operation of the mine have been characterised based on numerical modelling studies. With appropriate management, no significant impacts to groundwater resources or ecological communities are expected to occur over the life of the mine.

The development and abstraction of water from the Central Officer Basin borefield will create zone of drawdown that is expected to persist within the aquifer following the cessation of groundwater abstraction. However, as the maximum amount of pit water will be used for the processing, the TSF design will increase return water to the plant and because drawdown will be localised, impacts to the groundwater resource will be reduced.

Potential impacts to hydrological processes will be managed in accordance with the Wingellina Project Hydrological Processes Management Plan (Appendix B). This

Plan addresses threatening processes associated with groundwater drawdown, potentially contaminating substances and the management of the TSF.

Subject to the proposed mitigation and management measures, it is considered that the Project can be managed to meet the EPA's objective "*To maintain the hydrological regimes of groundwater and surface water so that existing and potential uses, including ecosystem maintenance, are protected*".

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CHAPTER 11

FLORA AND VEGETATION

11.0 FLORA AND VEGETATION

11.1 Assessment Approach

The flora and vegetation values of the Project area were assessed through a combination of desktop studies, reconnaissance field surveys and comprehensive field surveys undertaken in accordance with relevant EPA principles and guidance materials for this environmental factor. Additional targeted surveys and assessments for conservation significant flora were also completed in specific areas.

11.1.1 Flora and Vegetation Surveys

11.1.1.1 Mine Site

The following flora and vegetation surveys have been completed within the proposed mining area (tenement E69/535):

- HGM Maunsell (2002) - Wingellina Baseline Biological Survey in the period 5 - 8 April 2002 (Appendix H1);
- Outback Ecology (2009a) – Wingellina Nickel Project Baseline Vegetation and Flora Assessment in the period 13 - 22 April 2008 (Appendix H2); and
- Outback Ecology (2011) - Level 2 Flora and Vegetation Assessment of the Wingellina Mine in the period 6 – 11 October 2010 (Appendix H3).

In each case a desktop assessment was completed prior to conducting on-site vegetation and flora surveys. The combined results of the desktop assessments, field surveys and a targeted search for flora of conservation significance are documented in the Level 2 Flora and Vegetation Assessment report (Appendix H3).

The surveys were planned and implemented as far as practicable in accordance with the EPA Position Statement No. 3 Terrestrial Biological Surveys as an Element of Biodiversity Protection (EPA 2002b) and EPA Guidance Statement No. 51 Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia (EPA 2004b). The autumn 2008 and spring 2010 surveys built upon the baseline botanical information acquired in autumn 2002.

EPA Guidance Statement 51 advises that surveys should be conducted after the season contributing the most amount of rainfall to the area. Based on historic rainfall patterns, April was considered to be the most appropriate month for the 2008 survey. The Wingellina area experiences an arid climate with high inter-annual and inter-seasonal variability in rainfall, however the wettest months are typically November to March (Appendix H3).The DEC (now DPaW) advised that April was an appropriate time to undertake the survey contingent on adequate summer rains and supported the proposed survey to be undertaken in April 2008 (W. Thompson, DEC, pers. comm., September 2007).

The HGM Maunsell survey in autumn 2002 recorded a total of 188 vascular plant taxa from 87 genera and 37 families. In comparison, the Outback Ecology survey in autumn 2008 recorded a total of 100 taxa from 40 genera and 24 families. The difference in species diversity between these surveys suggested that low rainfall may have impacted on the autumn 2008 survey results; note that in the three months prior to the April 2008 survey below average rainfall was recorded in the region. In view of this a second survey with the same objectives was undertaken by Outback Ecology in spring 2010 (Appendix H3). Above average winter and spring rainfall was received prior to this later survey.

In light of the above, the results from autumn 2008 and spring 2010 surveys were aggregated and used to complete the flora and vegetation impact assessment for the proposed mining area.

11.1.1.2 Borefield and pipeline route

The following vegetation surveys have been completed within the proposed borefield area (tenement L69/12) and associated pipeline route:

- Outback Ecology (2008c) - Flora and Fauna Desktop Study of Tenement L69/12 conducted in 2008 (Appendix H4);
- Outback Ecology (2011a) - Level 1 Flora and Vegetation Assessment of the Wingellina Borefield in the period 4 – 9 May 2011 (Appendix H5);
- Outback Ecology (2012a) - Level 1 Flora and Vegetation Assessment of the Wingellina Borefield, involving a targeted search for conservation significant flora in proximity to proposed drill pads, associated drill line tracks and access track within the Wingellina borefield licence in the period 19-22 October 2011 (Appendix H6); and
- Outback Ecology (2011b) - Level 1 Flora and Vegetation Assessment of the Wingellina Borefield Pipeline in the period 23-26 October 2011 (Appendix H7).

The surveys were planned and implemented as far as practicable in accordance with the EPA Position Statement No. 3 Terrestrial Biological Surveys as an Element of Biodiversity Protection (EPA 2002b) and EPA Guidance Statement No. 51 Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia (EPA 2004b). The survey areas included an approximately 30 km long section and 80 km section of the Tjuntjuntjarra Track (being confined to the vegetation up to 30 m from the roadside), as well as three areas within the tenement L69/12 including (Appendix H5):

- An access track;
- A drill line track; and
- 11 drill pads along the drill line track, each of size 20 m by 10 m.

In response to a clearing permit condition (CPS4523/1) for water exploration drilling, Outback Ecology also undertook a survey for Declared Rare and Priority flora species within the access track, drill line track and drill pad areas (Appendix H6).

11.1.1.3 Infrastructure and Transport Corridors

To date no off-site infrastructure and transport corridors (excluding the borefield pipeline route) have been subject to vegetation and flora assessments. These areas will be surveyed as part of the Definitive Feasibility Study (DFS), following the selection of preferred infrastructure and transportation routes.

11.1.1.4 Post survey review and analysis

To assist in the consolidation of the findings from the various Project area flora and vegetation surveys (Appendices H1 – H7), an additional assessment was completed by Outback Ecology in 2015 (Appendix H8) in order to:

- Review the delineation of vegetation communities in the proposed mining area, borefield area and pipeline route based on multivariate statistical analysis;
- Evaluate the broader local and regional scale representation of these communities; and
- Review of the list of taxa identified in the completed surveys to review species/taxon identifications, and identify range extensions and their significance.

The assessment identified 11 floristic super groups across the survey areas (pooled dataset) differentiated by landforms, soils and dominant taxa. Additional comparison of species records against current flora databases for the broader region[2] was also completed. A detailed description of the methodology is provided in Appendix H8.

11.2 Mine Site

11.2.1 Existing Environment

The proposed mining area is located in the Mann-Musgrave (CR1) subregion of the Central Ranges Bioregion of the Interim Biogeographic Regionalisation for Australia (or IBRA) (Thackway and Cresswell 1995). The Mann-Musgrave subregion is located in WA and the southwest corner of the NT and is characterised by a high proportion of Proterozoic ranges (both volcanic and quartzites) and derived soil plains, interspersed with red Quaternary sandplains with some Permian exposure (Graham and Cowan 2001). The sandplains support low open woodlands of either Desert Oak or Mulga over *Triodia basedowii* hummock grasslands, while low open woodlands of Ironwood and Corkwoods over tussock or hummock grasses often fringe the ranges. The ranges support mixed wattle scrub or *Callitris glaucophylla* woodlands over hummock and tussock grasslands.

[2] WA Herbarium Florabase and Australia's Virtual Herbarium (AVH).

11.2.2 Vegetation Communities

A total of 13 vegetation communities were identified in the proposed mining area, based on consideration of vegetation structure, dominant species composition and landform (plains; slopes and hilltops/ridgelines) (Appendix H3; Appendix H8).

Seven communities occurring on plains were identified consisting of:

- 3a. Open Low Woodland of *Acacia aneura* and *A. pruinocarpa* over Hummock Grassland;
- 3b. Open Low Woodland of *Acacia aneura* over Low to Tall Shrubland;
- 4a. Open Low Mallee Woodland *of Eucalyptus socialis* and/or *E. gamophylla*;
- 5a. Sparse Tall Shrubland of *Acacia aneura* over a Mitchell Grass Tussock Grassland;
- 5b. Sparse Tall Shrubland of *Acacia aneura* over *Aristida* Tussock Grassland;
- 8. Open Low Mallee Woodland of *Eucalyptus socialis* or *E. gamophylla*; and
- 9. Sparse Low to Open Tall Shrubland of *Senna artemisioides*.

Five communities occurring on slopes were identified consisting of:

- 1a. Open Low Woodland of *Eucalyptus socialis* and/or *E. gypsophila*;
- 2a. Open Mid Mallee Woodland of *Eucalyptus socialis* and/or *E. gypsophila*;
- 2b. Open Mid Mallee Woodland of *Eucalyptus socialis* and/or *E. gypsophila* over Shrubland;
- 4b. Open Low Woodland of *Eucalyptus gamophylla* and *Corymbia eremaea*; and
- 6a. Low Mallee Woodland of *Eucalyptus socialis* and *E. Gypsophila* (Outback Ecology 2011) (Outback Ecology 2011).

One community occurred on hill tops and ridgelines (Community 7. Sparse Tall Shrublands of *Hakea lorea*). This landform type occurred in southern portions of tenement E69/535 and is considered to be locally significant.

The mapped distribution of these vegetation communities together with the locations of survey quadrat and relevé sites are shown in Figure 11.1. Based on multivariate statistical analysis of vegetation community type floristics and broad-scale vegetation mapping (Beard, 1974) and the land system mapping (DOLA, 1994), all of the mapped vegetation communities in the proposed mining area are considered to be present in the surrounding region (Appendix H8). None of the mapped vegetation communities are considered to be locally or regionally significant.

11.2.3 Vegetation Condition

Vegetation condition across the majority of the proposed mining area was generally rated as good to excellent to pristine condition, with localised areas that were more degraded (Appendices H2 and H3). Vegetation communities in the northern portions of the survey area exhibited recent impacts from fire and localised invasion by **Cenchrus ciliaris* (Buffel Grass).

11.2.4 Flora

A total of 324 species were recorded in the combined April 2008 and October 2010 surveys of the proposed mining area, representing 45 families and 130 genera (Appendix H3). Dominant families included Poaceae (55 taxa), Fabaceae (54 taxa), Chenopodiaceae (31 taxa), Malvaceae (29 taxa) and Scrophulariaceae (17 taxa). Dominant genera included *Acacia* (27 taxa), *Eremophila* (15 taxa), *Senna* (10 taxa), *Eucalyptus* (11 taxa), *Sclerolaena* (9 taxa), *Solanum* (9 taxa) and *Ptilotus* (8 taxa).

The floristic composition of the vegetation is typical of rocky and arid central Australian habitats, particularly with respect to the high number of Grasses, Eremophilas, Malvaceae and Eucalypts. The relatively high number of Asteraceae is indicative of good winter and spring rainfall prior to the 2010 survey.

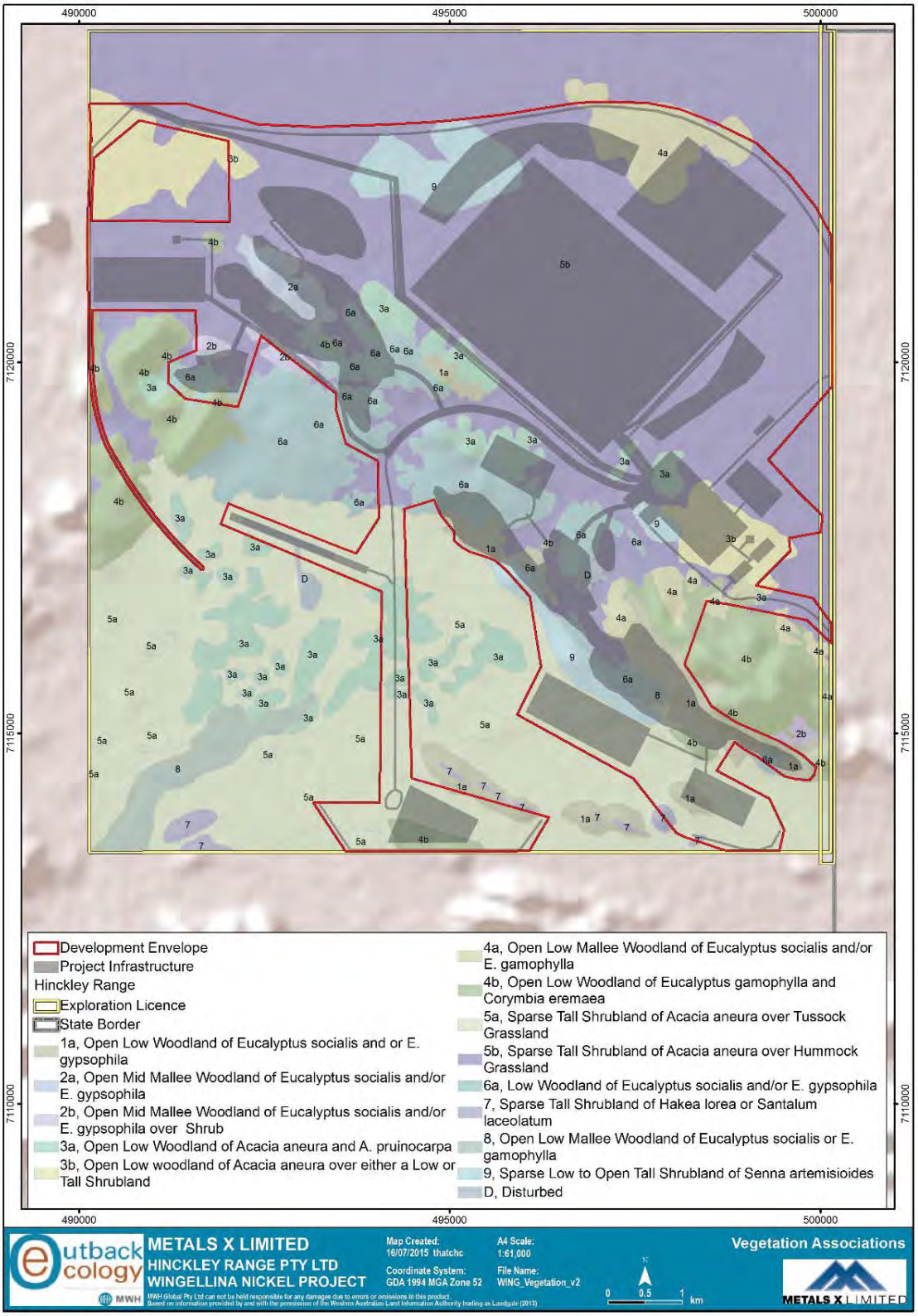

Figure 11.1 Vegetation communities in the proposed mining area

11.2.4.1 Declared Rare Flora and Priority Species

No Declared Rare Flora listed under the WC Act or Threatened species listed under the EPBC Act were identified in desktop assessments and/or field surveys of the proposed mining area. Four Priority species recognised by the DPaW were recorded in the October 2010 survey including:

- *Calotis latiuscula* (Priority 3);
- *Euphorbia inappendiculata* (Priority 1/2);
- *Goodenia lunata* (Priority 1); and
- *Menkea lutea* (Priority 1).

The distributions of these species within the surveyed area are shown in Figure 11.2. Note that with the exception of records from the south east corner of tenement E69/535 (*Calotis latiuscula* and *Menkea lutea*), all records were from areas outside the proposed development envelope.

Goodenia lunata, Euphorbia inappendiculata and *Calotis latiuscula* are common (and have no conservation rating) in South Australia and/or Northern Territory. All recorded occurrences of these species were in the southern portion of the surveyed area outside the proposed infrastructure footprint. Further descriptions each of these species are provided as follows.

***Goodenia lunata* (Priority 1):** *Goodenia lunata* is slender, erect or ascending perennial herb to 0.25 cm high with yellow flowers. *G. lunata* can be found in a variety of habitats from salt lake margins to Eucalyptus woodlands. Only three collections of *G. lunata* have been made in WA, including two from the Central Ranges bioregion north of the Project area and one from Halls Creek to the north of the State. Several collections, however, have been made from Queensland and also the Northern Territory, suggesting that its distribution may be under represented.

***Menkea lutea* (Priority 1):** *Menkea lutea* is an erect or prostrate annual, herb with yellow flowers. It is recorded as occurring on red loam soils. Four collections of *M. lutea* have been made in Western Australia in the Central Ranges bioregion, specifically in the Wingellina and Blackstone Range areas. It is also known from multiple locations in the northwest part of South Australia.

M. lutea was recorded in the low-lying southern portions of the survey area and the population size was estimated at over 1,000 individuals. Small numbers of *M. lutea* individuals were recorded within the accommodation village disturbance footprint, however extensive populations of this species were also observed outside of the proposed infrastructure footprint

***Calotis latiuscula* (Priority 3):** *Calotis latiuscula* is an erect herb to 0.5 m in height with yellow flowers, flowering from June to October. This species is noted as occurring on sand and loamy soils over a variety of habitats including; rocky hillsides, floodplains, rocky creeks and river beds. It has a wide distribution, and is

found in the Pilbara, Great Sandy Desert and Central Ranges bioregions within Western Australia. It is also known to occur within the Northern Territory.

Individuals of *C. latiuscula* were recorded in two locations in southern portions of the survey area. Small numbers of *C. latiuscula* individuals were recorded within the accommodation village disturbance footprint.

***Euphorbia inappendiculata* (Priority 1/2):** This is a low, spreading procumbent herb to 0.4 m in height that typically grows in clay soils amongst broken rocky screes. *E. inappendiculata* is widespread in South Australia and the Northern Territory, however in Western Australia *E. inappendiculata* is currently known only from the central Pilbara region of Western Australia. Since the time of the survey, two priority taxa within this species have been classified including *Euphorbia inappendiculata* Domin var. *inappendiculata* (Priority 2) and *Euphorbia inappendiculata* var. *queenslandica* Domin (Priority 1).

One individual of *E. inappendiculata* was putatively recorded outside the western boundary of tenement E69/535; which constitutes a range extension of approximately 1,100 km south-east of other known populations of this species.

Based on database searches, literature review, available habitat and field survey, additional Priority species considered likely or possible to occur in the broader Project area include *Acacia calcicola* (P4), *Eucalyptus sparsa* (P3), *Euphorbia parvicaruncula* (P1), *Lythrum paradoxum* (P2), *Teucrium grandiusculum* subsp. *grandiusculum* (P2) and *Vittadinia pustulata* (P3) (Appendix H8). However, the habitat types preferred by these species are not extensive within the proposed mining area development envelope.

11.2.4.2 Range Extensions

Based on the post survey assessment 32 taxa records from the proposed mining area considered to represent range extensions (Appendix H8). Of these, 20 were considered to have a high or medium level of significance based on consideration of their regional scale distributions including:

- *Acacia ampliceps;*
- *Acacia synchronicia;*
- *Aristida burbidgeae;*
- *Astrebla elymoides;*
- *Atriplex semibaccata;*
- *Corymbia hamersleyana;*
- *Digitaria ctenantha;*
- *Dodonaea lanceolata;*
- *Dodonaea lobulata;*
- *Eragrostis desertorum;*

- *Eucalyptus sheathiana;*
- *Euphorbia inappendiculata* (P1/2 – see above);
- *Hibiscus brachysiphonius;*
- *Hibiscus coatesii;*
- *Maireana erioclada;*
- *Paraceterach muelleri;*
- *Sida trichopoda;*
- *Swainsona campylantha;*
- *Triodia lanigera; and*
- *Triodia secunda.*

This finding is attributed to the limited number of flora and vegetation surveys that have been completed in the broader region and inland Australia generally (i.e. the range extensions are considered to reflect knowledge gaps in species distributions).

11.2.4.3 Threatened and Priority Ecological Communities

No Threatened Ecological Communities (TECs) or Priority Ecological Communities (PECs) were identified within the proposed mining area, nor are they considered likely to occur (Appendix H3).

11.2.4.4 Introduced Species/Weeds

Eight introduced species, **Cenchrus ciliaris* (Buffel Grass), **Cenchrus pennisetiformis* (Cloncurry Buffel Grass), **Acetosa vesicaria* (Ruby Dock), **Capsella bursa-pastoris* (Shepherd's Purse), **Malvastrum americanum* (Spiked Malvastrum), **Citrullus colocynthis* (Camel Melon), **Citrullus lanatus* (Pie Melon) and **Tribulus terrestris* (Caltrop) were recorded within the proposed mining area. *Portulaca oleracea* (Common Purslane) was also recorded. This species is considered in Western Australia to be introduced (DEC 2011) but is indigenous in South Australia (Barker et al. 2005). None of these species are Declared Plants under the *Agriculture and Related Resources Protection Act 1976* (WA). However, eight are classified as 'Environmental Weeds' by the Environmental Weed Strategy for Western Australia (WA Department of Environment and Conservation [DEC] 1999) (Outback Ecology 2011). **Cenchrus pennisetiformis* (Cloncurry Buffel Grass) has not previously been recorded from Western Australia but is known from arid parts of South Australia.

The environmental weed **Cenchrus ciliaris* (Buffel Grass) was located throughout the north-eastern sections of the proposed mining area, and recorded in 15 quadrats and 12 relevé sites in this area. Low density, scattered occurrences of the remaining weed species were detected in the survey area. This is considered to be a priority weed species for monitoring and management in the Project area (further discussed in Section 11.5).

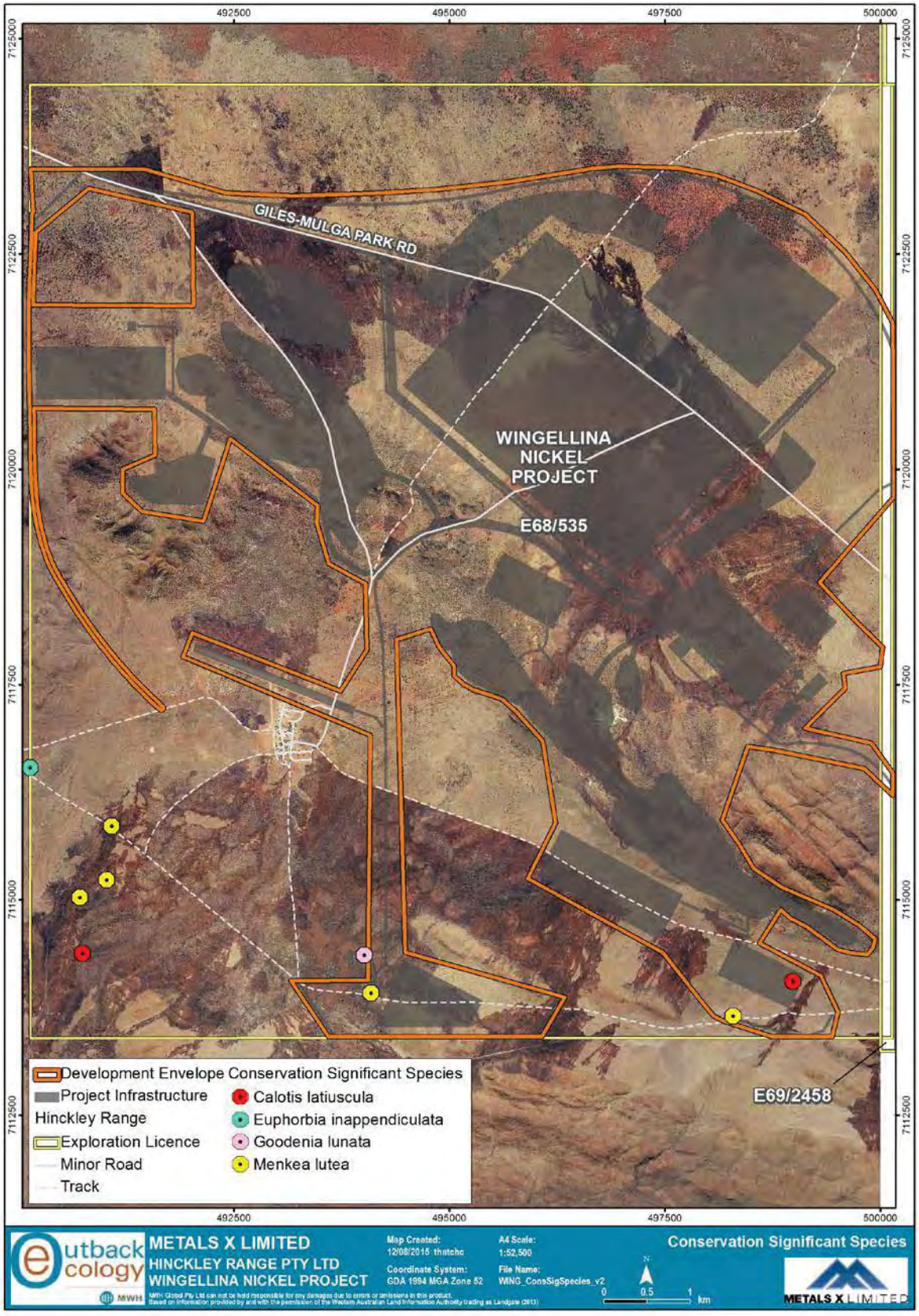

Figure 11.2 Conservation significant flora recorded in the proposed mining area in October 2010

11.3 Borefield and pipeline route

11.3.1 Existing Environment

The Central Officer Basin borefield lies within the Eastern subregion (GVD3) of the Great Victorian Desert biogeographic region (Thackway and Cresswell 1995). The eastern section of GVD 3 is underlain by Devonian sediments of the Gunbarrel Basin, with extensive sandplains of deep Quaternary Aeolian sands (Graham and Cowan 2001). Major landforms of the region consist of salt lakes and valley floors with lake derived dunes. Sand plains can also be found with extensive dunes running east-west, and occasional outcropping (breakaways) and quartzite hills provide minor relief. The vegetation of the region is primarily a tree steppe of *Eucalyptus gongylocarpa*, Mulga and *E. youngiana* over hummock grassland dominated by *Triodia basedowii* on the aeolian sands. *Acacia* spp., dominate the colluvial soils with *Eremophila* and *Santalum* spp. forming the understorey. Halophytes are confined to edges of salt lakes and saline drainage systems.

11.3.2 Vegetation Communities

11.3.2.1 Borefield area

Six vegetation communities were identified in surveys of the proposed borefield area, based on consideration of vegetation structure, dominant species composition and landform (Appendix H6):

- 1. Marblegum (*Eucalyptus gongylocarpa*) Low Open woodland on Broad Sandy Ridges.
- 2: *Eucalyptus oxymitra* ± Ooldea Mallee *(E. youngiana*) Very Open Shrub Mallee over *Aluta maisonneuvei* and *Thryptomene longifolia* Open Shrubland over *Triodia basedowii* (Very) Open Grassland.
- 3. *Eucalyptus glomerosa* and/or *E. gamophylla* ± *E. youngiana* (Very) Open Shrub Mallee over *Acacia ligulata* and *Acacia melleodora* or *Eremophila forrestii* (Low) Open Shrubland over *Triodia basedowii* Grassland. This community grades into *Triodia basedowii* Grassland with emergent mallee and mulga.
- 4a. Mulga (*Acacia aneura*) Tall (Open) Shrubland with a Tussock Grass Understorey of *Triodia basedowii*.
- 4b. *Acacia aneura* Tall Shrubland over *Eremophila latrobei* Low Open Shrubland over *Eragrostis eriopoda*, *Aristida holathera*, ± *Eriachne mucronata* (Very Open) Grassland.
- 5. Inland Red Mallee (*Eucalyptis socialis* subsp. *eucentrica*) Very Open Shrub Mallee with Tussock Grass Understorey of *Triodia scariosa*.

Vegetation community VC2 is closely related to vegetation community Group 26 (Umbrella Bush Dune Shrubland) described in Robinson et.al (2003) as widespread in the Anangu Pitjantjatjara Lands of North Western South Australia.

Vegetation community VC3 is also similar to a community described in Robinson et al. (2003), namely Group 27 (Hard Spinifex Communities on Sand Plains and Dunes) which is considered widespread in the Anangu Pitjantjatjara Lands of north western South Australia.

Vegetation community VC4a was considered widespread in the Great Victoria Desert of Western Australia by Beard (1974).

Vegetation community VC4b is conserved in the Unnamed Conservation Park in South Australia (Davies 1982, 1986, Neagle 1995). Robinson et al. (2003) indicate that a closely related vegetation community Group 29 (Mulga Woodland) is widespread in the Anangu Pitjantjatjara Lands of north-western South Australia.

Vegetation community VC5 appears to be closely related to community Group 22 (Spinifex Hummock Grassland on Limestone Plains), described in Robinson et al. (2003) and is moderately widespread in the Anangu Pitjantjatjara Lands of North Western South Australia. This community is also the habitat of the undescribed taxon *Goodenia* sp. *affin*. *quasilibera* (L. Ransom 868) recorded in the 2011 borefield area surveys.

11.3.2.2 Based on multivariate statistical analysis of vegetation community type floristics and broad-scale vegetation mapping (Beard, 1974) and the land system mapping (DOLA, 1994), all of the mapped vegetation communities in the proposed borefield area are considered to be present in the surrounding region (Appendix H8). None of the mapped vegetation communities are considered to be locally or regionally significant.

Ten vegetation communities were identified in surveys of the proposed pipeline route, based on consideration of vegetation structure, dominant species composition and landform (Appendix H7):

- 1. Mulga (*Acacia aneura*) and Harlequin Fuchsia Bush (*Eremophila duttonii*) Tall (Open) Shrubland with a very sparse dwarf shrub understorey dominated by *Ptilotus obovatus* and a mid-dense tussock grass understorey dominated by *Aristida contorta*, *Enneapogon avenaceus* and *E. polyphyllus*.
- 2. Porcupine Grass (*Triodia scariosa*) Grasslands with a very sparse dwarf shrub understorey dominated by *Ptilotus obovatus.*
- 3. Mulga (*Acacia incurvaneura*) Tall Open Shrubland, over very sparse low-shrub stratum of *Eremophila latrobei* and *Ptilotus obovatus*, and a mid-dense tussock grass understorey dominated by *Eriachne helmsii*, *Thyridolepis xerophila*, *Triodia scariosa*, *T. pungens* and *Enneapogon polyphyllus.*
- 4. Shiny-pod Wattle (*Acacia pachyacra*) Tall Open Shrubland, over very sparse low-shrub stratum of *Senna pleurocarpa*, and a mid-dense tussock grass understorey dominated by *Aristida jerichoensis*, and *Thyridolepis xerophila*.
- 5. Mulga (*Acacia aneura*) Low (Open) Woodland, over very sparse dwarf shrub stratum of *Sclerolaena convexula*, and a sparse tussock grass understorey dominated by *Eragrostis eriopoda*, *Triodia pungens*, *Enneapogon avenaceus*.

- 6. Red Gum (*Eucalyptus camaldulensis*) Open Woodland, over very sparse shrub stratum of *Eremophila longifolia*, and a mid-dense tussock grass/sedge understorey dominated by *Themeda avenaceus* and *Fimbristylis dichotoma*.
- 7. Cork-barked Hakea (*Hakea lorea* subsp. *suberea*) (with or without *Acacia aneura*) Low Open Woodland, over very sparse low shrub stratum of *Senna pleurocarpa* and a sparse tussock grass understorey dominated by *Themeda triandra* and *Cymbopogon obtectus*, and very-sparse dwarf-shrub layer dominated by *Sclerolaena convexula*, *Sida fibulifera*.
- 8. Rattle-pod Grevillea (*Grevillea stenobotrya*) (with or without *Acacia melleodora*, *Acacia ligulata*) Open Shrubland, over sparse low shrub stratum of *Aluta maisonneuvei*, and a sparse hummock grass understorey dominated by *Triodia basedowii*.
- 9. Yellow Flame Grevillea (*Grevillea eriostachya*) (with or without *Acacia pachyacra*) Open Shrubland (with emergent *Acacia coriacea*), over sparse tussock grass understorey dominated by *Triodia pungens*, *T. basedowii* or *Triodia schinzii*.
- 10. Sharp-capped Mallee (*Eucalyptus oxymitra*) and/or Blue Mallee (*E. gamophylla*) Very Open Shrub Mallee over sparse tussock grass understorey dominated by *Triodia schinzii*.

Of these, community type 5 was the most prevalent and community types 1, 8, 9 and 10 were also relatively extensive. Community type 6 has a restricted distribution associated with ephemeral drainage lines, and is considered to be highly susceptible to invasion by Buffel Grass (Outback Ecology 2012b).

Based on multivariate statistical analysis of vegetation community type floristics and broad-scale vegetation mapping (Beard, 1974) and the land system mapping (DOLA, 1994), all of the mapped vegetation communities in the proposed pipeline route area are considered to be present in the surrounding region (Appendix H8). None of the mapped vegetation communities are considered to be locally or regionally significant.

11.3.3 Vegetation Condition

The condition of vegetation in the Central Officer Basin borefield area was rated as excellent to pristine in the completed surveys (Appendices H5, H6 and H7).

11.3.4 Flora

A total of 163 taxa from 32 families and 87 genera were identified during the May 2011 flora and vegetation surveys of the borefield area (Appendix H5).

A total of 180 taxa from 35 families and 102 genera were identified during the October 2011 flora and vegetation surveys of the pipeline route (Appendix H7).

11.3.4.1 Undescribed Species

Of note was the discovery of a probable new undescribed species plant: *Goodenia* sp. *affin*. *quasilibera* (L. Ransom 868), recorded during the May 2011 survey. Two populations of this species were found, both confined to calcrete areas (Vegetation Community 5) (Outback Ecology 2011b). This taxon was again recorded during the October 2011 survey, with five populations (totalling 98 plants) found within 10 m of the proposed borefield access road.

11.3.4.2 Disjunct Populations

Two species recorded in the survey area appear to represent disjunct populations well outside their normal distributions. Fifty plants of Harrow Wattle (*Acacia acanthoclada*) were found in flat sandy plain mallee (Vegetation Community 3), while Thrytomene (*Thrytomene longifolia*) was found to be dominant on the crest of high dunes in Vegetation Community 2 (Outback Ecology 2011b).

11.3.4.3 Declared Rare Flora and Priority Species

No DRF listed under the WC Act, or threatened flora species listed under the EPBC Act, the South Australian *National Parks and Wildlife Act 1972* or the Northern Territory's *Territory Parks and Wildlife Conservation Act 2000*, were recorded within the area during the May 2011 or October 2011 surveys. Based on the completed field surveys, together with a habitat assessment of the likely occurrence of these species, none are expected to occur in the borefield area.

Priority species recognised by the DPaW recorded within the borefield area and access track survey area include:

- *Neurachne lanigera* (Priority 1);
- *Aristida jerichoensis* var. *subspinulifera* (Priority 1);
- *Calotis latiuscula* (Priority 3);
- *Goodenia modesta* (Priority 3); and
- *Stackhousia clementii* (Priority 3).

Priority species recorded along the pipeline route include:

- *Aristida jerichoensis* var. *subspinulifera* (Priority 1);
- *Calotis latiuscula* (Priority 3);
- *Goodenia modesta* (Priority 3); and
- *Stackhousia clementii* (Priority 3).

Brief descriptions of these species are provided below, except for *Calotis latiuscula*, which is described in Section 11.2.4.

***Neurachne lanigera* (Priority 1):** This species occurs in South Australia where it is listed as Rare (Barker et al. 2005). A number of plants were found in Mulga (*Acacia aneura*) Tall Open Shrubland over *Triodia basedowii* (Vegetation Community 4a). Solitary plants were also found in Marble gum (*Eucalyptus gongylocarpa*), Low Open Woodland (Vegetation Community 1) and in Mulga (*Acacia aneura*) Tall Open Shrubland.

During the October 2011 survey *Neurachne lanigera* (previously found along the Tjuntjuntjarra Track, within 2 km of the northern end of the Study area in the May 2011 survey) was not found on or within 10 metres of the proposed drill pads, drill line or access road.

***Aristida jerichoensis* var. *subspinulifera* (Priority 1):** *Aristida jerichoensis* var. *subspinulifera* is a compactly tufted perennial, which is grass-like or herb, from 0.3 to 0.8 m in height that occurs on hardpan plains.

Populations of this species were recorded in the borefield study area during the May and October 2011 surveys.

***Stackhousia clementii* (Priority 3):** *Stackhousia clementii* is a dense broom-like perennial herb, growing to 0.45 m in height. This species is found in a variety of settings including shallow skeletal sand on calcrete platforms, soft, silty saline soil over limestone, drainage tract woodland, saline playa in red-brown soil with gypsum, Kopi dunes and watercourses.

One individual was located within the original drill line route in the October 2011 survey (Outback Ecology 2012a).

***Goodenia modesta* (Priority 3):** *Goodenia modesta* is a spreading herb reaching 0.5 m in height. Recordings of the species have been made in the Kimberley and Pilbara.

11.3.4.4 Range Extensions

Based on the post survey assessment two taxa records from the proposed borefield area considered to represent range extensions (Appendix H8) including *Thryptomene longifolia* and *Neurachne lanigera* (P1 – see above). The identification of *Thryptomene longifolia* is notable as it has not previously been recorded in Western Australia, with the nearest known population occurring in South Australia approximately 230 km to the south-east. The range extension for this species is considered to be significant.

11.3.4.5 Threatened and Priority Ecological Communities

No vegetation communities conforming to recognised TECs or PECs in Western Australia were identified during the desktop survey or field surveys.

11.3.4.6 Introduced Species/Weeds

One weed of significance, **Cenchrus ciliaris* (Buffel Grass), was recorded during the May 2011 Outback Ecology survey, and was again recorded during the October 2011 survey along the edges of the Tjuntjuntjarra Road along with **Acetosa vesicaria* (Ruby Dock). Maps showing the locations of these records are provided in Appendix B.

Additional introduced or putative weed species recorded in the October 2011 survey included **Sonchus oleraceus* and *Portulaca oleracea*.

11.4 Impacts

11.4.1 Construction Impacts

Potential impacts on flora and vegetation resulting from Project construction activities include:

- Clearing of native vegetation;
- Disturbance of conservation significant flora species and communities;
- Introduction and/or spread of weeds;
- Increased fire risk;
- Hydrological changes;
- Smothering by dust; and
- Vegetation health decline associated with the use of brackish water for dust suppression.

11.4.1.1 Clearing of Native Vegetation

Mining area

It is estimated that up to 2,761 ha of native vegetation will be cleared (i.e. directly disturbed) within the proposed mining area (Table 11.1); within a defined development envelope of 5,875 ha. This equates to an upper limit of approximately 24.9% of vegetation within tenement E69/535. There are 13 vegetation communities within the proposed mining area associated with three landscape positions (plains, slopes and hill top/ridge lines). Of the three landscape positions within the proposed mining area, 25.1% of the plains vegetation, 23.7% of the slopes vegetation and 0.5% of the hill top/ridge lines vegetation is within the proposed disturbance footprint. The proposed clearing footprint also includes approximately 17 ha of existing disturbed land.

A large proportion of the proposed clearing (approximately 1,794 ha) will be confined to vegetation community 5b: Sparse Tall Shrubland of *Acacia aneura*; equating to 36.8% of the mapped extent of this community. Approximately 61.3% of the mapped extent of vegetation community 2a: Open Mid Mallee Woodland of *Eucalytpus socialis* and/or *E. gypsophila* is within the clearing footprint. Less than

40% of the mapped extent of all other vegetation communities occurs within the clearing footprint. The majority (i.e. >99%) of locally significant vegetation community 7: Sparse Tall Shrubland of *Hakea lorea* will be avoided.

The 5,875 ha development envelope encompasses greater than 50% of the mapped area of the following vegetation communities (Table 11.1):

- 1a: Open Low Woodland of *Eucalyptus socialis* and/ or *E. gypsophila* (65.7%);
- 2a: Open Mid Mallee Woodland of *Eucalytpus socialis* and/or *E. gypsophila* (99.8%);
- 3b: Open Low woodland of *Acacia aneura* over either a Low or Tall Shrubland (53.3%);
- 4a: Open Low Mallee Woodland of *Eucalyptus socialis* and/or *E. gamophylla* (82.8%);
- 5b: Sparse Tall Shrubland of *Acacia aneura* over *Aristida* Tussock Grassland (68.6%);
- 6a: Low Mallee Woodland of *Eucalyptus socialis* and *E. gypsophila* (61.2%); and
- 9: Sparse Low to Open Tall Shrubland of *Senna artemisioides* (96.8%).

Wherever practicable clearing in these vegetation communities will be minimised.

Borefield and pipeline route

The overall clearing footprint in the borefield area will be minimal. Clearing requirements are associated with upgrading the existing access road, to allow for borefield monitoring and maintenance, and construction of the production bores. While it is currently unknown how many production bores will be required; current estimates are that up to 76 bores spaced at 250 m apart will be required. Each bore will have a clearing footprint of approximately 250 m^2.

Clearing for the pipeline route will be restricted to a narrow zone adjacent to and aligned with existing roads. For each of the mapped vegetation communities along the proposed borefield pipeline route, the area within the proposed development envelope amounts to approximately 20% or less of the mapped extent of the community (Table 11.2).

11.4.1.2 Disturbance of Conservation Significant Flora Species and Communities

Mine site

Recorded occurrences of Priority species were generally outside the proposed development envelope in tenement E69/535, with the exception of some individuals of *Menkea lutea* (Priority 1) and *Calotis latiuscula* (P3) proximal to the southern boundary of the tenement (Figure 11.2). These species occur outside the proposed clearing footprint and therefore will not be significantly impacted by clearing.

Efforts will be made to detect and avoid Priority flora as a component of Project mitigation and management measures (refer to Section 11.5.2).

Additional measures to prevent indirect impacts on priority species resulting from weeds, fire, dust and the use of saline water for dust suppression will be applied (refer to Section 11.5).

Table 11.1 Summary of vegetation communities and percentage of disturbance associated with the Wingellina Nickel Project proposed mining area

Broad Floristic Formation (and Vegetation Communities)		Mapped area within tenement E69/535 (ha)	Area within Infrastructure Footprint (ha)	Proportion of mapped area within tenement E69/535 impacted (%)	Mapped area within Development Envelope (ha)	Proportion of mapped area within Development Envelope (%)
1a	Eucalyptus Open Low Woodland Open Low Woodland of *Eucalyptus socialis* and/ or *E. gypsophila*	325.8	124.2	38.1	214.2	65.7
2a	Eucalyptus Open Mid Mallee Woodland Open Mid Mallee Woodland of *Eucalytpus socialis* and/or *E. gypsophila*	76.3	46.8	61.3	76.1	99.8
2b	Eucalyptus Open Mid Mallee Woodland Open Mid Mallee Woodland of *Eucalyptus socialis* and/or *E. gypsophila* over Shrubland	49.3	8.3	16.8	22.9	46.5
3a	Mulga Open Low Woodland Open Low Woodland of *Acacia aneura* and *A. pruinocarpa*	564.8	57.8	10.2	207.3	36.7

Broad Floristic Formation (and Vegetation Communities)		Mapped area within tenement E69/535 (ha)	Area within Infrastructure Footprint (ha)	Proportion of mapped area within tenement E69/535 impacted (%)	Mapped area within Development Envelope (ha)	Proportion of mapped area within Development Envelope (%)
3b	Mulga Open Low Woodland Open Low woodland of *Acacia aneura* over either a Low or Tall Shrubland	350.7	80.5	23.0	192.49	54.9
4a	Eucalyptus Open Low Mallee Woodland Open Low Mallee Woodland of *Eucalyptus socialis* and/or *E. gamophylla*	296.7	70.6	23.8	245.5	82.8
4b	Eucalyptus Open Low Mallee Woodland Open Low Woodland of *Eucalyptus gamophylla* and *Corymbia eremaea*	684.7	43.3	6.3	147.3	21.5
5a	Mulga Sparse Tall Shrubland Sparse Tall Shrubland of *Acacia aneura over Astrebla Tussock Grassland*	2,594.2	200.9	7.8	647.8	25.0
5b	Mulga Sparse Tall Shrubland Sparse Tall Shrubland of *Acacia aneura over Aristida Tussock Grassland*	4,882.3	1794.1	36.8	3349.6	68.6

Broad Floristic Formation (and Vegetation Communities)		Mapped area within tenement E69/535 (ha)	Area within Infrastructure Footprint (ha)	Proportion of mapped area within tenement E69/535 impacted (%)	Mapped area within Development Envelope (ha)	Proportion of mapped area within Development Envelope (%)
6a	Eucalyptus Low Mallee Woodland Low Mallee Woodland of *Eucalyptus socialis* and *E. gypsophila*	740.1	213.4	28.8	453.2	61.2
7	Hakea Sparse Tall Shrubland Sparse Tall Shrubland of *Hakea lorea*	52.4	0.3	0.50	5.7	10.8
8	Eucalyptus Open Low Mallee Woodland Open Low Mallee Woodland of *Eucalyptus socialis* or *E. gamophylla*	157.9	6.9	4.40	6.94	4.4
9	Senna Sparse Low to Tall Open Shrubland Sparse Low to Open Tall Shrubland of *Senna artemisioides*	291.7	96.8	33.2	282.3	96.8
D	Disturbed	38.2	16.9	44.2	23.8	62.3
	Total	**11,105.1**	**2,760.7**	**-**	**5,875.0**	-

Table 11.2 Summary of vegetation communities and percentage of disturbance associated with the Wingellina Nickel Project proposed borefield pipeline route

Broad Floristic Formation (and Vegetation Communities)		Area within survey boundaries (ha)	Mapped area within Development Envelope (ha)	Proportion of mapped area within survey boundaries (%)
Northern survey area (Appendix H7)				
VC1	Mulga (*Acacia aneura*) and Harlequin Fuchsia Bush (*Eremophila duttonii*) Tall (Open) Shrubland with a very sparse dwarf shrub understorey dominated by *Ptilotus obovatus* and a mid-dense tussock grass understorey dominated by *Aristida contorta*, *Enneapogon avenaceus* and *E. polyphyllus*	74.3	14.8	19.9
VC2	Porcupine Grass (*Triodia scariosa*) Grasslands with a very sparse dwarf shrub understorey dominated by *Ptilotus obovatus*	12.2	2.7	21.9
VC3	Mulga (*Acacia incurvaneura*) Tall Open Shrubland, over very sparse low-shrub stratum of *Eremophila latrobe*i and *Ptilotus obovatus*, and a mid-dense tussock grass understorey dominated by *Eriachne helmsii*, *Thyridolepis xerophila*, Triodia scariosa, T. pungens and *Enneapogon polyphyllus*	1.6	0.3	20.4
VC4	Shiny-pod Wattle (*Acacia pachyacra*) Tall Open Shrubland, over very sparse low-shrub stratum of *Senna pleurocarpa*, and a mid-dense tussock grass understorey dominated by *Aristida jerichoensis*, and *Thyridolepis xerophila*	2.2	0.4	20.5

Broad Floristic Formation (and Vegetation Communities)		Area within survey boundaries (ha)	Mapped area within Development Envelope (ha)	Proportion of mapped area within survey boundaries (%)
VC5	Mulga (*Acacia aneura*) Low (Open) Woodland, over very sparse dwarf shrub stratum of *Sclerolaena convexula*, and a sparse tussock grass understorey dominated by *Eragrostis eriopoda*, *Triodia pungens*, *Enneapogon avenaceus*	299.3	59.7	19.9
VC6	Red Gum (*Eucalyptus camaldulensis*) Open Woodland, over very sparse shrub stratum of *Eremophila longifolia*, and a mid-dense tussock grass/sedge understorey dominated by *Themeda avenaceus* and *Fimbristylis dichotoma*	0.8	0.2	20.5
VC7	Cork-barked Hakea (*Hakea lorea* subsp. *suberea*) (with or without *Acacia aneura*) Low Open Woodland, over very sparse low shrub stratum of *Senna pleurocarpa* and a sparse tussock grass understorey dominated by T*hemeda triandra* and *Cymbopogon obtectus*, and very-sparse dwarf-shrub layer dominated by *Sclerolaena convexula*, *Sida fibulifera*	24.6	4.9	19.8
VC8	Rattle-pod Grevillea (*Grevillea stenobotrya*) (with or without *Acacia melleodora*, *Acacia ligulata*) Open Shrubland, over sparse low shrub stratum of *Aluta maisonneuvei*, and a sparse hummock grass understorey dominated by *Triodia basedowii*	27.5	5.4	19.8

Broad Floristic Formation (and Vegetation Communities)		Area within survey boundaries (ha)	Mapped area within Development Envelope (ha)	Proportion of mapped area within survey boundaries (%)
VC9	Yellow Flame Grevillea (Grevillea eriostachya) (with or without Acacia pachyacra) Open Shrubland (with emergent Acacia coriacea), over sparse tussock grass understorey dominated by Triodia pungens, T. basedowii or *Triodia schinzii*	105.9	21.3	20.1
VC10	Sharp-capped Mallee (*Eucalyptus oxymitra*) and/or Blue Mallee (*E. gamophylla*) Very Open Shrub Mallee over sparse tussock grass understorey dominated by *Triodia schinzii*	61.6	12.5	20.2
VC1/5	Mosaic of vegetation communities 1 and 5	6.0	1.2	20.1
VC5/7	Mosaic of vegetation communities 5 and 7	8.7	1.8	20.1
VC5/10	Mosaic of vegetation communities 5 and 10	91.8	18.3	20.0
VC8/9	Mosaic of vegetation communities 8 and 9	84.9	16.9	20.0
VC9/10	Mosaic of vegetation communities 9 and 10	15.0	3.0	20.0
VC8/9/10	Mosaic of vegetation communities 8, 9 and 10	21.9	4.5	20.6
	Sub-total (northern survey area)	**838.2**	**167.8**	-
Southern survey area (Appendix H5)				
VC1	Marblegum (*Eucalyptus gongylocarpa*) Low Open Woodland on Broad Sandy Ridges	25.0	0	0.00

Broad Floristic Formation (and Vegetation Communities)		Area within survey boundaries (ha)	Mapped area within Development Envelope (ha)	Proportion of mapped area within survey boundaries (%)
VC2	Sharp-capped Mallee (*Eucalyptus oxymitra*) ± Ooldea Mallee (*E. youngiana*) Very Open Shrub Mallee on High Dunes	30.2	1.2	4.1
VC3	Jingulu (*Eucalyptus glomerosa*) and/or Blue Mallee (*Eucalyptus gamophylla*) ± Ooldea Mallee (*E. youngiana*) Very Open Shrub Mallee grading into *Triodia basedowii* Grassland on Flat Sandy Plains	172.1	12.8	7.4
VC4a	Mulga (*Acacia aneura*) Tall (Open) Shrubland with a Tussock Grass Understorey of *Triodia basedowii* on Undulating Sandy Loam Plains	59.1	2.1	3.5
VC4a/ VC4b	Mosaic of: Mulga (*Acacia aneura*) Tall (Open) Shrubland with a Tussock Grass Understorey of *Triodia basedowii* on Undulating Sandy Loam Plains; and Mulga (*Acacia aneura*) Tall Shrubland with Hummock Grass Understorey of *Eragrostis eriopoda* and *Aristida holothera* on Loam Plains	243.7	13.0	5.4
VC5	Inland Red Mallee (*Eucalyptis socialis* subsp. *eucentrica*) Very Open Shrub Mallee with Tussock Grass Understorey of *Triodia scariosa* on Undulating Calcrete Plains	41.4	1.6	3.9
	Sub-total (southern survey area)	**571.4**	**30.7**	**-**

Borefield and pipeline route

No DRF, TEC or PEC's were recorded in surveys of the proposed borefield area and pipeline route.

A total of five Priority flora were recorded during the three surveys of the proposed borefield area and pipeline route. It is possible that Priority species individuals may occur with the proposed development envelope. Efforts will be made to detect and avoid individual plants as a component of Project mitigation and management measures (refer to Section 11.5.2). Targeted surveys for Priority flora have already been completed in the proposed borefield area, to help inform the selection of alternative routes to avoid these species (Appendix H7).

Additional measures to prevent indirect impacts on priority species resulting from weeds, fire, dust and the use of saline water for dust suppression will be applied (refer to Section 11.5).

11.4.1.3 Introduction and/or Spread of Weeds

Nine introduced species were recorded within the proposed mining area and three introduced species were recorded in the proposed borefield area and pipeline route.

Without adequate management, there is the potential for these weeds to be spread further and for new weed species to be introduced in association with vegetation clearing activities, earthmoving, topsoil management and off-road vehicle movements. Buffel Grass is particular is recognised as a highly invasive weed, with the potential to be spread by Project related activities (for example movement of vehicles between the mining area and the borefield).

11.4.1.4 Increased Fire Risk

The Project area has historically been impacted by altered fire regimes relating to local hunting practices, and the Wingellina locality remains subject to these practices. The impact of changed fire regimes is identified as a threat to the Central Ranges Bioregion (Graham and Cowan 2001). The landscape around the borefield exploration area in the Great Victoria Desert Bioregion is also subject to frequent burning as a component of land management practices.

The Project has the potential to increase the frequency and intensity of fires during construction if appropriate fire management practices are not undertaken. Habitats such as Mulga woodlands and hummock grass plains can be adversely affected by frequent burning (Appendix H2). Fire disturbance can also predispose affected to areas to colonisation by Buffel Grass and other weeds.

11.4.1.5 Dust

Dust can accumulate on the foliage of vegetation adjacent to dust source areas. In extreme cases this could potentially hinder leaf transpiration and photosynthesis, resulting in vegetation health decline. If appropriate dust management measures

are applied, these effects are expected to be highly localised and of low overall significance.

11.4.1.6 Use of Brackish Water for Dust Suppression

Surface application of saline water for dust suppression has the potential to increase the exposure of vegetation to salt loads. In extreme cases this could potentially result in vegetation health decline. Based on groundwater data from the proposed mining area, the groundwater to be used for dust suppression is likely to be mildly saline, with total dissolved solid (TDS) concentrations of approximately 1,000 – 8,000 mg/L (Rockwater Pty Ltd 2012).

11.4.1.7 Hydrological Changes

Changes to the quality and quantity of surface and groundwater flow regimes have the potential to impact the condition of surrounding flora and vegetation. Project infrastructure will be designed and constructed to minimise disturbance to the existing surface water regime. Preliminary designs indicate that up to six ephemeral drainage lines may be affected by the development footprint.

The vegetation of the ephemeral drainage lines is represented more broadly by vegetation community 8: Open Low Woodland of *Eucalyptus socialis or E. gamophylla*, which has a distribution of approximately 158 ha within the proposed mining area of which about 7 ha (4.4% of mapped extent) is located within the clearing footprint (Table 11.1). The majority of this vegetation community is located in the southwest portion of tenement E69/535 outside the development envelope. Potential effects of hydrological disturbances on this vegetation type are not considered to be significant.

11.4.2 Operational Impacts

Potential impacts on flora and vegetation associated with Project operations activities principally relate to indirect effects on vegetation. These can arise due to the following:

- Altered hydrological regimes, including sedimentation and silting from fugitive drainage;
- Smothering by dust;
- The introduction and spread of weeds;
- Altered fire regimes; and
- Unregulated vegetation clearing.

Groundwater drawdown in the proposed mining and borefield areas is not expected to have any significant effect on vegetation, as none of the vegetation communities are likely to be groundwater dependent (Appendix H3).

11.5 Management and Mitigation Measures

11.5.1 Management Objectives

Project construction and operations activities will be subject to a Flora and Vegetation Management Plan with the following objectives (Appendix B):

- Minimise vegetation clearing;
- Protect flora and vegetation of conservation significance; and
- Prevent the introduction and spread of weeds.

The Flora and Vegetation Management Plan includes monitoring and management measures that address clearing practices and threatening processes associated with weeds, fire regimes, hydrological regimes, dust and feral animals. The Plan also addresses aspects of progressive rehabilitation during the operations phase. The remainder of this section described the key elements of the Plan.

Note that post-mining management measures are addressed in the Wingellina Mine Closure Plan (Appendix J).

11.5.1.1 Clearing of Native Vegetation

In order to minimise impacts associated with clearing of vegetation, the following management actions will be undertaken:

- Minimisation of clearing footprints during final design including the avoidance of drainage line and ridgeline vegetation where possible;
- Mine planning to include progressive clearing and rehabilitation to minimise the amount of bare soil at any one time; and
- Implementation of clearing procedures to prevent accidental clearing of vegetation, including the avoidance of species of conservation significance.

A progressive rehabilitation strategy will be adopted over the operational life of the Project.

11.5.1.2 Disturbance of Significant Flora Species

Priority flora populations in the Project area will be maintained. Prior to clearing activities, Priority flora individuals will be identified and avoided where practicable.

The status of populations of Priority flora will be monitored during the construction and operational phases of the Project. This includes in particular populations of *Menkea lutea* that are at higher risk of impact from dust (i.e. close to roads).

Other threats to flora and vegetation of conservation significance including weeds, fire regimes, hydrological regimes, dust and feral animals will be managed (see below).

11.5.1.3 Introduction and/or Spread of Weeds

Weed management procedures will be adopted to manage the spread of weeds and prevent the introduction of new weeds in the Project area including:

- All vehicles arriving on-site will be subject to an inspection and wash down to remove weed seeds and/or other propagules at designated washdown locations;
- Vehicles will be confined to authorised tracks and roads;
- Weed species distributions will be mapped, and regular inspections will be undertaken to identify weed growth, and control actions implemented to prevent the spread of weed infestations;
- Feral herbivores will be excluded from the Project area, including rehabilitated sites; and
- Precautions will be undertaken during rehabilitation to prevent the spread of weeds.

Buffel Grass has been identified as a priority weed in the Project area (refer to Appendix B). Preventing the spread of Buffel Grass into the pipeline route and borefield areas is a key management objective, to be achieved through:

- Effective vehicle hygiene and quarantine for vehicles and equipment travelling between the proposed mining area, pipeline route and borefield areas; and
- Mapping, early detection and ongoing control where necessary of Buffel Grass in the pipeline route and borefield areas. This includes targeted follow up actions after rains and fire events.

11.5.1.4 Increased Risk of Fire

Fire management on site will be undertaken in accordance with safety requirements under the *Mines Safety and Inspections Act 1994* (WA) and the *Bushfires Act 1954* (WA).

A Fire Management Plan will be developed for the Project and will include development and identification of the following responses and procedures:

- Safe work procedures and permitting for welding and grinding work, designed to prevent accidental fires;
- Fire hazard procedures for mine site personnel;
- Maintenance and deployment of fire response vehicles;
- Bushfire contingency plans;
- Emergency fire response procedures; and
- Installation of fire breaks where necessary.

11.5.1.5 Dust

Dust impacts to native vegetation will be managed through the implementation of a dust suppression program, which includes spraying mine roads. Speed restrictions for light vehicles will also be enforced.

11.5.1.6 Use of brackish water for dust suppression

All access roads and haul roads will be regularly sprayed with mildly saline groundwater to minimise dust suppression. All roads will be constructed to prevent water run-off into native vegetation, e.g. bunds and sumps will be installed at appropriate locations and intervals.

11.5.1.7 Hydrological Changes

Project infrastructure will be designed and constructed to minimise disturbance to existing surface water flows while preventing the potential for flooding. Culverts will be constructed at multiple locations to aid in the maintenance of existing flows and rates and therefore minimise potential impacts to vegetation from localised flooding or drought.

Regular inspections will be undertaken to ensure that erosion is detected and controlled, and fugitive drainage lines are managed during Project operations.

11.6 Predicted Environmental Outcome

The implementation of the Project is not predicted to result in significant impacts on flora and vegetation conservation values. The Project area does not contain any DRF, TEC or PEC's.

Progressive clearing of up to 2,761 ha in the proposed mining area will be required, within a 5,875 ha development envelope. The majority of the vegetation in the proposed clearing footprint is in good to excellent to pristine condition; however the affected vegetation types are widespread outside the proposed clearing footprint. There will be minimal impact on species of conversation significance, as Priority taxa recorded in the proposed mining area will largely be avoided. Therefore the Project will not cause any significant impact upon the diversity of flora and vegetation at a local or regional scale.

Vegetation clearing of up to 211 ha will be required to establish the borefield (and associated access track) and pipeline to the proposed mining area. Clearing for the borefield is expected to be minimal, mainly consisting of a small cleared area (approximately 250 m^2) for each bore hole) and linear infrastructure corridors. Clearing for the pipeline route will be restricted to a narrow zone adjacent to and aligned with existing roads. Priority taxa recorded in the proposed borefield and pipeline route areas will largely be avoided.

Groundwater drawdown from pit dewatering is not expected to have any effect on surrounding vegetation communities, as none of these are considered to be groundwater dependent.

Other potential impacts to flora and vegetation will be managed in accordance with the Wingellina Project Flora and Vegetation Management Plan. This Plan addresses threatening processes associated with weeds, fire regimes, hydrological regimes, dust and feral animals. Prevention of the spread of the invasive weed Buffel Grass has been identified as a management priority.

Subject to the proposed mitigation and management measures, it is considered that the Project can be managed to meet the EPA's objective "*to maintain the abundance, diversity, geographic distribution and productivity of flora at species and ecosystem levels through the avoidance or management of adverse impacts and improvement in knowledge*".

CHAPTER 12

TERRESTRIAL FAUNA

12.0 TERRESTRIAL FAUNA

12.1 Assessment Approach

The terrestrial fauna values of the Project area were assessed through a combination of desktop studies, reconnaissance field surveys and comprehensive field surveys undertaken in accordance with relevant EPA principles and guidance materials for this environmental factor. The completed surveys collectively address terrestrial fauna and short range endemics (SRE) in the proposed mining and borefield pipeline and track areas. The surveys were planned and implemented as far as practicable in accordance with:

- EPA's Position Statement No. 3 *Terrestrial Biological Surveys as an Element of Biodiversity Protection* (EPA 2002b);
- Guidance Statement No. 56 *Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia* (EPA 2004c); and
- EPA Guidance Statement No 20. *Sampling for Short Range Endemic Invertebrate Fauna* (EPA 2009).

Relevant surveys conducted in the region to support this PER, include:

- Outback Ecology. (2009) Wingellina Nickel Project Terrestrial Fauna Assessment, Report prepared for Metals X Limited;
- HGM Maunsell. (2002) Wingellina Baseline Biological Survey, report prepared for Acclaim Exploration NL;
- Outback Ecology. (2011b) Wingellina Nickel Project: Proposed Borefield Drill Line Targeted Fauna Assessment, preliminary report prepared for Metals X Limited; and
- Outback Ecology (2012) Wingellina Nickel Project: Level 1 Terrestrial Fauna Assessment of the Wingellina Borefield and Borefield Pipeline Route. Report prepared for Metals X Limited.

12.1.1 Mine Site

A terrestrial fauna assessment of the proposed mining area (tenement E69/535) was completed in 2008. The overall objectives of the terrestrial vertebrate fauna assessment were to:

- Develop an inventory of terrestrial vertebrate fauna species identified from the proposed mining area, or likely to be present within the area, and characterise the habitats present;
- Assess site information in a regional context by comparisons with available data from other localities within the Central Ranges bioregion;
- Assess the potential impacts of the Project on vertebrate fauna and their habitats; and

- Provide quantitative data constituting a baseline against which future rehabilitation can be assessed and also providing a basis for future terrestrial fauna monitoring.

The assessment involved:

- A desktop study involving comprehensive database searches and a literature review of previous fauna survey work conducted within tenement E69/535, including the Wingellina Baseline Biological Survey undertaken in the period 5 - 8 April 2002 (HGM Maunsell, 2002; Appendix H1); and

12.1.1.1 Level 2 Vertebrate Fauna Survey

A Level 2 fauna survey over the proposed mining area undertaken in the period 8 to 17 April 2008 (Figure 12.1) (Outback Ecology 2009; Appendix I1).

The April 2008 survey involved a variety of sampling techniques, including systematic and opportunistic sampling in collaboration with members of the Wingellina community and Metals X field staff.

Systematic sampling was undertaken over a fixed time period in each broad fauna habitat identified in the proposed mining area. Fauna survey techniques implemented included pitfall traps, Elliott traps, funnel traps, cage traps, active searching, spotlighting, AnaBat recording of bat echolocation calls, avifauna censussing and targeted searches for species of conservation significance.

12.1.1.2 Short Range Endemic Species

In conjunction with the terrestrial fauna assessment undertaken in the April 2008 survey, a SRE invertebrate survey was also undertaken. The survey targeted invertebrate groups that have the potential for restricted ranges such as mygalomorph spiders, scorpions, pseudoscorpions and terrestrial snails. Specimens collected in the field were distributed to WA specialists from the University of Western Australia (UWA) and the WA Museum for identification.

12.1.2 Borefield and pipeline route

The following terrestrial fauna surveys have been completed within the proposed borefield area comprising portions of tenement L69/12 and the Tjuntjuntjarra Track, and pipeline route (Figure 12.2):

- Outback Ecology (2008c) - Flora and Fauna Desktop Study of Tenement L69/12 conducted in 2008 (Appendix I4);
- Outback Ecology (2012c) - Level 1 Terrestrial Fauna Assessment of the Wingellina Borefield and Borefield Pipeline Route in the period 2 to 8 October 2011 (Appendix I5); and
- Outback Ecology (2011c) - Proposed Borefield Drill Line Targeted Vertebrate Fauna Assessment in the period 16 to 22 October 2011 (Appendix I6). This assessment was undertaken in order to satisfy Condition 4 of Clearing Permit

4523/1, with the primary purpose of searching for the presence of burrows of four species of conservation significance at proposed drill pads and access tracks. These species included:

- The Greater Bilby (*Macrotis lagotis*): Listed as Vulnerable under the EPBC Act and Schedule 1 under the WC Act;
- Brush-tailed Mulgara (*Dasycercus blythi*): Listed as a Priority 4 species by the Department of Parks and Wildlife (DPaW);
- Crest-tailed Mulgara (*Dasycercus cristicauda*): Listed as Vulnerable under the EPBC Act and Schedule 1 under the WC Act; and
- Great Desert Skink (*Liopholis kintorei*): Listed as Vulnerable under the EPBC Act and Schedule 1 under the WC Act.

Targeted searches were performed for burrows, tracks and scats on foot at each proposed drill pad and on foot and by vehicle for the proposed access and drill tracks. Habitats were assessed at each targeted search location. Baited, motion-sensor cameras were also used throughout the borefield survey area.

12.2 Existing Environment

12.2.1 Mine Site

12.2.1.1 Habitats

Four broad habitats were identified over the proposed mining area. Subsequent to the Level 2 fauna survey, a desktop study defined and mapped these broad fauna habitats based on the fauna survey site descriptions (Appendix I1), existing vegetation mapping, (Outback Ecology 2015) and aerial photography interpretation. Habitat descriptions were aligned with fauna habitats identified from the borefield and pipeline route (Outback Ecology 2015). These habitats and aligned vegetation associations are considered to be well represented in the surrounding region (Outback Ecology 2009) (Appendix H8). A summary of these broad habitat types, survey sites, vegetation associations and habitat descriptions is provided in Table 12.1, and presented in Figure 12.1. Table 12.1 also presents land systems that are associated with each habitat to provide regional context. Of the three land systems that occur in the Study Area, each are well represented within the surrounding Central Ranges Bioregion.

Table 12.1 Fauna habitats within the proposed mining area

Habitat Type	Vegetation Associations		Area within Study Area (ha)	Survey Sites (Appendix I1)	Survey Site description	Land systems (ref)	Habitat Description
Mallee Woodland on Stony Slopes	1a	Eucalyptus Open Low Woodland	1618.41	Systematic sites: MWN3A MWN3B	Open Mallee woodland /spinifex	MY109 BA21 Fa34	This habitat comprised open mallee woodland of *Eucalyptus socialis*, *Eucalyptus gamophylla* to 7m high over a sparse shrubland of *Ptilotus obovartus* and *Eremophilia* spp. up to 2 m in height over a *Triodia* hummock grassland up to 0.5 m high with a cover of approximately 30%. Soils comprised of sandy clay/loam with a surface layer of gravel 1-6 cm in diameter. Land form was typically undulating. Leaf litter and woody debris were generally present beneath the large Eucalypts. This habitat tended to occur on low slopes and around the base of Rocky hills and escarpments and was in good condition.
	2b	Eucalyptus Open Mid Mallee Woodland					
	6a	Eucalyptus Low Mallee Woodland					
	8	Eucalyptus Open Low Mallee Woodland					
Rocky Hills and Escarpments	2a	Eucalyptus Open Mid Mallee Woodland	631.84	Systematic sites: MWN4B MWN4A	Rocky escarpment	MY109 BA21 Fa34	This habitat comprised outcropping escarpments commonly including large, blocky boulders 0.5-2m in size. Vegetation was relatively consistent across the habitat type, with the exception of vegetation associations on the lower slopes having a sparse overstorey of *Eucalyptus socialis*,
	4b	Eucalyptus Open Low Mallee Woodland					

Habitat Type	Vegetation Associations		Area within Study Area (ha)	Survey Sites (Appendix I1)	Survey Site description	Land systems (ref)	Habitat Description
	7	Hakea Sparse Tall Shrubland					*Eucalyptus gamophylla* and shrubland of *Acacia*, *Dodonaea*, *Sida* and *Senna*. The understory comprised of *Triodia* hummock grassland about 0.5m in height with approximately 60% cover. Leaf litter and woody debris was present beneath the Eucalypts, but was absent on the higher slopes and escarpments. This habitat occurred on the more prominent hills and associated exposed rocky escarpments within the survey area and was generally in good condition.
Mulga over Tussock Grassland	3a	Mulga Open Low Woodland	8618.59	Systematic sites: MWN1A MWN1B MWN2A MWN2B	Sparse Mulga woodland/ grasses Open Mulga woodland Sparse Mulga	MY109 BA21 Fa34	This habitat comprised open to very sparse overstorey of Mulga (*Acacia aneura* sp complex) up to 5 m in height over a mixed tussock grassland ranging between 40 and 50% cover on loamy soils. This habitat was degraded over large areas with most of the Mulga trees dead from repeated broad scale fires. Additionally, many of the remaining live trees had distinctive signs of grazing from camels, including branches
	3b	Mulga Open Low Woodland					
	5a	Mulga Sparse Tall Shrubland					

Habitat Type	Vegetation Associations		Area within Study Area (ha)	Survey Sites (Appendix I1)	Survey Site description	Land systems (ref)	Habitat Description
	5b	Mulga Sparse Tall Shrubland		MWN5A MWN5B MWN6A MWN6B Targeted site: MWN9	woodland/ grasses Open dead Mulga woodland Mulga woodland over chenopod shrubland		that had been broken down for grazing. The middle stratum was absent from this habitat and there were very limited signs of Mulga recruitment. This habitat was common within the survey area and immediate surrounds as were indicators of fire and grazing.
	9	Senna Sparse Low to Tall Open Shrubland					
Mulga-Mallee over Hummock Grassland	4a	Eucalyptus Open Low Mallee Woodland	197.99	Targeted site: MWN8	Open Mallee woodland/dense spinifex	MY109	This habitat comprised open woodland of mixed Mulga (*Acacia aneura* sp complex) and Mallee (*Eucalyptus socialis* and *E. gamophylla*) typically 4-6m higher with 20-30% cover. The middle stratum of vegetation was largely absent. The understorey predominantly consisted of hummock (*Triodia* sp.) grasses from 0.5-1m high with 60-70% cover on deep red sandy soils. Land form was a flat plain. This habitat occurred in the northern portion of the survey area and was in very

Habitat Type	Vegetation Associations		Area within Study Area (ha)	Survey Sites (Appendix I1)	Survey Site description	Land systems (ref)	Habitat Description
							good condition.
Disturbed area			38.32				Historically disturbed areas with severely degraded vegetation.
Total			**11,105.15**				

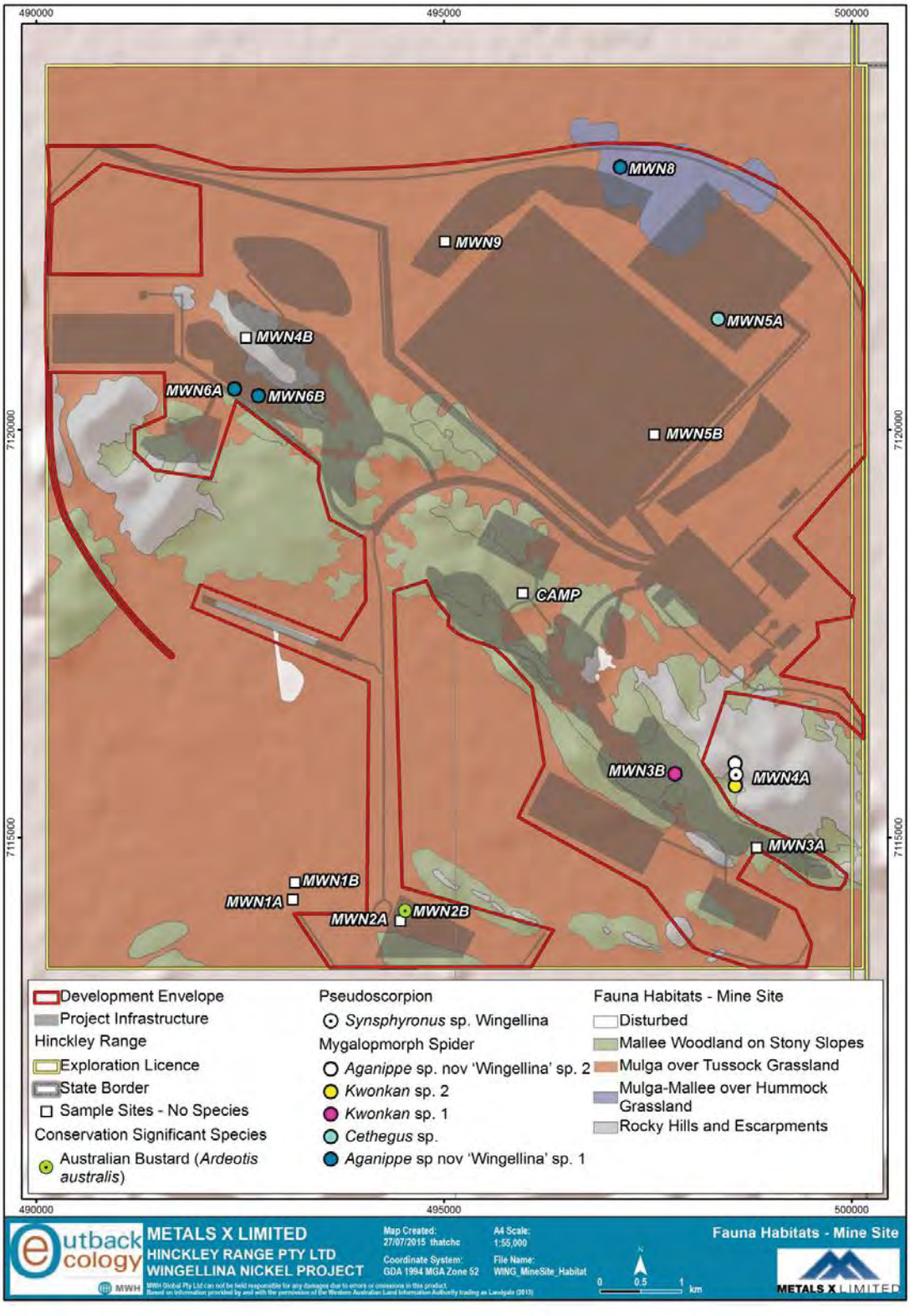

Figure 12.1 Survey locations, habitats and conservation significant fauna records from the Level 2 terrestrial fauna survey of the proposed mining area in relation to the Development Envelope and Infrastructure footprint

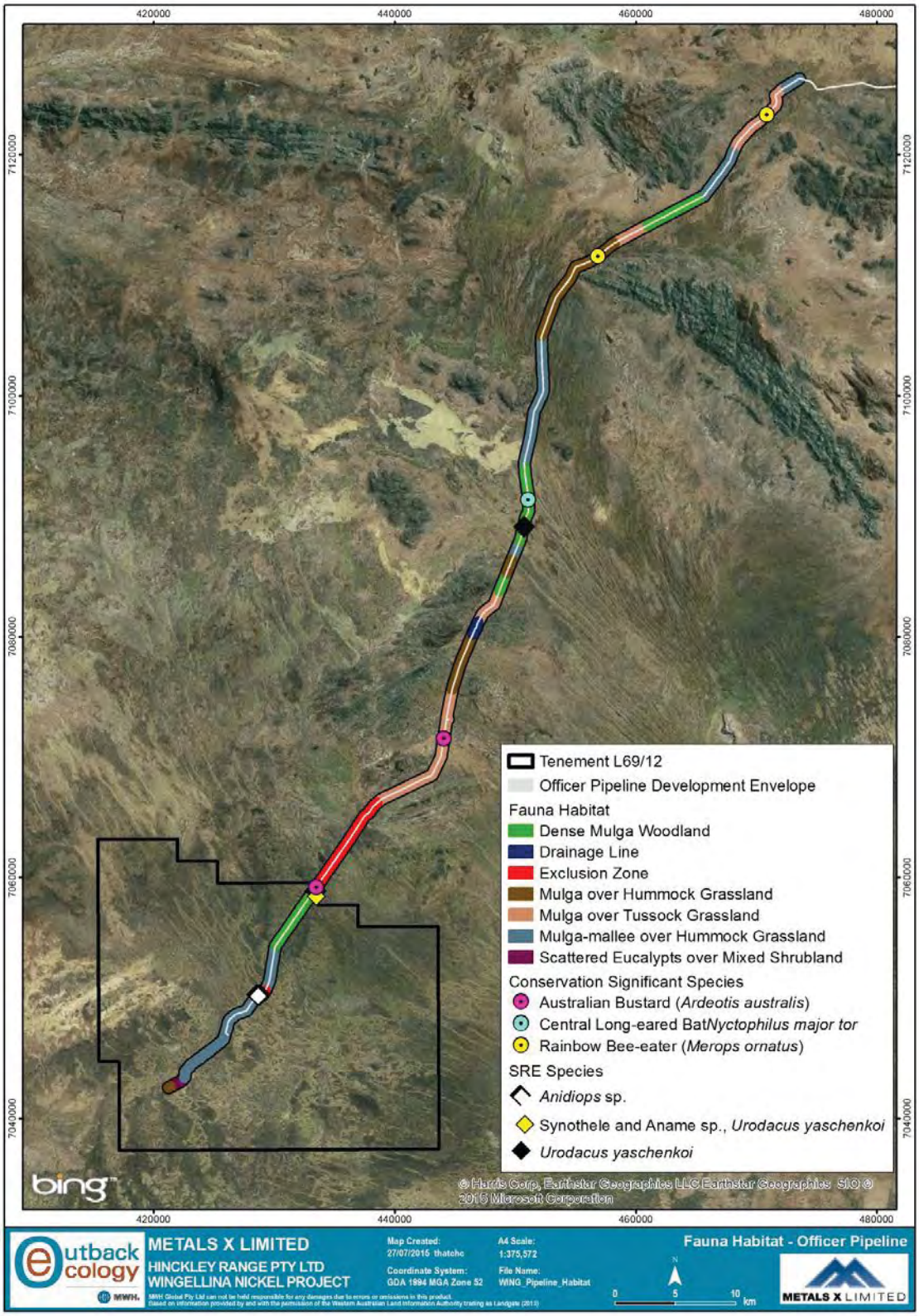

Figure 12.2 Study Area for the Level 1 terrestrial fauna survey of the proposed borefield pipeline route with habitats, records of conservation significant fauna and in relation to the Development Envelope

A total of 66 terrestrial vertebrate fauna species were recorded during the April 2008 survey including 16 mammal species, 27 reptiles and 23 bird species. In comparison, in the April 2002 survey five mammal species, 54 bird species and 10 reptile species were recorded. Results from the survey conducted in April 2008 may have been impacted by below average rainfall in the three months prior to the survey, as evidenced by nil recordings of amphibians during the survey. Amphibians only emerge in desert environments following significant rainfall events which are infrequent in the Wingellina area. Note however that the survey undertaken in April 2002, which followed above average rains, also did not record any amphibian species and concluded that the proposed mining area is largely unsuitable for frogs and few, if any, species are expected to occur (Appendix H1).

Overall species diversity in the proposed mining area was similar to other regional sites (Appendix I1). Relatively fewer bird and reptile species were recorded at Sites 4A, 4B, 5A and 5B in comparison with other sampling sites (Table 12.2). These sites also had lower animal abundances (Table 12.3). A lack of sandy substrates, which are important to a wide-range of burrowing and fossorial ground fauna, may have contributed to these results. Bird diversity was also considered to be influenced by the structural complexity of woodland habitats.

Much of the proposed mining area includes the Mulga over Tussock Grasslands Habitat, which has been degraded as a result of repeated fires and camel grazing (Plate 1). Consequently, this habitat lacked many important fauna habitat characteristics that may otherwise have contributed to higher abundance and diversity of vertebrate species, in particular, bird species. In general, the habitats in the proposed mining area were noted to be more degraded and less diverse than those encountered within the borefield and pipeline route survey area.

Plate 1 Survey sites MWN2B and MWN5B in the proposed mining area

Plate 2 Evidence of camel and camel damage to Mulga trees within the proposed mining area

Ten native and six introduced mammal species were recorded in the April 2008 survey, including five bat species (Table 12.4). The One-humped Camel (*Camelus dromedarius*) was recorded at high densities, including one herd of greater than 40 in number (Outback Ecology 2009).

The assessment identified a number of existing disturbances to vertebrate fauna and habitat within the proposed mining area including: feral cat predation, a fire regime characterised by frequent broad-scale burning, hunting of native fauna by the local community, and alteration of vegetation associations by the local camel populations (Appendix I1).

12.2.1.2 Conservation Significant Species

One vertebrate fauna species of conservation significance was recorded within the proposed mining area during the 2008 fauna survey; the Australian Bustard (*Ardeotis australis*). This is listed as a Priority 4 species by the DPaW.

Based on the findings of the desktop study and available habitat within the proposed mining area, the following conservation significant bird species listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) are considered likely to occur, at least intermittently, over the proposed mining area: the Princess Parrot (*Polytelis alexandrae*) (listed as Vulnerable); and the migratory Rainbow Bee-eater (*Merops ornatus*) and Fork-tailed Swift (*Apus pacificus*) (Appendix I1).

Other conservation significant species not previously recorded in the proposed mining area but considered to possibly occur include the Crest-tailed Mulgara (*Dasycercus cristicauda*), Brush-tailed Mulgara (*Dasycercus blythi*), Long-tailed Dunnart (*Sminthopsis longicaudata*), Striated Grasswren (*Amytornis striatus striatus*), Major Mitchell's Cockatoo (*Calcatua leadbeateri*) and the Woma (*Aspidites ramsayi*).

Conservation significant species occurring, or with the potential to occur, in the proposed mining area are discussed in further detail below.

Australian Bustard (*Ardeotis australis*)

The Australian Bustard has a wide distribution across Australia and there is a WA Museum record west of the proposed mining area (FaunaBase 2008). Five birds were sighted in Mulga over Tussock Grassland habitat during the survey. Introduced predators, unfavourable fire regimes, influence of climatic conditions on food sources, and hunting by traditional owners are likely to have a major influence on the population of this species in the Project area.

Princess Parrot (*Polytelis alexandrae*)

The Princess Parrot is an inhabitant of lightly wooded country of desert areas to the north-west and north-east of the proposed mining area; from the Great Sandy Desert, through the Gibson Desert and into the Great Victoria Desert (Blakers *et al*. 1984). In the April 2008 survey an unconfirmed sighting of a small flock of Princess Parrots occurred at Site 8 in Mulga-Mallee over Hummock Grassland habitat. It is likely that the Princess Parrot overflies the proposed mining area.

Rainbow Bee-eater (*Merops ornatus*) and Fork-tailed Swift (*Apus pacificus*)

Although not recorded, the Rainbow Bee-eater and the Fork-tailed Swift are migratory species considered likely to occur over the habitats of the proposed mining area intermittently. The Rainbow Bee-eater occupies numerous habitats including open woodlands with sandy loamy soil, sandridges, sandpits, riverbanks, road cuttings, beaches, dunes, cliffs, mangroves and rainforests (Pizzey and Knight 1998). The Fork-tailed Swift is an aerial species that would overfly the proposed mining area without specifically utilising the habitats present.

Crest-tailed Mulgara (*Dasycercus cristicauda*)

The Crest-tailed Mulgara has previously been recorded in the region (NLWRA 2002). It is possible that this species occurs in the proposed mining area, particularly within the Mulga-Mallee over Hummock Grassland habitat. The Crest-tailed Mulgara typically inhabits sandplains dominated by *Triodia* spp., where it burrows between low sand dunes as well as laterite rises and hills. It tends to be recorded infrequently in field surveys, in part due to dynamic population densities (i.e. related to boom-bust cycles involving contraction to core habitat areas in lean times and rapid expansion during favourable conditions) (Gibson and McKenzie 2005).

The Brush-tailed Mulgara (*Dasycercus blythi*) is a closely related species that was recorded in Mulga-Mallee over Hummock Grassland habitat surveys of the proposed borefield and pipeline route. Given its regional presence, this species could also occur in the proposed mining area.

Long-tailed Dunnart (*Sminthopsis longicaudata*)

The Long-tailed Dunnart has previously been recorded in the region, at various locations primarily to the west and north-west of the proposed mining area (FaunaBase 2008). It typically occurs in rocky habitats (Strahan 2002) and may be rarely captured due to the difficulties of installing pit traps in these areas. Although not recorded in surveys of the proposed mining area, suitable habitat for this species in the form of the Rocky hills and escarpments was noted and it is therefore possible that it occurs.

Striated Grasswren (*Amytornis striatus striatus*)

The Striated Grasswren occurs in spinifex communities, with or without an overstorey of shrubs, on sandy or loamy plains. The species has previously been recorded west and north-west of the proposed mining area (FaunaBase 2008). It now occurs as scattered but widespread populations in the Gibson Desert and Little Sandy Desert, as well as the Pilbara (Higgins *et al*. 2001). Although not recorded in surveys of the proposed mining area, suitable habitat for this species in the form of Mulga-Mallee over Hummock Grassland was noted and it is possible that it occurs.

Major Mitchell Cockatoo (*Calcatua leadbeateri*)

The Major Mitchell Cockatoo's distribution is both patchy and disjunct. The proposed mining area lies outside the species distribution as identified by Johnstone and Storr (1998) and the WA Museum. However, it is possible that this species could occur from time-to-time as its preferred habitat of very open woodland occurs over the area.

Woma (*Aspidites ramsayi*)

The Woma occurs throughout arid zones of Australia with a disjunct south west population in WA that is now very rare (and may be taxonomically differentiated from the desert 'form'). In the more arid zones the Woma favours open myrtaceous heath on sandplains, and dunefields dominated by spinifex. In the south-west it also appears to favour sandplain habitats (Storr *et al.* 2002), though few records exist. The WA Museum lists a specimen recorded 8 km from the proposed mining area. Although not recorded in surveys of the proposed mining area, suitable habitat for this species was noted within the Mulga-Mallee over Hummock Grassland habitat and it is possible that it occurs.

Table 12.2 Fauna species richness recorded at survey sites in the proposed mining area in April 2008

Group	Sites														
	MWN1A	MWN1B	MWN2A	MWN2B	MWN3A	MNW3B	MWN4A	MWN4B	MWN5A	MWN5B	MWN6A	MWN6B	MWN8	MWN9	**Other**
Mammals (excluding bats and exotics)	1	0	0	1	1	0	2	2	1	1	0	0	1	0	2
Birds	10	4	5	5	5	1	3	3	1	4	6	4	0	1	6
Reptiles	1	7	6	5	8	7	0	3	2	1	6	4	2	0	6
Total	**12**	**11**	**11**	**11**	**14**	**8**	**5**	**8**	**4**	**6**	**12**	**8**	**3**	**1**	**14**

Table 12.3 Animal abundances recorded at survey sites in the proposed mining area in April 2008

Group	Sites														
	MWN1A	MWN1B	MWN2A	MWN2B	MWN3A	MNW3B	MWN4A	MWN4B	MWN5A	MWN5B	MWN6A	MWN6B	MWN8	MWN9	**Other**
Mammals (excluding bats and exotics)	1	0	0	1	1	0	9	4	1	1	0	0	1	0	7
Birds	11	6	9	9	7	3	5	3	6	10	10	8	0	1	6
Reptiles	5	20	11	8	8	10	0	3	13	1	9	10	6	0	16
Total	**17**	**26**	**20**	**18**	**16**	**13**	**14**	**10**	**20**	**12**	**19**	**18**	**7**	**1**	**29**

Table 12.4 Mammal species recorded in the proposed mining area in April 2008

Species		Sites														
Common Name	**Scientific Name**	MWN 1A	MWN 1B	MWN 2A	MWN 2B	MWN 3A	MNW 3B	MWN 4A	MWN 4B	MWN 5A	MWN 5B	MWN 6A	MWN 6B	MWN 8	MWN 9	**Other**
Non-volant species																
Striped - faced Dunnart	*Sminthopsis macroura*	X														
Fat-tailed Dunnart	*Sminthopsis crassicaudata*				X											
Fat-tailed False Antechinus	*Pseudante chinus macdonnellensis*							X	X							
Euro	*Macropus robustus erubescens*					X		X	X	X						
Spinifex Hopping-mouse	*Notomys alexis*													X		
Feral species																
*House Mouse	*Mus musculus*	X	X	X	X		X			X	X	X	X			
*Dingo	*Canis lupus dingo*										X					
*Wild Dog	Canis familiaris															X
*Feral Cat	Felis catus															X
*European Rabbit	*Oryctolagus cuniculus*	X	X	X	X	X	X			X	X	X	X			

*One-humped Camel	*Camelus dromedarius*	X	X	X	X	X	X	X	X	X	X	X	X	X	

Species		Sites					
Common Name	**Scientific Name**	**Camp No. 1**	**Camp No. 2**	**Camp No. 3**	**MWN3A**	**MWN4A**
Bat species						
Gould's Wattled Bat	*Chalinolobus gouldii*	X	X	X	X	
Finlayson's Cave Bat	*Vespadelus finlaysoni*	X	X		X	X
Lesser long-eared Bat	*Nyctophilus geoffroyi*		X	X	X	
Inland Broad-nosed Bat	*Scotorepens balstoni*		X		X	
Hill's Sheathtail Bat	*Taphozous hilli*	X	X			

* Introduced species

Table 12.5 Bird species recorded in the proposed mining area in April 2008

Species		Sites													
		MWN1A	MWN1B	MWN2A	MWN2B	MWN3A	MNW3B	MWN4A	MWN4B	MWN5A	MWN5B	MWN6A	MWN6B	MWN8	MWN9	Other
Bourke's Parrot	*Neopsephotus bourkii*														X	
Budgie	*Melopsittacus undulatus*	X		X												
Brown Falcon	*Falco berigora*	X	X	X	X	X		X	X			X	X			

Species		Sites														
		MWN1A	MWN1B	MWN2A	MWN2B	MWN3A	MNW3B	MWN4A	MWN4B	MWN5A	MWN5B	MWN6A	MWN6B	MWN8	MWN9	Other
Crested Bellbird	*Oreoica gutturalis*	X				X										
Magpie	*Gymnorhina tibicen*	X	X													X
Pied Butcher Bird	*Cracticus nigrogularis*	X										X				X
Torresian Crow	*Corvus orru*	X	X	X	X	X	X	X	X	X	X	X	X			
Richard's Pipit	*Anthus novaeseelandiae*	X		X	X						X					
Pallid Cuckoo	*Cacomantis pallidus*	X														
Zebra Finch	*Taeniopygia guttata*	X									X	X				X
Australian Bustard	*Ardeotis australis*				X											
Spiny Cheeked Honeyeater	*Acanthagenys rufogularis*				X				X							
Grey Headed Honeyeater	*Lichenostomus keartlandi*					X										
Grey Shrike Thrush	*Colluricincla harmonica*					X		X								
Black-faced Wood Swallow	*Artamus cinereus*	X			X				X			X	X			
Willy Wagtail	*Rhipidura leucophrys*											X				
Southern Whiteface	*Aphelocephala leucopsis*												X			
Spotted Nightjar	*Eurostopodus argus*															X
Jacky Winter	*Microeca fascinans*				X											
Yellow Throated Miner	*Manorina flavigula*															X
Wedge-tailed Eagle	*Aquila audax*															X

Species		Sites													
		MWN1A	MWN1B	MWN2A	MWN2B	MWN3A	MNW3B	MWN4A	MWN4B	MWN5A	MWN5B	MWN6A	MWN6B	MWN8	MWN9	Other
Singing Honeyeater	*Lichenostomus virescens*															X
Black Kite	*Milvus migrans*															X

Table 12.6 Reptile species recorded in the proposed mining area in April 2008

Species		Sites													
		MWN1A	MWN1B	MWN2A	MWN2B	MWN3A	MNW3B	MWN4A	MWN4B	MWN5A	MWN5B	MWN6A	MWN6B	MWN8	MWN9	Other
Long-nosed Dragon	*Amphibolurus longirostris*					X										
Black-collared Dragon	*Ctenophorus clayi*															X
Central-netted Dragon	*Ctenophorus nuchalis*				X		X					X				
Central Military Dragon	*Ctenophorus isolepis*													X		
Centralian Earless Dragon	*Tympanocryptis centralis*			X									X			
Pebble Dragon	*Tympanocryptis cephalus*															X
Fat-tailed Gecko	*Diplodactylus conspicillatus*		X	X	X					X				X		
Sandplain Gecko	*Diplodactylus stenodactylus*		X	X	X	X						X				
	Gehyra purpurascens															X
Variegated Gecko	*Gehyra variegata*		X	X					X			X		X		X
Bynoe's Gecko	*Heteronotia binoei*		X		X											
Smooth Knob-tailed Gecko	*Nephurus levis levis*											X				
Northern Spiny-tailed Gecko	*Strophurus ciliaris*		X													

Species		Sites														
		MWN1A	MWN1B	MWN2A	MWN2B	MWN3A	MNW3B	MWN4A	MWN4B	MWN5A	MWN5B	MWN6A	MWN6B	MWN8	MWN9	Other
Jewelled Gecko	*Strophurus elderi*					X	X									
	Delma nasuta					X										
Burton's Legless lizard	*Lialis burtonis*					X										
Fence Skink	*Cryptoblepharus plagiocephalus*								X							
	Ctenotus leonhardii	X	X	X	X	X	X			X	X	X	X			X
Leopard Ctenotus	*Ctenotus pantherinus*						X									
Spinifex Slender Blue-tongue	*Cyclodomorphus melanops*						X									
Broad-banded Sand-swimmer	*Eremiascincus richardsonii*		X													X
	Lerista bipes					X							X			
	Lerista muelleri					X	X		X							
	Lerista spp.											X				
	Proablepharus tenuis						X									
Pygmy Mulga Monitor	*Varanus gilleni*			X	X											
Sand Monitor	*Varanus gouldii*	X	X	X	X				X	X	X	X				

12.2.1.3 Short Range Endemic Species

Findings of the April 2008 survey for SRE invertebrates are presented in Table 12.7. Several species of scorpions were collected from Sites 2 and 3, all of which were found to belong to the widespread genus *Lychas* (Appendix I1). Although the specimens could be identified to species level none are considered likely to be SRE species.

Six previously unknown invertebrate species with the potential for short-range endemism were collected during the 2008 survey. These consisted of five mygalomorph spider species; *Aganippe* sp. nov "Wingellina" sp. 1, *Ananippe* sp. nov "Wingellina" sp. 2, *Kwonkan* sp. 1 sp. nov, *Kwonkan* sp. 2 sp. nov, *Cethegus* sp. and one pseudoscorpion species *Synsphyronus* sp. "Wingellina".

Table 12.7 Potential SRE species collected during the April 2008 survey

Group	Species	Location	Habitat
Mygalomorph Spiders	*Kwonkan* sp. 2	MWN04A	Rocky Hills and Escarpments
	Kwonkan sp. 1	MWN03B	Mallee woodland on Stony Slopes
	Aganippe sp nov 'Wingellina' sp. 1	MWN03B	Mallee woodland on Stony Slopes
	Aganippe sp nov 'Wingellina' sp. 1	MWN06A	Mulga over Tussock Grassland
	Aganippe sp nov 'Wingellina' sp. 1	MWN06B	Mulga over Tussock Grassland
	Aganippe sp nov 'Wingellina' sp. 1	MWN08A	Mulga-Mallee over Hummock Grassland
	Aganippe sp. nov 'Wingellina' sp. 2	MWN04A	Rocky Hills and Escarpments
	Cethegus sp.	MWN05A	Mulga over Tussock Grassland
Pseudoscorpion	*Synsphyronus* sp. Wingellina	MWN04A	Rocky Hills and Escarpments

Rocky Hills and Escarpment habitat (Site MWN4a) was found to support three of these potential SRE species: the mygalomorph spiders *Ananippe* sp. nov "Wingellina" sp. 2 and *Kwonkan* sp. 2 sp. nov; and the pseudoscorpion *Synsphyronus* sp. "Wingellina" (Table 12.7). The rocky hills and escarpments are a patchy habitat type in the region and it is likely that these species have a restricted geographic range within this habitat type. The Rocky Hills and Escarpment habitat is relatively well represented in the proposed mining area (Table 12.1, Figure 12.1). Additionally, it is likely that this habitat occurs more broadly in the landscape in association with land systems BA21 and FA34 to the south of the proposed mining area.

The mygalomorph spider species *Aganippe* sp. nov "Wingellina" sp. 1. was collected from four locations within two habitat types: Mulga over Tussock Grassland and Mulga-Mallee over Hummock Grassland (Table 12.7). Although the Mulga-Mallee over Hummock Grassland habitat is uncommon in the proposed mining area, this habitat is also know to occur along the proposed borefield pipeline route (Outback Ecology 2012). The Mulga over Tussock Grassland habitat is common and well connected within the proposed mining area (Table 12.1, Figure 12.1) and is likely to occur in adjacent areas in association with land system MY109.

The mygalomorph *Cethegus* sp. was collected within Mulga over Tussock Grassland habitat (MWN05) (Table 12.7). Main (2008) proposes that the species is likely to have a wider distribution in appropriate habitats, although it is also suggested that this habitat type may be important for this species. The Mulga over Tussock Grassland habitat is common and well connected within the proposed mining area (Table 12.1, Figure 12.1) and is likely to occur more widely in adjacent areas in association with land system MY109.).

The mygalomorph spider *Kwonkan* sp. 1 sp. nov. was collected within the Mallee woodland over Stony Slopes habitat (Table 12.7) and is considered likely to have a restricted distribution (Main 2008). The Mallee woodland on Stony Slopes habitat occurs along the base of the hills that run from north-west to south-east through the proposed mining area (Table 12.1, Figure 12.1). It is likely that this habitat occurs more broadly in the landscape in association with land systems BA21 and FA34.

Pseudoscorpions were collected from Sites 1, 2, 3, 4 and 6 (Table 12.7). These specimens were found to belong to a single species which is extremely similar to specimens collected from other regions of WA (Appendix I1). This suggests that the species is widespread and is not an SRE species (Harvey 2002). The single specimen of the pseudoscorpion *Synsphyronus* 'sp. Wingellina' (Family Garypidae) collected from Site 4A (Rocky Hills and Escarpment habitat) (Table 12.7) is a species not previously described or represented in the collections of the Western Australian Museum (Harvey 2008). Many species of *Synsphyronus* may qualify as SREs but based on current taxonomic knowledge, it is difficult to state whether this species does so (Harvey 2008, *pers. comm*.). The Rocky Hills and Escarpment habitat is relatively well represented in the proposed mining area (Table 12.1, Figure 12.1) and is likely to occur more widely in the landscape in association with land systems BA21 and FA34.

The SRE invertebrate survey was completed as part of the terrestrial fauna assessment in April 2008, and as such the results may have been affected by the limitations of the survey timing due to below average rainfall in the summer months prior to the survey. However, consultation with the Environmental Management Branch of the DEC in February 2011 determined that given the findings of the proposed mining area survey (Appendix I1) further SRE surveys of the proposed mining area were not considered necessary, due to the amount of SRE habitat affected within the proposed disturbance footprint.

12.2.2 Borefield and pipeline route

12.2.2.1 Habitat Availability

Six broad fauna habitats were identified within the proposed borefield area and pipeline route including:

- Dense Mulga Woodland;
- Mulga over Hummock Grassland;
- Mulga over Tussock Grassland;
- Mulga-Mallee over Hummock Grassland;
- Drainage Line; and
- Scattered Eucalypts over Mixed Shrubland.

These habitat types are relatively widespread outside the survey area. The Drainage Line and Scattered Eucalypts over Mixed Shrubland habitat types had limited distributions within the survey area.

12.2.2.2 Fauna Species

A total of 60 terrestrial vertebrate fauna species were recorded during the October 2011 survey including 14 mammal species (4 of which were introduced species), 15 reptiles and 31 bird species (Appendix I5). No fish or amphibian species were recorded. This represents a relatively small proportion of the 359 vertebrate fauna species identified to potentially occur in the proposed borefield area and pipeline route in the 2008 desktop assessment ((Appendix I4)).

The vertebrate fauna species richness was comparable with previous field surveys in the locality of similar size and scope. One species recorded during this survey, the Western Long-eared Bat (*Nyctophilus major tor*) was not recorded during database searches or previous surveys in the locality or the wider region.

12.2.2.3 Conservation Significant Species

Four vertebrate species of conservation significance were recorded in the October 2011 survey ((Appendix I5)). These included:

- The Western Long-eared Bat (*Nyctophilus major tor)*: Listed as Priority 4 by the DPaW;
- The Australian Bustard (*Ardeotis australis)*: Listed as Priority 4 by the DPaW;
- The Rainbow Bee-eater (*Merops ornatus)*: Listed as Migratory under the EPBC Act and S3 under the WC Act; and
- Brush-tailed Mulgara (*Dasycercus blythi*) - Listed as Priority 4 by the DPaW. Motion-sensor cameras captured two records of this species at the northern end of the proposed access track. This confirms the presence of this species within tenement L69/12.

A further sixteen vertebrate species of conservation significance were not recorded in the field survey, but nevertheless are considered to have the potential to occur within the

survey area (Table 12.8). The likelihood of each of these species occurring was determined based on the habitat assessments performed during the field survey, reported data on species distributions and habitat from previous surveys in the wider region, and published knowledge on the biology of individual species. Conservation significant species considered having a possible or high likelihood of occurring in the proposed borefield area and pipeline route are discussed in further detail as follows:

Southern Marsupial Mole (*Notoryctes typhlops*)

The Southern Marsupial Mole is a small carnivore highly adapted to life burrowing amongst sand dunes and sandy plains (Menkhorst and Knight 2010, Van Dyck and Strahan 2008). The species tunnels through lightly cemented sand, and backfills as it proceeds; the tunnels are not thought to be re-used, and may persist in the soil profile for lengthy amounts of time (Van Dyck and Strahan 2008). It feeds on a range of subterranean prey, including termites and insect larvae (Menkhorst and Knight 2010), but is also known to be capable of taking arthropods and small vertebrates such as geckos (Van Dyck and Strahan 2008).

The proposed borefield area and pipeline route is well within the currently accepted distribution of the Central Marsupial Mole (Van Dyck and Strahan 2008), and the sandy habitats within the area in particular associated with extensive dune systems) are capable of supporting this species.

Malleefowl (*Leipoa ocellata*)

The Malleefowl is a ground-dwelling bird that builds large and distinctive mounds of soil and litter, which it uses to incubate its eggs. The distribution of Malleefowl is fragmented and scattered through semi-arid rangelands across southern Australia. Their primary habitat consists of Mallee and semiarid shrublands, with sandy or gravel soils (Garnett and Crowley 2000). Malleefowl sparsely populate the Watarru Indigenous Protected Area, which is in the Aṉangu Pitjantjatjara Lands to the east of the Study Area adjacent to the South Australia-Western Australia border (Benshemesh 2007, Robinson et al. 2003).

Habitat apparently similar to that utilised by Malleefowl on the Watarru IPA occurs within the survey area. Given this, it is considered possible that the Malleefowl occurs within the area.

Peregrine Falcon (*Falco peregrinus*)

The Peregrine Falcon is an aerial carnivore, which in the Australian arid zone nests on cliffs and steep-sided rocky outcrops. In central Australia, Peregrine Falcons are sparsely distributed and closely associated with waterholes, range and gorge environments, although they do range widely over riverine and Acacia woodland habitats when hunting (Garnett and Crowley 2000).

This species was not recorded during the October 2011 survey, but was found during two surveys in the wider region, and was reported by two database searches as occurring. Potential habitat for Peregrine Falcons occurs within 10 km of some parts of the proposed borefield area and pipeline route, and much of the area contains habitat suitable for foraging. Therefore it is considered possible that this species occurs in the area.

Princess Parrot (*Polytelis alexandrae*)

Refer to Section 12.2.1.2 for species description.

Although not recorded in surveys of the proposed mining area, the nomadic nature of this species suggests that it is possible that it occurs in the proposed borefield area and pipeline route.

Great Desert Skink (*Liopholis kintorei*)

The Great Desert Skink is a large, smooth bodied lizard that measures, on average, 200 mm long and up to 350 g in body mass (Pavey 2006). The species lives communally in warren systems with multiple entrances, dug amongst spinifex grasslands in sandy soils (Moseby et al. 2009). The Great Desert Skink is thought to forage nocturnally (Wilson and Swan 2010), consuming a wide variety of invertebrates and small vertebrates, as well as the leaves, flowers and fruits of plants (Pavey 2006). This species is known to occur amongst Spinifex hummocks over arid red sand flats or loamy clay soils (Wilson and Swan 2010).

The habitats within the proposed borefield area are capable of supporting the Great Desert Skink, and two previous surveys and one database search in the wider region have recorded this species. It is therefore considered possible that the Great Desert Skink occurs in the proposed borefield area and pipeline route.

Woma (*Aspidites ramsayi*)

Refer to Section 12.2.1.2 for species description. Although not recorded in surveys of the proposed borefield area and pipeline route, suitable habitat for this species was noted and it is possible that it occurs.

An additional 12 migratory bird species listed under the EPBC Act were identified as potentially occurring in the region, but considered unlikely to occur in the survey area (Appendix I5).

Table 12.8 Fauna of conservation significance with the potential to occur in the proposed borefield area (not recorded in surveys)

Group	Common name	Scientific name	EPBC Act	WC Act	Likelihood of occurrence
Mammals	Southern Marsupial Mole	*Notoryctes typhlops*	Endangered	Schedule 1	Likely
Birds	Fork-tailed Swift	*Apus pacificus*	Migratory		Possible
	Peregrine Falcon	*Falco peregrinus*		Schedule 4	Possible
	Malleefowl	*Leipoa ocellata*	Vulnerable	Schedule 1	Possible
	Princess Parrot	*Polytelis alexandrae*	Vulnerable		Possible
Reptiles	Great Desert Skink	*Egernia kintorei*	Vulnerable	Schedule 1	Possible
	Woma	*Aspidites ramsayi*		Schedule 4	Likely

12.2.2.4 Short Range Endemic Species

Of the invertebrates collected during the terrestrial fauna field survey of the proposed borefield area and pipeline route, four of the species were considered potential SRE species based on current taxonomic and distribution knowledge, including:

- *Synothele* sp. (mygalomorph spider);
- *Anidiops* sp. (mygalomorph spider);
- *Aname* sp. (mygalomorph spider); and
- *Urodacus yaschenkoi* (scorpion).

The desktop study also identified seven SRE mygalomorph spider species and two SRE pseudoscorpion species that have been collected in the area surrounding the borefield and pipeline (Appendix I4). Although none of these species were collected within the proposed borefield area and pipeline route, all have the potential to occur based on the land systems where they were collected and the distribution of these land systems within the proposed borefield area and pipeline route.

No exploration or mining activity within the vicinity of rocky ridgelines, rocky outcrops or gorges is proposed under the Project. Therefore, it is not anticipated that the small-scale of disturbance footprints needed to undertake groundwater exploration and establish a borefield will impact on SRE species in this area (Appendix I4).

12.3 Impacts

12.3.1 Construction Impacts

Potential impacts on terrestrial fauna resulting from Project construction activities include:

- Habitat removal and fragmentation due to vegetation clearing and topsoil removal;
- Reduction in the area of habitat utilised by conservation significant species, including SRE invertebrates, and potential loss of individual animals of these species;
- Death or injury of individual animals from vehicle movements (i.e. collisions) and the operation of other mining equipment;
- Death or injury of individual animals resulting from entrapment in trenches/excavated areas;
- Disruption to animals resulting from dust, noise and light emissions;
- Increased risk of wildfires;
- Habitat degradation resulting from the introduction and spread of weeds;

- Increased feral animal numbers in the Wingellina locality, resulting in heightened threat to native species. Feral animals are known to be attracted to mining camps where food waste is not appropriately managed, and may benefit from more persistent water sources (e.g. ponded water); and
- Habitat contamination from spills and leaks in localised areas associated with, vehicle operation, refuelling and maintenance.

Vehicle movements present an inherent risk of fauna mortality through strikes. Some species are more vulnerable at particular times of the day, for example those that forage at dawn or dusk, or nocturnal species at night.

Noise and light emissions during construction have the potential to cause localised disturbance to foraging fauna especially bat species. However, foraging habitat for bats is widespread outside of the Project area and therefore these impacts are unlikely to be significant. No bat species of conservation significance are considered to occur in the Project area.

Contamination of surface waters from spills and leaks (e.g. process reagents, hydrocarbons), toxic dust or sedimentation from ground disturbance could potentially cause chronic or acute health effects on fauna.

An increase in human activity has the potential to increase the local population of feral animals, through the provision of extra water, food (e.g. food scraps and landfills), shelter (e.g. buildings) and increased immigration. Species commonly associated with human activity in the region include the Wild Dog, Feral Cat, European Rabbit, One-humped Camel and the House Mouse, all of which already occur at the site. These species can predate or compete with native species and/or degrade their habitat.

Fire impacts may increase unless fire sources are well managed during construction. These sources include sparks from hot works and grinding, unprotected exhausts from vehicles and poorly extinguished cigarette butts.

Fauna is at risk of mortality from falling in and being trapped in trenches/excavated areas, particularly at night during nocturnal activity.

12.3.2 Operational Impacts

Potential impacts on fauna associated with Project operations activities include:

- Death or injury of individual animals from vehicle movements (i.e. collisions) and the operation of other mining equipment;
- Death or injury of individual animals resulting from entrapment in trenches/excavated areas and the TSF;
- Disruption to animals resulting from dust, noise and light emissions;
- Increased risk of wildfires;
- Habitat degradation resulting from the introduction and spread of weeds;

- Increased feral animal numbers in the Wingellina locality, resulting in heightened threat to native species. Feral animals are known to be attracted to mining camps where food waste is not appropriately managed, and may benefit from more persistent water sources (e.g. ponded water); and
- Habitat contamination from spills and leaks in localised areas associated with, vehicle operation, refuelling and maintenance.

Operation of the borefield will be primarily automatic, with little traffic. No standing water will be available and increased populations of feral animals are not anticipated. Impacts due to vehicle strike, dust generation and introduction of pest species will be minimal, if managed appropriately. Bores will be well spaced and powered by diesel generators. Noise from these generators is not expected to represent a significant impact to fauna. There is a risk of spills and leaks of hydrocarbons; however the implementation of standard hydrocarbon management procedures will reduce the risk of impacts to fauna.

12.3.2.1 Mine area

Habitat

In broad terms, the habitat types in the Project area are unexceptional with respect to biodiversity values, habitat values and regional conservation significance. It is estimated that up to 2,761 ha of habitat will be cleared within the proposed mining area; equating to an upper limit of approximately 24.9% of the habitat within tenement E69/535. The area of each habitat that occurs within the proposed mining area (i.e. tenement E69/535) and the proportion of each habitat that occurs within the Development Envelope and Infrastructure Footprint is presented in Table 12.9 and shown in Figure 12.1.

Clearing can isolate habitat, and thus populations, and increasing the relative impact of stochastic events on population size. However, given the current level of disturbance in the immediate vicinity of the Project area associated with local hunting practices and altered fire regimes, the proposed clearing footprint is unlikely to significantly impact on habitat connectivity for the locally occurring fauna assemblage. Similar habitat is extensive outside the Project area.

Four broad fauna habitats were identified within the proposed mining area (Section 12.2.1), including: Mulga over Tussock Grassland, Rocky hills and escarpments, Mallee woodland on stony slopes and Mulga-Mallee over Hummock Grassland. Within the proposed mining area, each of these habitats are represented outside the proposed Development Envelope and outside the proposed Infrastructure Footprint (Table 12.9, Figure 12.1). Additionally, each of these habitats are likely to occur more widely in the surrounding landscape in association with land systems My109, BA21 and FA34 (Table 12.1) and none are considered of regional significance.

The rocky hills and escarpment habitat type is locally restricted to the south east and central west portions of the proposed mining area near Sites 4A and 4B (Figure 12.1). This habitat type may be important for SRE species and conservation significant vertebrate fauna species, such as the Long-tailed Dunnart. Of the 632 ha

of this habitat occurring within the proposed mining area, approximately 10% occurs within the proposed Infrastructure footprint. Additionally, extensive areas of the Rocky escarpments habitat type also occur to the south-east of the Project area. Therefore the Project is expected to have minimal impact on this habitat.

Table 12.9 Fauna habitats occurring within the proposed mining area (tenement E69/535), Development Envelope and Project Infrastructure Footprint

Broad Fauna Habitats	Ha Area within tenement E69/535*	Ha Area within Infrastructure Footprint (ha)^	% Infrastructure Footprint Impacted	Ha Area within Development Envelope^	% Development Envelope Impacted
Mallee woodland on stony slopes	1618.41	444.67	27.48	1003.9	62.03
Rocky hills and escarpments	631.84	63.68	10.08	186.7	29.55
Mulga over Tussock Grassland	8618.59	2173.94	25.22	4482.11	52.01
Mulga-Mallee over Hummock Grassland	197.99	61.52	31.07	172.85	87.3
Disturbance	38.32	16.9	44.10	23.8	62.11
Total	**11105.15**	**2760.71**	**-**	**5869.36**	**-**

* The area of each habitat was calculated subsequent to the Level 2 survey report (Outback Ecology 2009) and is based on vegetation mapping completed during the Level 2 flora and vegetation survey (Outback Ecology 2011). This desktop approach is described in Section 12.2.1.

^ Area calculations are based on the most recent project footprints and superseded those presented in the Lave 2 fauna report (Outback Ecology 2009) and the Mine Closure Plan (Appendix J).

Conservation Significant Species

The location and extent of the proposed clearing footprint will not constitute a significant loss of habitat for species of conservation significance.

Conservation significant bird species listed under the EPBC Act that are considered likely to occur, at least intermittently, over the proposed mining area are the Princess Parrot (*Polytelis alexandrae*) (listed as Vulnerable) and the migratory Rainbow Bee-eater (*Merops ornatus*) and Fork-tailed Swift (*Apus pacificus*). The latter two species are widespread in Western Australia. The Princess parrot is likely to overfly the proposed mining area only. All of these species are unlikely to be impacted by the Project.

Potentially suitable habitat for the Crest-tailed Mulgara and Striated Grasswren occurs in the Mulga-Mallee over Hummock Grassland habitat in the northern portion of the proposed mining area near Site 8 (Table 12.1, Figure 12.1); which is intersected by the TSF and haul road footprints. Animals in this area could be exposed to a heightened risk of, vehicle strike and exposure to dust and contaminated runoff from the TSF.

One vertebrate fauna species of conservation significance was recorded within the Project area during the 2008 fauna survey; the Australian Bustard (*Ardeotis australis*) (Priority 4). This is a highly mobile and nomadic species with a wide geographic range in Western Australia. Local populations are already subject to heightened threats of introduced predators, unfavourable fire regimes, influence of climatic conditions on food sources, and hunting by traditional owners (Outback Ecology 2009). The Project has the potential to locally accentuate these threats without appropriate management controls.

Short Range Endemic Invertebrates

Although several SRE taxa were recorded in Project area surveys, potential impacts on SRE invertebrate habitat and species diversity are predicted to be minimal due to the small size of the proposed disturbance footprint relative to the surrounding landscape. Suitable habitat for SRE species is widespread outside of the proposed disturbance footprint.

Specifically, three species may be restricted to the Rocky Hills and Escarpments habitat which is uncommon in the Study Area: the mygalomorph spiders *Kwonkan* sp. 2 and *Aganippe* sp. nov 'Wingellina' sp. 2, and the pseudoscorpion *Synsphyronus* sp. Wingellina (Table 12.7). The location of these records occurs outside the Project Development Envelope and outside the Project Infrastructure Footprint (Figure 12.1). Additionally, 168.7ha (29.55%) and 63.68ha (10.08%) of this habitat occur within the Project Development Envelope and Project Infrastructure Footprint respectively (Table 12.9). Consequently, given that the location of the records are outside of Project footprints and given the occurrence of suitable habitat outside of footprints, it is unlikely that the species will be substantially impacted by the Project.

The mygalomorph spider *Kwonkan* sp. 1 was only collected from one location within the Mallee Woodland on Stony Slopes habitat within the proposed Development Envelope and within the proposed Project Infrastructure Footprint. Although the location where this specimen was collected will be impacted by the project, it is likely that this species has a distribution in association with the Mallee Woodland on Stony Slopes habitat which occurs outside the Project Footprint and Development Envelope 444.67 ha (27.48%) and 1003.9ha (62.03%) of this habitat is known to occur outside the Project Development Envelope and Project Infrastructure Footprint respectively (Table 12.9).

Additionally, this habitat is likely to occur more widely in the landscape in association with the land systems BA21 and FA34. Consequently, it is unlikely that the species will be substantially impacted by the Project.

The remaining two species of mygalomorph spider, although collected from within the Development Envelope and three within the Infrastructure Footprint are unlikely to be impacted by the Project as they were collected from the Mulga over Tussock Grassland habitat widespread and common in the Study Area and likely to be more widely distributed in the surrounding landscape.

12.3.2.2 Borefield Area and pipeline route

There is potential for conservation significant species and fauna habitats to be impacted by the construction and operation of the Officer Basin borefield and pipeline. The most significant impact will be caused by vegetation clearing during construction. While a layout and design of the borefield is not yet finalised, the overall footprint will be minimal and restricted to the placement of the boreholes, pipelines and access tracks (refer to Section 11.4.1.1). In the borefield area existing tracks will be used where possible to minimise new clearing requirements. The proposed clearing footprint is unlikely to significantly impact on habitat connectivity for the locally occurring fauna assemblage. Similar habitat is extensive outside the proposed borefield and pipeline route footprint. The area of each habitat within the borefield pipeline survey area and associated Development Envelope is presented in Table 12.10 and shown in Figure 12.2. The linear nature of the pipeline route resulted in the intersection of a number of habitats. Each of these intersected habitats occur more extensively in the landscape and along the length of the pipeline and are likely to align with regional soil-landscape system mapping (Outback Ecology, 2015).

Table 12.10 Fauna habitats occurring within the Borefield Pipeline Study Area and Development Envelope

Broad Fauna Habitats	Ha Area within the survey area[3]	Ha Area within Development Envelope	% Development Envelope Impacted
Dense Mulga Woodland;	115.39	38.54	33.40
Mulga over Hummock Grassland	100.34	32.88	32.77
Mulga over Tussock Grassland	155.82	52.06	33.41
Mulga-Mallee over Hummock Grassland	195.53	54.39	27.82
Drainage line	7.44	2.48	33.33
Scattered Eucalypts and Mixed Shrubland	7.56	0	0.00
Exclusion Zone	54.49	18.19	33.38
Total	**636.57**	**198.54**	**-**

12.3.2.3 Off-site Infrastructure and Transport corridors

Definition of the Project's off-site infrastructure requirements will be finalised as part of the DFS and targeted terrestrial fauna surveys will be undertaken once the final transport option and disturbance footprint is defined from the DFS.

[3] Note; these habitat types are considered to be extensive outside the survey area

12.4 Management and Mitigation Measures

12.4.1 Management Objectives

Project construction and operations activities will be subject to a Fauna Management Plan with the following objectives (Appendix B):

- Minimise vegetation clearing;
- Protect fauna of conservation significance; and
- Control feral animals.

The Fauna Management Plan includes monitoring and management measures that address clearing practices and threatening processes associated with vegetation clearing, vehicle/plant/equipment operations, operation of the TSF, dust and feral animals. The Plan also addresses aspects of progressive rehabilitation during the operations phase. The remainder of this section described the key elements of the Plan.

Note that post-mining management measures are addressed in the Wingellina Mine Closure Plan (refer to Section 14). Management measures addressing the introduction and spread of weeds and fire prevention and suppression are contained in the Flora and Vegetation Management Plan (Appendix B).

12.4.1.1 Clearing of habitat

In order to minimise impacts associated with clearing of habitat, the following management actions will be undertaken:

- Minimisation of clearing footprints during final design including the avoidance of Mulga-Mallee over Hummock Grassland and rocky hills and escarpment habitat types where practicable;
- Mine planning to include progressive clearing and rehabilitation to minimise the amount of bare soil at any one time; and
- Implementation of staged clearing methods to minimise the risk of harming fauna, including species of conservation significance.

A progressive rehabilitation strategy will be adopted over the operational life of the Project, which will include habitat reinstatement objectives.

12.4.1.2 Construction, mining and ore processing operations

In order to minimise impacts associated with construction and operations activities, the following management actions will be undertaken:

- Ensure vehicle speeds are controlled and that vehicles only use authorised access routes;
- Maintain a register of vehicle impacts on vertebrate fauna;
- Construct drainage so that indirect impacts of erosion and sedimentation do not occur;

- Minimise fauna mortality as a result of falling into excavated areas by minimising the trench/excavation area open at any given time, install escape ramps into excavated areas and conduct regular inspections of excavated areas and trenches;
- Minimise noise and light emissions;
- Control spills and implement cleanup procedures when spills do occur;
- Undertake dust control on exposed surfaces and during ground disturbance;
- Undertake regular erosion and sedimentation inspections of construction and control erosion through rock armouring and/or redirection of fugitive drainage;
- Prevent animals from accessing the TSF by a combination of deterrent methods and fencing. Animal egress matting will be installed on the sides of the TSF and WSF to help prevent entrapment. Tailings will be neutralised prior to discharge and are not expected to contain significant contaminants and therefore the risk to migratory birds and other wildlife is considered low;
- The continued management of landfills as outlined in the Project Waste Management Plan (Appendix B); and
- Manage threats associated with weeds and fire in accordance with the Project Flora and Vegetation Management Plan (Appendix B).

12.5 Predicted Environmental Outcome

The implementation of the Project is not predicted to result in significant impacts on terrestrial fauna conservation values. The Project is distant from high value conservation assets and will not result in the direct loss of any critically important habitat areas or significantly impact on any World Heritage Properties, Ramsar Wetland or Nationally Important Wetland sites.

Progressive vegetation clearing of up to 2,761 ha in the proposed mining area will result in habitat removal. Additional clearing of up to 211 ha will be required to establish the borefield (and associated access track) and pipeline to the proposed mining area. However the impacted habitat types are well represented outside of the Project area. Rocky ridgelines have local area conservation significance; however these areas are outside the proposed disturbance footprint.

Potential impacts to terrestrial fauna will be managed in accordance with the Wingellina Project Fauna Management Plan. This Plan addresses threatening processes associated with vegetation clearing, vehicle/plant/equipment operations, operation of the TSF, dust and feral animals. Other threatening processes to fauna habitat including weeds and fire are addressed in the Project Flora and Vegetation Management Plan.

Subject to the proposed mitigation and management measures, it is considered that the Project can be managed to meet the EPA's objective "*To maintain representation, diversity, viability and ecological function at the species, population and assemblage level*".

CHAPTER 13

SUBTERRANEAN FAUNA

13.0 SUBTERRANEAN FAUNA

13.1 Assessment Approach

Subterranean fauna are animals that inhabit underground habitats and include:

- Stygofauna - obligate, groundwater dwelling aquatic fauna, and
- Troglofauna - obligate, subterranean dwelling fauna occurring in the unsaturated profile above the water table.

The subterranean fauna values of the Project areas were assessed through a combination of desktop studies and field surveys. Field surveys in proposed mining areas were undertaken from 2008 to 2011 and implemented as far as practicable in accordance with the then relevant EPA principles and guidance materials for this environmental factor. The one exception was no troglofauna sampling was conducted in the proposed Wingellina pit areas as no suitable uncased bores were available. To compensate for this, troglofauna sampling was conducted in neighbouring portions of the proposed mining area (e.g. TSF area) and more broadly to characterise subterranean fauna values within the region, including from areas considered to host optimal habitats for subterranean fauna such as the large Pipalyatjara Calcrete system.

Field surveys of proposed borefield areas were undertaken from 2011 to 2013 and implemented as far as practicable in accordance with the new environmental assessment guidelines (EAG 12) released in 2013 that superseded Guidance Statement 54. The relevant EPA recommendations and guidance statements used for investigating subterranean fauna values within the Project areas and to determine if they may represent a key environmental factor were:

- EPA Guidance Statement No. 54 Consideration of Subterranean Fauna in Groundwater and Caves during Environmental Impact Assessment in Western Australia (EPA 2003) (later replaced by EAG 12, 2013);
- EPA Guidance Statement No. 54a *Sampling Methods and Survey Considerations for Subterranean Fauna in Western Australia* (EPA 2007); and
- EPA Environmental Assessment Guideline (EAG) 12 for *consideration of subterranean fauna in environmental impact assessment in Western Australia* (EPA 2013).

The relevant subterranean fauna surveys conducted in the region to support this PER are:

- Outback Ecology (2008) *Wingellina Nickel Project Pilot stygofauna survey;*
- Outback Ecology (2011) *Wingellina Nickel Project Subterranean Fauna Assessment*; and
- Outback Ecology (2013) *Supplementary Report: Wingellina Borefields Subterranean Fauna Assessment*.

13.1.1 Mining area

A pilot survey for stygofauna was completed in the proposed mining area in the period 8 to 9 April 2008 (Outback Ecology 2008d; Appendix I2).

Twelve exploration bores were sampled during the April 2008 survey. The intensity of sampling was limited by the number of suitable bores available. Bores were classified as 'control' or 'impact' according to their location within the proposed disturbance footprint. Control bores were located in areas not anticipated to be affected by the mining activities; while impact bores were in areas where potential stygofauna habitat could be affected by the Project. Of the 12 bores, three were designated as control bores and the remainder classified as impact bores.

An additional subterranean fauna survey, involving the assessment of stygofauna and troglofauna in the proposed mining area was completed in the period 2008 to 2011 (Outback Ecology 2011c; Appendix I3). The assessment involved a comprehensive desktop study, searches of relevant databases and field surveys of four areas including:

- Wingellina Pit – stygofauna pilot survey (four sampling phases between April 2008 and January 2011, totalling 32 samples);
- Wingellina TSF – stygofauna and troglofauna pilot survey (three sampling phases between April 2008 and January 2011, totalling 10 stygofauna and 24 troglofauna samples);
- Pipalyatjara calcrete (South Australia) – located approximately 30 km south east of the proposed mining area. Stygofauna and troglofauna baseline surveys (three sampling phases between September 2010 and January 2011, totalling 62 stygofauna and 67 troglofauna trap and 62 scrape samples); and
- Area 3, the Wedge and Yapan (South Australia) – located approximately 30 km east of the proposed mining area. Stygofauna pilot surveys (three sampling phases between September 2010 and January 2011, totalling 28 samples).

Note that the surveys within the South Australian Project areas were undertaken to enhance the regional context of the assessment and provide a reliable characterisation of the subterranean fauna values present.

13.1.2 Borefield

A pilot stygofauna survey at the proposed borefield area was undertaken with two sampling phases in October 2011 and January 2013, respectively (Outback Ecology 2013; Appendix I7). Twelve samples from 12 boreholes were collected across the borefield area. Collectively, this exceeds the EPA guidance for expected sampling effort for a pilot (low intensity sampling) stygofauna survey (6-10 sites) (EPA 2007). Given that no stygofauna were recorded, no additional Level 2 (Baseline) surveys for subterranean fauna in the area were considered to be necessary. The January 2013 sampling phase included two other sites within the region (Nyikukura – located approximately 10 km east of the proposed mining area; and Cobb Depression – located approximately 80 km north east of the proposed mining area) for comparative purposes.

Troglofauna reconnaissance surveys were also undertaken when onsite stygofauna sampling to assess the likelihood of each of the possible borefield areas hosting potential troglofauna habitat.

13.2 Assessment Findings

13.2.1 Mining area

The assessment in 2008 indicated that the proposed mining area did not include characteristic stygofauna habitats. The desktop assessment returned no subterranean fauna records from the surrounding region as no published studies existed from the region or were not accessible. Geological and hydrogeological investigations indicate that the groundwater systems of the area are comprised of small, unconsolidated sedimentary aquifers or fractured rock aquifers of low yield (Appendix I2). The Wingellina deposits are hosted in deeply weathered olivine-rich ultramafic members (dunites and peridotites) of the Hinckley Range Gabbro and consist of numerous separate intrusions of layered mafic and ultramafic lithologies (**Figure 13.1**). The surface geology consists of aeolian sands (silica/iron or oxide/haematite), magnesite, calcium carbonate and dolomite (**Figure 13.2**). At greater depths, substrates are consolidated and become more compact (mainly clay and iron oxide) providing little to no interstitial spaces for subterranean fauna to inhabit. Ridges in the area consist of gabbro (resistant to erosion), made up of pyroxene, feldspar and minor olivine (**Figure 13.3**). Possible crevices/fissures may be likely occur in the top 10 m of the ridges, although would be considered to mainly be limited to the top 3 m, the main depth of which would not be considered deep enough to commonly intercept groundwater nor provide a stable and relatively high humid refugia that troglofauna are reliant upon for long term persistence (Humphreys 2000). At greater depths in the proposed mining area there may be some shears and pores present mostly below the water table ranging from approximately 5 to 10 mm (Hinckley Range 2014).

Between April 2008 and March 2011 a total of 132 stygofauna net samples and 91 troglofauna trap samples were taken across all study areas yielding 5,970 invertebrates (Appendices I2 and I3). The number of surface aquatic or terrestrial invertebrate (non-stygofauna and non-troglofauna) species represented approximately 99.8% of the sample collected.

Only two obligate subterranean species were collected during the assessment (Appendix I3):

1. One stygofauna species, *Sussartcyclops* sp. TK1 (Copepoda), was collected from a single hole in the Pipalyatjara calcrete deposit (South Australia); and
2. One troglofauna species, *Tyrannochthonius* sp. OES6 (Pseudoscopionida), was collected in a net scrape sample, also from the Pipalyatjara calcrete deposit.

The findings of four sampling phases demonstrated that no obligate subterranean fauna were present in the Wingellina Pit or the TSF Project areas. These results were consistent with the habitat characterisation for each area, which indicated a low likelihood of habitat elements supporting significant subterranean fauna values. The baseline survey of the Pipalyatjara calcrete deposit, which was considered to

provide optimal habitat for both stygofauna and troglofauna, also found a very low subterranean fauna species richness and abundance to be present.

13.2.2 Borefield

Troglofauna were not actively sampled for during the pilot stygofauna survey assessment of the borefield area because desktop assessments, regional survey results, and habitat characterisation reconnaissance surveys demonstrated that the borefield area as well as the greater Wingellina region has limited potential for hosting troglofauna species (Appendix I7).

No stygofauna fauna species were recorded from the Nyikukura and Officer Basin borefield areas. Only one putative stygofauna species (oligochaete Enchytraeidae OES18) was collected at Cobb Depression from a single bore. The level of sampling undertaken for the Officer Basin borefield area is considered more than sufficient to provide a reliable demonstration that the habitat characterisation for the Officer Basin Borefield was correct (i.e. habitat is unlikely to support any stygofauna species). As no stygofauna species were collected from the borefield area during the 2013 subterranean pilot survey (Appendix I7) it was concluded that a Level 2 baseline assessment would not be required.

Figure 13.1 Sub-surface geology and distribution of subterranean fauna sample sites in the Wingellina Project proposed mining area.

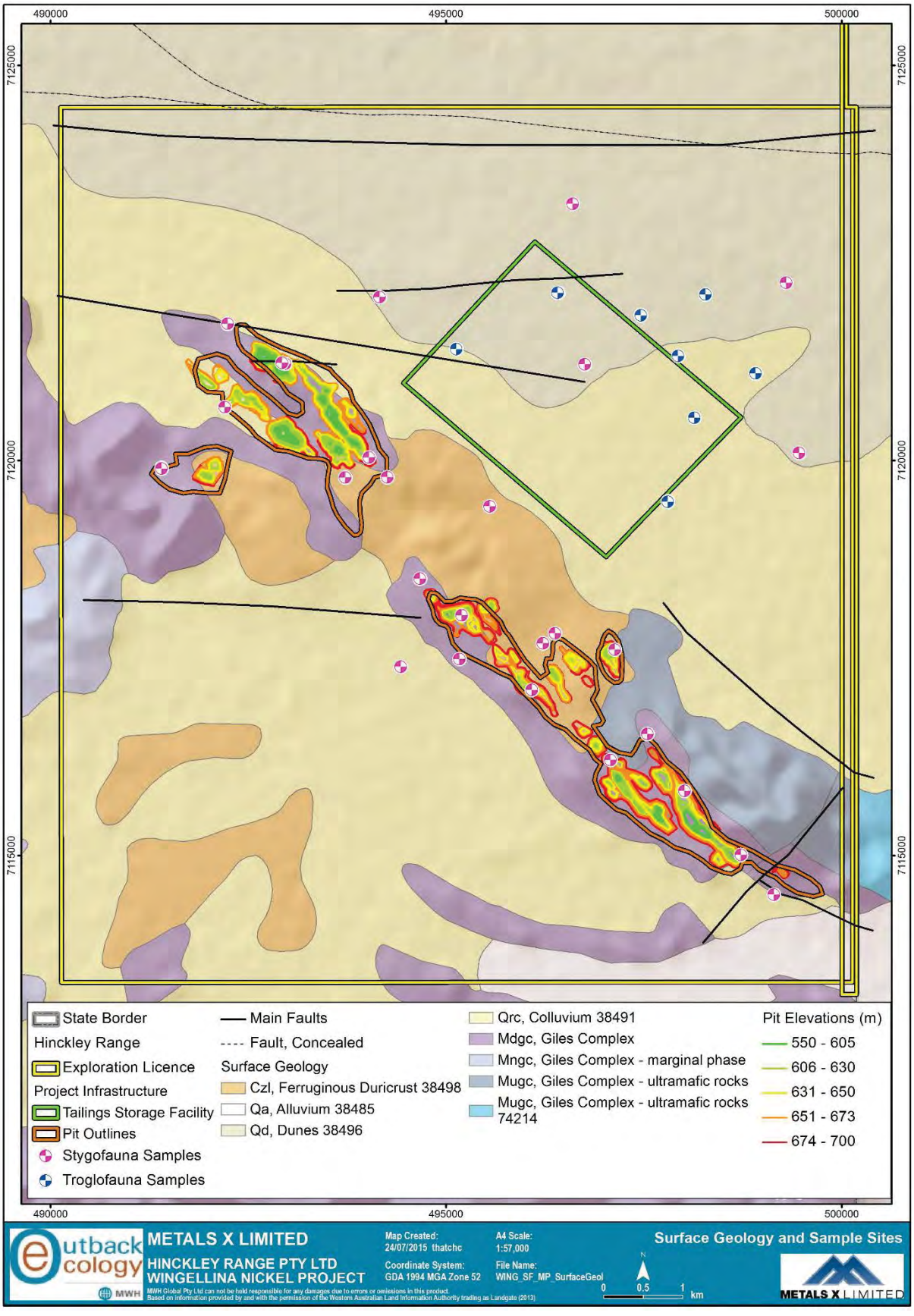

Figure 13.2 Surface geology and distribution of subterranean fauna sample sites in the Wingellina Project proposed mining area.

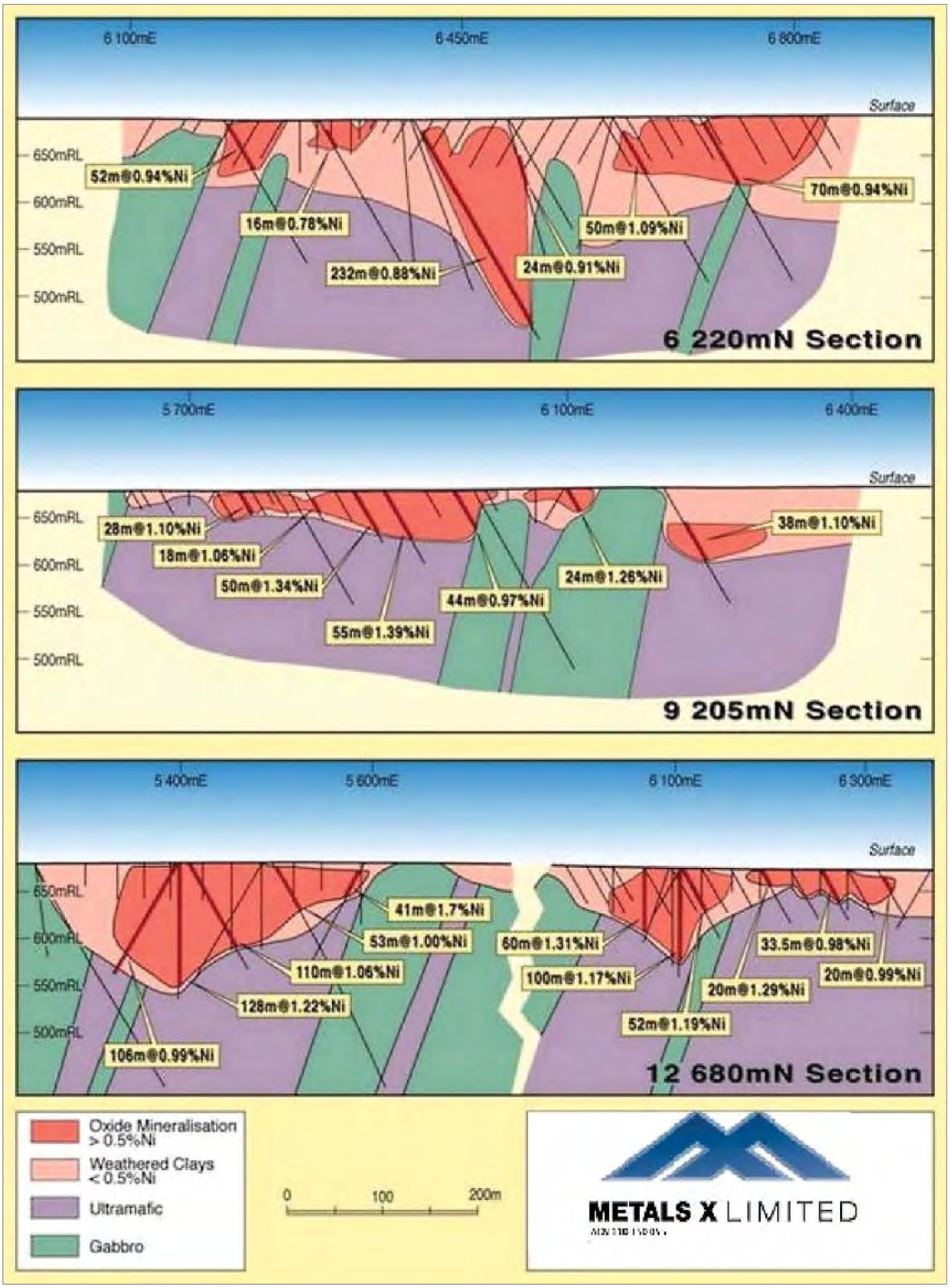

Figure 13.3 Geological cross-section of mineralisation in the Wingellina Project proposed mining area

13.3 Impacts

The two main potential direct impacts on subterranean fauna associated with the development of the Wingellina Project are:

- Removal of habitat through excavation of the proposed Wingellina mining pits; and
- Drying out of habitat through the lowering of the water table associated with mine pit dewatering (**Figure 13.4**), and groundwater extraction from the proposed borefield.

In general terms, the removal of habitat through mining excavation poses a relatively greater risk to the conservation of stygofauna and troglofauna species than the lowering of the water table only. Groundwater drawdowns are considered to have greater impacts on stygofauna compared to troglofauna, because lowering of the groundwater table can directly reduce the extent of stygofauna habitat. For troglofauna, the impacts of groundwater drawdown are likely to be less direct.

Troglofauna are considered to represent relictual fauna related to surface dwelling (epigean) groups that have evolved to be obligate inhabitants of subterranean environments that provide more constant and humid refugia (Humphreys 2000). The reliance of troglofauna on stable and relatively high humid conditions can make them susceptible to artificially changing water tables, particularly if the lowering of the water table is of sufficient magnitude to dry out zones that they inhabit (EPA 2007). However, the lowering of the water table, particularly if not of too great a magnitude, could mean that portions of the desaturated geology containing suitable habitable voids may become available for colonisation.

Potential indirect impacts posed by proposed mining developments that could impact on aquifers inhabited by stygofauna include:

- Groundwater contamination from fuel spills; and
- Increase in sediment load in run-off from mining activities, leading to reduced surface-subsurface water exchange during flow periods (e.g. lessen input of resources) and altered groundwater chemistry (Marmonier 1991).

These potential indirect impacts to groundwater quality were not considered further within the risk assessment because they can be greatly reduced or avoided through project design and leading practice environmental management procedures.

13.3.1.1 Mining area

Both pit excavation and drawdown associated with pit dewatering are not considered to pose any risk to the conservation of stygofauna species, given that the habitat is unfavourable and no species were recorded from within the proposed mining areas or modelled groundwater drawdown exceeding two metres below standing water level (m bSWL) (**Figure 13.4**). In addition, no stygofauna or troglofauna species were found to occur within the neighbouring TSF area.

The troglofauna assessment indicated that the geologies associated with the Wingellina Pit and TSF area do not harbour a troglofauna assemblage.

The potential habitats associated with the subsurface geologies are relatively widespread and contiguous throughout each area and the surrounding region. Therefore, the distributions of potentially undetected troglomorphic species would be highly unlikely to be restricted to Project disturbance areas.

No stygofauna or troglofauna species are considered to be restricted in distribution to within the direct impact zones of the proposed mine pits and associated groundwater drawdowns. Consequently, on the basis of the completed investigations, it was concluded that the proposed development activities associated with the proposed mining area pose no risk to subterranean fauna.

13.3.1.2 Borefield Area

The predicted groundwater drawdown associated with the Officer Basin borefield is not considered to pose any risk to the conservation of stygofauna species, given that no species were recorded from within the borefield area. The troglofauna desktop and habitat reconnaissance assessment, coupled with survey findings from other areas in the region, indicated that the geologies associated with the borefield are unlikely to harbour a troglofauna assemblage. No stygofauna or troglofauna species are considered to be restricted in distribution to within the direct impact zones of the proposed borefield. Consequently, on the basis of the completed investigations, it was concluded that proposed groundwater drawdown activities associated with the borefield pose no risk to subterranean fauna.

13.3.1.3 Off-site Infrastructure and Transport corridors

Potential impacts from off-site infrastructure and transport corridors to subterranean fauna will be limited to surface disturbance and contamination from leaks and spills. Given the low probability of intersections with prospective subterranean fauna habitat, with standard management strategies these are not expected to represent a significant risk to subterranean fauna.

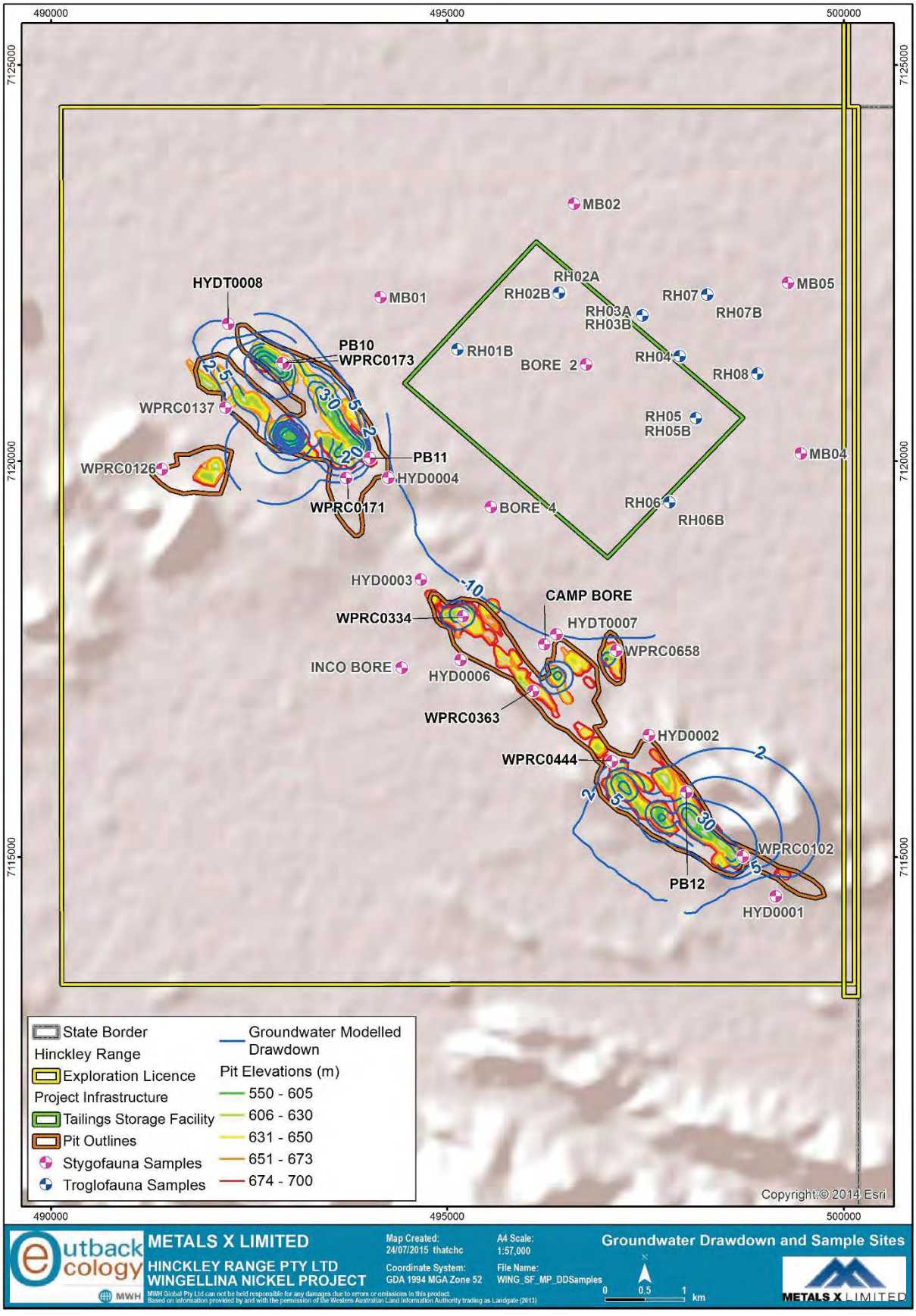

Figure 13.4 Sub-surface geology and distribution of subterranean fauna sample sites in the Wingellina Project proposed mining area

13.4 Management and Mitigation Measures

No specific stygofauna or troglofauna environmental management strategy is considered to be necessary, due to the lack of subterranean fauna present within the proposed mining and borefield areas.

13.5 Predicted Environmental Outcome

The implementation of the Project is not predicted to result in any significant impacts on subterranean fauna conservation values, given the lack of suitable habitat and species present in the proposed mining and borefield areas. The wider region also appears to lack suitable habitat for subterranean fauna; with the most prospective habitat evaluated (the Pipalyatjara calcrete deposit) demonstrated to host a depauperate species assemblage.

On the basis of the completed investigations, subterranean fauna are not considered to represent a significant environmental factor for the Project. Therefore the Project can be managed to meet the EPA's objective "*To maintain representation, diversity, viability and ecological function at the species, population and assemblage level*".

CHAPTER 14

REHABILITATION AND CLOSURE

14.0 REHABILITATION AND CLOSURE

14.1 Assessment Approach

Hinckley Range has undertaken an assessment of decommissioning, mine closure and rehabilitation as part of its feasibility investigations for the Project. Planning for mine closure is incorporated into the Project's design and construction and will be conducted as a life-of-mine (LoM) process. A Mine Closure Plan (MCP) (Appendix J) has been prepared with consideration of the following guidelines and standards:

- Guidelines for preparing Mine Closure Plans (DMP and EPA 2011);
- Tailings Storage Facilities in Western Australia - Code of Practice (DMP, 2013);
- Environmental Protection Bulletin No. 19 - EPA Involvement in Mine Closure (EPA, 2013);
- Guidance Statement No. 6. Rehabilitation of Terrestrial Ecosystems (EPA 2006);
- Western Australian Water In Mining Guideline (DoW, 2013);
- Strategic Framework for Mine Closure (Australia and New Zealand Minerals and Energy Council (ANZMEC) and Minerals Council of Australia (MCA) 2000);
- The Mine Closure and Completion Handbook (Department of Industry, Tourism and Resources 2006);
- Oldham CE (2013), Environmental sampling and modelling for the prediction of long term water quality of mine pit lakes, The University of Western Australia Publishing, Perth; and
- Planning for Integrated Mine Closure (International Council on Mining and Metals, 2008).

The preparation of the MCP involved a risk assessment process, examining key project domains and features as informed by relevant studies and investigations. The MCP provides a framework for the development and implementation of workable solutions to all significant closure risks.

In addition, mine closure planning and preliminary landform design criteria have been proposed having consideration of rehabilitation learnings from nearby mines in similar environments. These include Tropicana Gold Project, Mt Keith, and Ravensthorpe Nickel Project.

14.2 Stakeholder Engagement

The development of an effective strategy for stakeholder consultation is critical to ensure that both primary and secondary stakeholders are able to contribute to the closure planning process, and therefore influence mine closure outcomes.

The following stakeholder groups have been identified to have an interest in the Project during operations and at mine closure:

- The Wingellina local community;
- Indigenous stakeholder groups including the Ngaanyatjarra Land Council (NLC) of WA, Anangu Pitjantjatjara Yankunytjatjara (APY) in SA, and the Central Land Council (CLC) in the NT;

- Government Agencies Western Australia;
- Government Agencies South Australia;
- Government Agencies Northern Territory;
- Non-government organisations including pastoral lease holders relevant to off-site transport corridors and Australian Rail Group; and
- The Shire of Ngaanyatjarraku.

In July 2010, Hinckley Range, signed a landmark mining agreement with the Traditional Owners and the granted Native Title holders of the Project. The agreement is the first to be successfully negotiated on the Ngaanyatjarra lands and the Aboriginal Reserve. The agreement provides consent for the grant of a mining lease and subsequent mining operations. Hinckley Range has developed a very strong relationship with the Traditional Owners, which is evident by successfully negotiating the agreement.

The proposed post mining land use of return to Aboriginal Lands is relevant to the local environment, achievable, ecologically acceptable, and aesthetically acceptable. Consultation with key stakeholders with respect to the acceptability of the proposed post mining land use is ongoing. Hinckley Range recognises the need to undertake further consultation on specific aspects of mine closure with key stakeholders. During the DFS, consultation will be undertaken to attain agreement on the proposed post mining land use, closure objectives and completion criteria. Hinckley Range will also present the potential closure issues, and proposed management of these issues.

14.3 Mine Site Key Domains and Features

To facilitate effective mine closure planning, the Project has been divided into a number of physically distinct ‘domains’ and ‘features’ (Table 14.1; Figure 14.1). Each domain includes features that have similar rehabilitation and closure requirements. Detailed descriptions of the domains and features are provided in Chapter 5.

Table 14.1 Wingellina Mine Closure Domains and Features

Domain	Feature	
Landforms	Waste Rock Landforms (WRL)	Topsoil stockpiles
	Tailings Storage Facility (TSF)	Low-grade stockpiles
	Run of Mine (ROM) Pad	Calcrete ROM Pad
Industrial Infrastructure	Sulphuric Acid Plant and High Pressure Acid Leach (HPAL)	Bulk Fuel Facilities
	Calcrete Plant	Waste Disposal Facilities
	Lime Slaking Plant	Co-generation Power Plant
	Wastewater Treatment Facility	Natural Gas distribution
	Magazine	Workshops and Washdown Bay
	Reverse Osmosis Plant	Administration Buildings
	Accommodation Village	Laydown area
	Airstrip	
Water Containment Structures	Process Water Storage Facility	Raw Water Storage Facility
	TSF Water Storage Facility	Flood Diversion Drain and Bund
	Process and run-off water containment	
Mining Infrastructure	Open Pits	Abandonment Bunds
	Laydown area	
Groundwater Infrastructure	Officer Basin Borefield	Monitoring Bores
	Dewatering bores and pipelines	
Transport Corridors	Access Roads	
	Haul Roads	
Historical Disturbance	Drill sites and Grid lines	Core Yard and Bag Farm
	Chrysoprase workings	

Figure 14.1 Overview of the proposed Wingellina mine site and features

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14.4 Risk Assessment and Management of Impacts

In order to identify, evaluate and mitigate closure risks, a closure risk assessment workshop was undertaken in August 2014 with key management, mine planning and environmental specialists. The key outcomes of the risk assessment are presented in Table 14.2. Further details are provided in the MCP (Outback Ecology 2014, Appendix J).

The assessment was undertaken on a domain and feature basis, and identified a range of potential environmental impacts associated with mine closure. Suitable mitigation and management options were proposed for the potential impacts.

Given the abundance of clays throughout the highly-weathered profile in the proposed mining area, some mined materials are likely to be highly-erosive and therefore separate management of these materials will be required. The variability of water holding characteristics of the sub-surface soils also has the potential to affect rehabilitation outcomes and is an important consideration for final landform design particularly with respect to surface covers.

Three aspects were considered to have a significant residual risk, after assessment of proposed controls:

- Tailings Storage Facility - Dispersive and sodic materials – rehabilitation failure;
- Waste Rock Landforms - Dispersive and sodic materials – rehabilitation failure; and
- Mining Infrastructure – Open Pits - Safety – public injury.

In response to these findings, the following research and investigation trials will be undertaken to assist in closing the knowledge gaps identified relating to these aspects.

Tailings Storage Facility:

- Develop a detailed landform design;
- Develop a detailed decommissioning plan for the TSF including a cover design based on the characterisation of the final tailings bed profile and outer embankment;
- Determine the requirement to mine waste (gabbro and saprock) specifically for use in rehabilitation and cover of the TSF;
- Monitor groundwater throughout the life of the mine, to determine the impact on groundwater quality and levels post closure;
- Undertake trials throughout operations to determine the capillary rise of salts into the cover profile, and the potential impact on vegetation growth and establishment, and to validate the proposed cover design; and
- Identify which vegetative species will be established according to the limitations of the landform and growth medium.

Waste Rock Landforms:

- Develop a final landform design which details final height and surface water management and also considers slope characteristics (shape, slope angle), topsoil placement and surface armouring;
- Undertake field trials to validate final landform and rehabilitation prescriptions during operations;
- Develop and maintain throughout operations a mine waste schedule;
- Determine the volumes of the gabbro and saprock waste available for use in rehabilitation;
- Determine the requirement to selectively mine waste (gabbro and saprock) specifically for use in rehabilitation of the landforms;
- Review the mine schedule to ascertain if sodic or dispersive waste can be backfilled into the open pits on completion of mining;
- Develop and implement a waste management plan that details the appropriate placement of erosive, dispersive or sodic material that will be generated throughout the LoM within the WRL; and
- Identify which vegetative species will be established according to the limitations of the landform and growth medium.

Open Pits:

- Develop a detailed mine schedule to identify opportunities to backfill sterilised open pits progressively throughout the life of mine;
- Determine volume and suitable source of material for abandonment bunding for the open pits;
- Assess the quantity and quality of local groundwater resources, direction of groundwater flows and the hydraulic connectivity between the open pit and local groundwater resources;
- Update final void modelling report to determine water quality and levels of the open pit post closure; and
- Investigate the potential for pit walls to contribute to saline and/ or neutral mine drainage.

Table 14.2 Summary of high closure risk and management controls

Feature	Unwanted Event	Residual Risk	Existing Control	Proposed Control
Site wide	Community – disturbance of indigenous heritage sites.	Moderate.	Heritage exclusion zones are mapped.	Employee training to include heritage areas and exclusion zones. Heritage areas to be considered when developing life of mine plans.
	Corporate – unplanned closure costs.	Moderate.	Development of MCP.	Development of detailed closure costing utilising third party rates to be developed during the DFS and regularly updated throughout operations.
Tailings Storage Facility	Dust emissions – impacts to surrounding vegetation.	Moderate.	TSF deposition method (maintain wet tails), salt crust on tails, reduced surface area, undertake progressive rehabilitation throughout operations.	Undertake progressive rehabilitation, trials, stockpile rehabilitation materials (rock armour), and investigate an integrated waste landform (IWL) design. Develop final landform design including cover. Dust mitigation measures to be implemented.
	Corporate – unplanned closure costs.	Moderate.	Development of MCP, indicative waste inventory (material types and volumes).	Review and update the waste inventory throughout operations. Identify suitable source of cover material. Detailed closure costing to be developed during the DFS (utilising third party rates) and will be updated tri-annually in accordance with the MCP updates.

Feature	Unwanted Event	Residual Risk	Existing Control	Proposed Control
	Landform – inappropriate landform design for closure.	Moderate.	Workshop and consideration of TSF design, review other Projects and success of TSF designs. Review of options concluded that Paddock Style Facility is preferred option. Paddock style facility –enables the opportunity to undertake progressive rehabilitation and trials.	Develop detailed design (paddock option) and operations manual. Regularly update the operations manual in accordance with local conditions. Undertake progressive rehabilitation. Operate TSF for Closure. Implement monitoring programs. Ongoing test work of the tails (physical and chemical properties).
	Dispersive and sodic materials – rehabilitation failure.	High.	Indicative topsoil and waste inventory developed, detailing volumes material available. Desktop review undertaken from nearby mine sites. Source competent material for use in rehabilitation.	Characterise waste and schedule waste placement. Maintain topsoil and waste inventory throughout the operation. Ascertain an appropriate source of available cover material. Incorporate MCP into LoM plans (5 year strategy and annual operational planning).
	Dispersive and sodic materials – slope erosion.	Moderate.	Workshop and consideration of TSF design, review other Projects and success of TSF designs. Review of options concluded that Paddock Style Facility is preferred option. Paddock style facility – opportunity to undertake progressive rehabilitation and trials.	Develop detailed landform design based on material types. Characterise waste and schedule waste placement. Incorporate surface water management into final landform design, investigate IWL design.

Feature	Unwanted Event	Residual Risk	Existing Control	Proposed Control
Waste Rock Landforms	Dust emissions – impacts to surrounding vegetation.	Moderate.	Waste inventory detailing material types and volumes.	Develop detailed landform design including consideration of placement of any dispersive material. Maintain and update waste inventory.
	Corporate – unplanned closure costs.	Moderate.	Development of MCP, indicative waste inventory (material types and volumes).	Review and update the waste inventory throughout operations. Identify suitable source of cover material. Develop detailed closure costing during the DFS (utilising third party rates) and update tri-annually in accordance with the MCP updates.
	Dispersive and sodic materials – rehabilitation failure.	High.	Indicative topsoil and waste inventory developed, detailing volumes material available. Desktop review undertaken from nearby mine sites. Source competent material for use in rehab.	Characterise waste and schedule waste placement. Maintain topsoil inventory and update throughout the operation. Ascertain an appropriate source of cover material. Undertake progressive rehabilitation and trials. Develop final landform design (incorporating placement of dispersive material).
	Dispersive and sodic materials – slope erosion.	Moderate.	Waste material inventory detailing material types and volumes.	Develop detailed landform design based on material types. Incorporate surface water management into final landform design, investigate IWL design. Characterise waste and schedule waste placement.

Feature	Unwanted Event	Residual Risk	Existing Control	Proposed Control
ROM Pad	Dust emissions – impacts to surrounding vegetation.	Moderate.	Dust management throughout operations.	Dust mitigation measures to be implemented throughout operations. Ascertain material properties of ROM Pad and whether a final landform will remain or whether this material will be utilised in rehabilitation.
	Soil contamination.	Moderate.	Spill management procedures.	Develop spill response procedure. Ensure adequate bunding and regular servicing and maintenance of equipment.
Industrial Infrastructure	Alteration of surface water quality.	Moderate.	Incident registers, bunding and sumps around plant site, secondary containment, EMP – spill response, hazardous materials, DG Licence, compliance reporting auditing. Internal plant drainage system.	Detailed plant design, bunding, sumps, secondary containment (process plant containment pond), development of monitoring and trigger levels.
Mining Infrastructure – Open Pits	Alteration of pit lake water quality.	Moderate.	Wingellina will evaluate the opportunity to back fill pits.	Undertake modelling to ascertain the long term pit lake water quality post closure including accumulation of salts over time, and the percolation of salts from the pit wall into the pit lake.
	Safety – public injury.	High.	Consultation with the community, signage, abandonment bund to be constructed post closure.	Continue to consult throughout the LoM and closure. Maintain abandonment bunding/ signage until relinquishment.

Feature	Unwanted Event	Residual Risk	Existing Control	Proposed Control
Water Storage Facility	Wind blowing salt water onto surrounding vegetation.	Low.	Development of mine closure plan, including evaluation of options and considerations for incorporation into the detailed design.	Water Storage Facility design to consider pond/ cell size to reduce potential of wave generation and impacts to embankments and surrounding vegetation.
	Seepage resulting in alteration of groundwater quality and level.	Moderate.	Development of mine closure plan, including evaluation of options and considerations for incorporation into the detailed design.	Install a HDPE liner to mitigate seepage from the WSF.
Roads (haul roads and access tracks)	Alteration of surface water quality.	Moderate.	Incident registers, EMP – spill response, hazardous materials, compliance reporting, Auditing. Regular maintenance of vehicles and equipment.	Consideration of surface water flows in road designs. Development of incident registers, EMP – spill response, hazardous materials, compliance reporting, and auditing. Regular maintenance of vehicles and equipment. Appropriate disposal of contaminated material at closure.

14.5 Management Objectives

The overarching objective for closure, decommissioning and rehabilitation of the Project is to ensure, as far as practicable, that rehabilitation achieves a stable and functioning landform that is consistent with the surrounding landscape and other environmental values. As far as practicable, mine rehabilitation and closure will be undertaken progressively.

The MCP includes a set of specific mine closure objectives presented in Table 14.3.

The closure objectives are consistent with the EPA / DMP guidelines "*to ensure that premises can be closed, decommissioned and rehabilitated in an ecologically sustainable manner, consistent with agreed outcomes and land uses, and without unacceptable liability to the State*".

14.6 Completion criteria and performance indicators

Completion criteria for the Project are proposed for the closure objectives identified under the following five aspects:

- Compliance;
- Landforms;
- Ecosystem function;
- Key stakeholders; and
- Mining infrastructure.

At this pre-feasibility stage qualitative completion criteria and performance indicators have been developed for the Project (Table 14.3); these will be refined and become quantitative completion criteria throughout the LoM. A measurement approach and quantitative standard values will be developed in accordance with these criteria, and presented within subsequent MCPs. Where applicable, criteria will be measured against local target ecosystems, which will form the basis for the quantitative standard values.

Table 14.3 Project closure objectives and preliminary completion criteria

Closure Objective		Completion Criteria	Type of monitoring	Performance indicators
1. Compliance				
1.1	All legally binding conditions and commitments relevant to rehabilitation and closure will be met.	All conditions and commitments are met.	Auditing.	All conditions and commitments are achieved.
1.2	Infrastructure will be retained or removed in accordance with agreed post mining land use in consultation with relevant stakeholders.	Retained infrastructure will be left in a safe condition and transferred to a legally responsible entity. Infrastructure and equipment that is not retained will be removed in accordance with the post mining land use of the area.	Inspections of retained features prior to handover. Signed asset transfer agreement in place prior to transfer of legal responsibility. Review against Decommissioning Plans.	Removal of all redundant surface infrastructure where required. Transfer of liabilities completed.
1.3	To rehabilitate using leading practice rehabilitation techniques and within the constraints of the post mining environment.	Rehabilitation is conducted using leading practice rehabilitation techniques and within the limits of the expected post mining environment.	Qualitative assessment. Auditing.	Compliance with regulatory standards through audits.

Closure Objective		Completion Criteria	Type of monitoring	Performance indicators
1.4	Topsoil or appropriate growth medium is applied to all areas requiring rehabilitation.	Vegetative material, topsoil and subsoil will be stripped and stockpiled separately. In-situ topsoil and subsoil depth will be assessed prior to stripping and this depth will not be exceeded during clearing. Topsoil stockpiles will not be compacted or exceed 2 m height. Assess available topsoil and areas requiring rehabilitation to determine topsoil application rate.	Assessment against Mine Closure Plan and/or appropriate management plan. Assessment against topsoil inventory.	Compliance with Mine Closure Plan.
1.5	Surface drainage patterns will be reinstated or managed where practicable to be consistent with the regional drainage function.	Surface drainage to downstream environments is retained, or reinstated where possible. Sedimentation basins will be installed, where required, to minimise sediment transport into catchments.	Review against Mine Closure Plan and/or appropriate management plan. Review the requirement to maintain sediment basins post closure.	Compliance with Mine Closure Plan and/or appropriate management plan. Sediment basins in place at required locations.
1.6	Groundwater levels and quality to reflect original levels and water chemistry as much as practicable.	Groundwater chemistry and levels not to exceed licence conditions.	Groundwater monitoring data compared against available baseline data.	Compliance with licence conditions during operations and post closure.

Closure Objective		Completion Criteria	Type of monitoring	Performance indicators
2. Landforms				
2.1	Establish safe, stable, non-polluting post mining landforms which support vegetation growth and are erosion resistant.	Landforms are conducive to revegetation and are constructed to support local provenance vegetation.	Establishment of vegetation communities is monitored against target ecosystems.	Compliance with proposed completion criteria for vegetation.
		Final surfaces develop resistance to erosive forces through placement of gabbro and saprock on outer surfaces. Final surface water management and drainage has been incorporated into the landform design. Final rehabilitated slopes to not exceed 15 degrees.	Surface stability and erosion features of the landform will be monitored. Audit constructed landform for compliance against design specifications.	Rehabilitation area meets agreed standard.
		Material characterisations will be conducted for all waste and rehabilitation materials to determine appropriate material placement and use for rehabilitation.	Audit of material characterisations conducted. Audit against landform design, incorporating appropriate placement of waste.	Material characterisations completed. Completion of landform design.
2.2	Compliance with appropriate TSF Guidelines.	Compliance with relevant guidelines for landform safety and stability.	Audit of the TSF as per tenement conditions.	Full compliance with regulatory guidelines.

Closure Objective		Completion Criteria	Type of monitoring	Performance indicators
2.3	Appropriately manage mine waste throughout the life of mine.	Dispersive and sodic mined waste materials have been identified and managed appropriately.	Audit of landform during construction and at completion of works to ensure material has been appropriately managed.	Full compliance with placement and cover specifications in planning and engineering designs.
3. Ecosystem Function				
3.1	The rehabilitated ecosystem has function and resilience indicative of the target ecosystem.	Establish rehabilitation profiles that promote soil stability and vegetation growth and are comparable with the surrounding environment.	Ecosystem function assessed to determine infiltration and nutrient cycling values.	Percentage (%) achieves an agreed proportion of the target ecosystem for stability, infiltration and nutrient cycling indices.
3.2	Vegetation in rehabilitated areas will have values indicative of the target ecosystems.	Revegetation is represented by local provenance species assemblage.	Vegetation assessed to produce a native perennial species richness value.	Achievement of values that trend towards those of relevant analogue sites in terms of density, plant cover and species composition/ richness. Presence of an upper storey in areas where an upper storey is required.
		Revegetation demonstrates viability through propagule development, and effective recruitment, and is subject to colonisation by surrounding species.		
		Revegetation demonstrates values that trend towards relevant target ecosystem sites.		

Closure Objective		Completion Criteria	Type of monitoring	Performance indicators
3.3	The final landscape will have the ability to withstand or have the capacity to recover following stochastic occurrences or final land use pressures.	Monitoring confirms that the recruitment of native perennial species reaches sexual maturity.	Qualitative assessment of vegetation health.	Flowering, fruiting, soil seed bank or second generation seedlings.
		Research trials demonstrate the potential of the rehabilitation to regenerate following fire.	Qualitative assessment of vegetation health.	Structurally dominant species have reached age sufficient to tolerate fire (defined through research, or review of published information).
		Monitoring has confirmed the rehabilitation can survive one or more season of drought.	Qualitative assessment of vegetation health.	Recovery of plant populations to appropriate pre-drought levels.
		Presence of weed species does not exceed target ecosystems.	Qualitative assessments of species richness and species presence.	Achievement of values less or equal to target ecosystems.
3.4	Where the completion criteria above are attained, fauna utilisation, abundance and diversity will trend towards original levels in the areas rehabilitated.	Fauna utilisation is indicative of agreed percentage of target ecosystem.	Qualitative assessments of species richness and species presence.	Fauna utilisation demonstrates values trending towards those of relevant target ecosystem sites.

Closure Objective		Completion Criteria	Type of monitoring	Performance indicators
3.5	To monitor environmental performance during rehabilitation and post closure of the Project and take appropriate action until the specified completion criteria have been met.	Adherence to monitoring schedule within the Mine Closure Plan or other applicable management plans.	Audits and Qualitative assessment. Post closure monitoring will be undertaken in accordance with the Mine Closure Plan.	Compliance with regulatory standards. Compliance with proposed completion criteria for vegetation, and erosion (see Landforms).
4. Key Stakeholders				
4.1	Actively engage key stakeholders on a regular basis including attaining agreement on the post mining land use.	A post mining land use has been determined in consultation with key stakeholders. Key stakeholders will be informed on the Project status, and any proposed changes to the project and closure plan. All key stakeholders contacted and given the opportunity to comment on post mining land use.	The post mining land use has been documented and endorsed by the key stakeholder groups.	Compliance with stakeholder agreements. Priority outcomes of community and stakeholder consultation in relation to closure are taken into consideration in development and reviews of the Mine Closure Plan.

Closure Objective		Completion Criteria	Type of monitoring	Performance indicators
5. Mining Infrastructure				
5.1	Inadvertent public access to open pits will be prevented as far as is practicable.	Access points to open pits to be blocked off to conform to appropriate guidelines, regulations and existing approvals.	Audit against the Department of Industry and Resources (DoIR) *Safety Bund Walls Around Abandoned Open Pit Mines Guideline. 1997* Visual assessment to ensure that the bund is in place across open pits.	Compliance with regulatory guidelines and Mine Closure Plan.

14.7 Management Measures

Closure planning is a complex process that commences at initial mine planning and evolves with the project and improved knowledge. The MCP is a live document that will be updated during operations and mine closure.

In accordance with s83AA of the *Mining Act 1978*, Hinckley Range will implement a management strategy to review and update the mine closure plan during the DFS; to update and augment the Mining Proposal and subsequent to the Project approval every three years (or at such time as specified in writing) and submit to the DMP for review.

This plan will be reviewed periodically and updated accordingly for currency with legislation, standards, guidelines and operational requirements. It is intended that as much rehabilitation as possible will be undertaken progressively during the life of the mine. This will allow rehabilitation methods to be tested and refined to determine the most suitable and, successful method for final rehabilitation.

The triennial update and review of the MCP will include a review of the financial provision. In addition to this, any significant closure outcomes will result in a review of the MCP and financial provisioning.

Upon the commencement of the Project, a closure implementation schedule will be developed detailing timeframes the research and trials, progressive rehabilitation, closure and decommissioning and monitoring and maintenance activities will be undertaken. This schedule will be utilised to implement closure activities on site throughout the life of mine and will be updated regularly.

End land-use has not been finalised and will be a significant consideration as the mine progresses and the closure plan reviewed and updated drawing on inputs from the Traditional Owners (through the Ngaanyatjarra Council), and the State and Federal governments. Given the very low level of development in the area, it is likely that the Ngaanyatjarra people will benefit from retention of some or all buildings and infrastructure, and planning and conditions should adequately allow for the needs of the Ngaanyatjarra people.

The MCP identifies a commitment to undertake the following closure activities:

- Re-instate natural hydrology upon closure as far as practicable;
- Upon completion of the definitive feasibility study (DFS), a detailed closure implementation plan will be developed which will identify scheduling of progressive rehabilitation, research, investigations and trials, closure and decommissioning tasks and post closure monitoring and maintenance activities;
- Design landforms within the constraints of the soil properties, to ensure geotechnical stability and to minimise erosion;
- Ensure that water runoff is managed effectively to reduce erosion in rehabilitated areas;
- Design landforms not exceeding the height of the North Hinckley Range;

- Detailed financial provision for closure will be developed during the definitive feasibility study (DFS) utilising third party contractor rates, based on realistic estimations of closure costs;
- Identify target ecosystems (analogues) in undisturbed vegetation to define achievable rehabilitation, taking into account the physical and chemical characteristics of waste materials and the placement within landforms;
- Continue to undertake and document consultation with key stakeholders throughout the life of the project to reach agreement on the post mining land use and any infrastructure to remain post closure;
- The topsoil and waste inventory will be updated on a regular basis throughout the operation; and
- Further characterisation of mine waste units will be conducted during operations, and this information will be incorporated into the mining schedule and into the detailed design of landforms.

14.8 Predicted Environmental Outcome

Mine closure, decommissioning and rehabilitation has been considered in the Project planning phase and a MCP has been developed in accordance with relevant guidelines and standards.

Preliminary closure objectives and completion criteria have been developed, commensurate with the current status of the Project. The MCP provides the basis for ongoing stakeholder consultation to develop broad agreement on the final land use of the Project area post-mining. This will inform the development of closure criteria for the agreed final land use.

Mitigation and management options have been identified for a range of potential environmental impacts associated with mine closure, as identified in a risk based assessment process. A number of residual risks have been identified requiring further studies and investigations in order to formulate suitable management controls.

Subject to the proposed mitigation and management measures, including future studies and investigations, via the implementation of the MCP it is considered that the Project can be managed to meet the EPA's objective, "*To ensure that premises are closed, decommissioned and rehabilitated in an ecologically sustainable manner, consistent with agreed outcomes and land uses, and without unacceptable liability to the State*".

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CHAPTER 15

OFFSETS

15.0 OFFSETS

15.1 Assessment Approach

Environmental offsets are defined by the EPA as 'actions that provide environmental benefits which counterbalance the significant residual environmental impacts or risks of a project or activity' (EPA 2014). The purpose of environmental offsets is to counterbalance the significant residual loss or risk with an environmental gain elsewhere; after all other reasonable attempts to mitigate adverse environmental impacts have been exhausted in accordance with the mitigation hierarchy depicted in Figure 15.1. Mitigation actions may include impact avoidance and minimisation, and also post-impact environmental rehabilitation.

Environmental factors with the potential to be subject to significant residual impacts as a result of the Project were identified during the preparation of the Project ESD. These included vegetation, flora, fauna habitat and species of State and National significance.

The significance of residual environmental impacts were evaluated based on the findings of baseline studies described Chapters 6 to 13, taking into consideration the application of proposed mitigation and management measures. The assessment was conducted in accordance with the recently updated WA Environmental Offsets Guidelines (EPA, 2014).

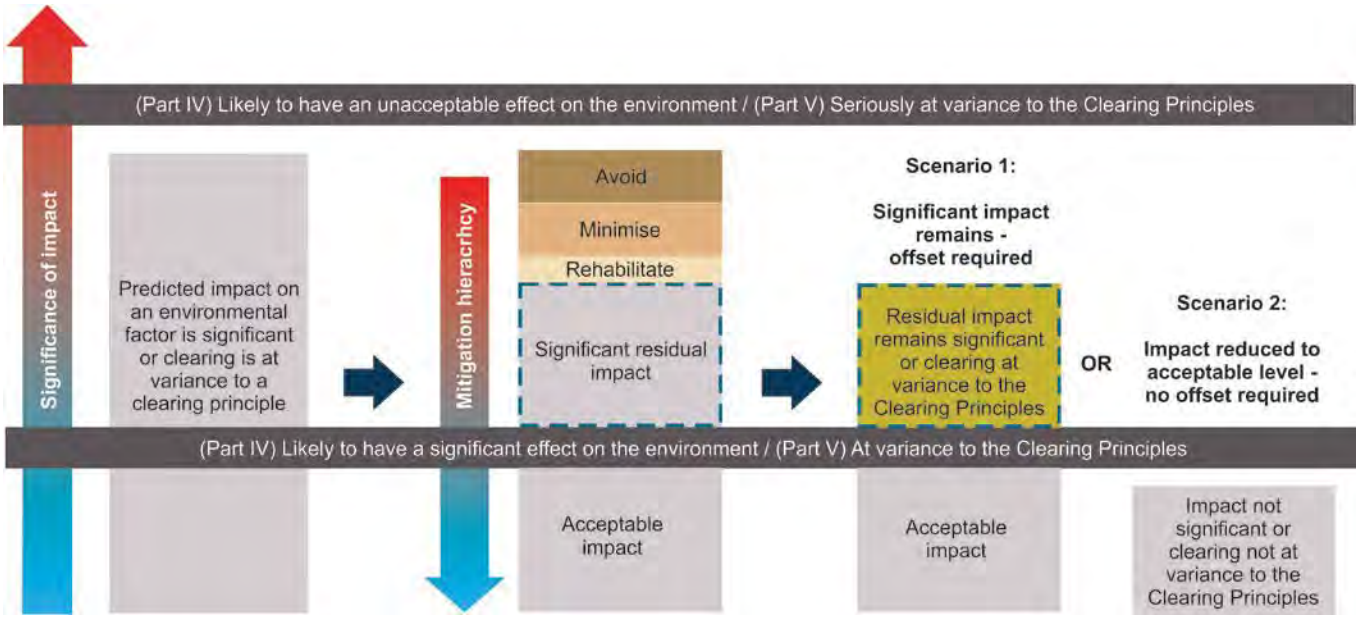

Figure 15.1 Mitigation hierarchy - with each level of mitigation, the proposal's environmental impact is reduced

Note: Figure reproduced from WA Environmental Offsets Guideline (EPA, August 2014)

15.2 Project area environmental values

The environmental values of the Project area relating to vegetation, flora, fauna habitat and species of State and National significance were determined from the findings of biological surveys described in Chapters 11 and 12. The identified values are summarised in Table 15.1.

Table 15.1 Summary of environmental values in the Wingellina Nickel Project area

Value	Mine operations area (Tenement E69/535)	Borefield (Tenement L69/12) & pipeline route
Threatened Flora species, Threatened Ecological Communities and Priority Ecological Communities	None	None
Species of national significance listed under the EPBC Act.	None	None
Priority Flora	*Goodenia lunata* (Priority 1) *Menkea lutea* (Priority 1) *Calotis latiuscula* (Priority 3) *Euphorbia inappendiculata* (Priority 1/2)	*Neurachne lanigera* (Priority 1) *Aristida jerichoensis* var. *subspinulifera* (Priority 1) *Calotis latiuscula* (Priority 3) *Goodenia modesta* (Priority 3) *Stackhousia clementii* (Priority 3).
Conservation significant terrestrial fauna species (listed under the *Wildlife Conservation Act 1950*; Priority species recognised by the DPaW)	Australian Bustard (*Ardeotis australis*) (Priority 4)	Brush-tailed Mulgara (*Dasycercus blythi*) (Priority 4) Western Long-eared Bat (*Nyctophilus major tor*) (Priority 4) Australian Bustard (*Ardeotis australis*) (Priority 4) Rainbow Bee-eater (*Merops ornatus*) (Schedule 3)
Short Range Endemic (SRE) taxa	Mygalomorph spiders and pseudoscorpion	Four potential SRE species based on current taxonomic and distribution knowledge: *Synothele* sp. (mygalomorph spider)

Value	Mine operations area (Tenement E69/535)	Borefield (Tenement L69/12) & pipeline route
		Anidiops sp. (mygalomorph spider) *Aname* sp. (mygalomorph spider); and *Urodacus yaschenkoi* (scorpion)
Subterranean fauna	No obligate subterranean fauna have been recorded in surveys of the proposed Wingellina mine pit or TSF areas. Subterranean habitats in the proposed mine operations area are small, unconsolidated sedimentary aquifers or fractured rock aquifers of low yield. A very low diversity and abundance of subterranean fauna species is associated with these habitats.	No obligate subterranean fauna have been recorded in surveys of the proposed borefield area.

15.3 Evaluation of residual environmental impacts

Residual impacts associated with the Project are described in Table 15.2. In summary:

- The Project involves vegetation clearing within defined development envelopes. The vegetation condition in the proposed development footprint ranges from Degraded to Excellent, however a significant proportion has been assessed to be in Good or better condition. The main sources of historical disturbance are attributable to human activities (repeated fires) and grazing by feral camels;
- The vegetation and habitats found in the Project area are considered to be widely represented throughout the surrounding region. The Project is located in a largely undeveloped landscape and will not result in any significant landscape fragmentation;
- The Project area does not contain any rare flora species listed under the WC Act or EPBC Act. Populations of several priority flora have been recorded in the Project area (Table 15.1) however these are predominately outside the proposed development footprint and will therefore be avoided. Some individuals of *Menkea lutea* have been recorded within the proposed development footprint; however these individuals only represent a small percentage of the wider local

population, which is extensive throughout the southern sections of the Project area;

- A number of conservation significant fauna species have been recorded in the Project area (Table 15.1), however these are all mobile species that occur over a wide geographical range. The Project area does not include habitat of special conservation importance for these species;
- Habitat containing potential SREs will be avoided; and
- The Project will not impact on any critical or high value environmental assets recognised at the State level, or matters of national environmental significance recognised under the Commonwealth EPBC Act. It is distant from any known threatened ecological communities, wetlands and waterways, or formal conservation areas.

A variety of mitigation measures during the Project construction and operations phases are proposed, which address the key environmental factors identified in the Project ESD. These are discussed in Chapters 6 to 14 and further detailed in the following environmental management plans developed for the Project (Appendix B):

- Air Quality Management Plan;
- Cultural Heritage Management Plan;
- Amenity (Noise and Vibration) Management Plan;
- Hydrological Processes Management Plan;
- Flora and Vegetation Management Plan;
- Fauna Management Plan; and
- Waste Management Plan.

A Mine Closure Plan has also been prepared that addresses environmental management commitments post mining and processing (refer to Chapter 14).

Relevant specific management measures relating to the protection of vegetation, flora, fauna habitat and species are described in Table 15.3.

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Table 15.2 Evaluation of residual environmental impacts associated with the Wingellina Nickel Project

Existing environment/ Impact	Mitigation			Significant residual impact	Offset calculation methodology				
	Avoid and minimise	Rehabilitation type	Likely rehabilitation success		Type	Risk	Likely offset success	Time lag	Offset quantification
Clearing of up to 2,762 ha of native vegetation for mine operations area (i.e. mine pits, TSF and associated infrastructure) and 211 ha associated with the Officer Basin borefield and pipeline route.									
Remnant vegetation	The clearing footprint of the mine operations area will be contained within a 5,875 ha development envelope. The clearing footprint of the borefield and pipeline route will be contained within a 2,243 ha development envelope and largely aligned with existing tracks. Progressive clearing and rehabilitation will be undertaken to minimise the amount of bare soil at any one time.	Progressive rehabilitation with locally occurring native species. A program of research and investigation trials will be implemented from Project commencement to inform appropriate landform design and landscape rehabilitation and revegetation methods. A materials inventory will be developed and managed to ensure that suitable materials are available for use in rehabilitation.	<u>What is the type of vegetation being rehabilitated?</u> Predominantly sparse or open shrublands and woodlands (refer to Table 11.1). <u>Can the environmental values be rehabilitated?</u> Broad industry experience suggests that partial reinstatement of pre-disturbance ecosystem function is achievable; based on stability, infiltration and nutrient cycling targets developed from analogue sites. Similarly, partial reinstatement of pre-disturbance vegetation structure and species diversity is achievable; based on density, plant cover and species composition/ richness targets developed from analogue sites. <u>Time lag?</u> Rehabilitation will be progressive; however a time lag of up to 40 years may be applicable for some mine domains depending on the operating life of the mine. <u>Credibility of the rehabilitation proposed (evidence of demonstrated success)</u> Mine closure planning and preliminary landform design criteria have been proposed having consideration of rehabilitation learnings from nearby mines in similar environments including the Tropicana (Gold), Mt Keith (Nickel), and Ravensthorpe (Nickel) Projects. Risk factors for rehabilitation (e.g. the occurrence of dispersive and sodic materials) have been evaluated as part of this process (refer to Chapter 14).	No	N/A	N/A	N/A	N/A	N/A
Rare flora	Avoidance of priority taxa individuals and populations.	N/A – Priority flora populations will be avoided.	*Menkea lutea* is intended to be included in the rehabilitation species mix. The efficacy of re-establishing this species will be evaluated as a component of rehabilitation trials during the mine operations phase of the Project.	No	N/A	N/A	N/A	N/A	N/A

Existing environment/ Impact	Mitigation			Significant residual impact	Offset calculation methodology				
	Avoid and minimise	Rehabilitation type	Likely rehabilitation success		Type	Risk	Likely offset success	Time lag	Offset quantification
Habitat for rare fauna	The proposed clearing footprint does not include habitat of special conservation importance to rare fauna species.	The habitat values of the Project area will be largely reinstated, in accordance with rehabilitation targets developed from analogue sites.	See above.	No	N/A	N/A	N/A	N/A	N/A

Table 15.3 Proposed management measures for the protection of vegetation, flora, fauna habitat and species

Potential impact	Action(s)
Vegetation clearing	Minimisation of clearing footprints during final design including the avoidance of drainage line and ridgeline vegetation where possible.
	Mine planning to include progressive clearing and rehabilitation to minimise the amount of bare soil at any one time.
	Implementation of clearing procedures to prevent accidental clearing of vegetation.
Disturbance of significant flora and vegetation	Locations of Priority flora outside the development footprint will be demarcated and access/clearing prevented.
	The condition of Priority flora in the Project area will be regularly monitored.
Introduction and/or spread of weeds	Vehicles will be confined to authorised tracks and roads.
	All vehicles arriving on-site will be required to undertake a wash down to remove weed seeds.
	A regular inspection will be undertaken to identify weed growth and control of weeds will be undertaken by appropriate spraying.
	Weed infested topsoil stockpiles will be treated.
	Feral herbivores will be excluded from the Project area, including rehabilitated sites.
Altered fire regimes	A Fire Management Plan will be developed for the Project and will include development and identification of the following responses and procedures: • Safe work procedures and permitting for welding and grinding work; • Personnel fire hazard procedures; • Fire response vehicles; • Bushfire contingency plans; • Emergency fire response procedures; and • Installation of fire breaks where necessary.
	The use of fire for hunting will not be permissible within the mine site Project area.
Vehicle collisions with fauna	Ensure vehicle speeds are controlled and that vehicles only use authorised access routes.
	Maintain a register of vehicle impacts on vertebrate fauna.

Potential impact	Action(s)
Animal entrapment and exposure to toxic substances	Minimise fauna mortality as a result of falling into excavated areas by minimising the trench/excavation area open at any given time, install escape ramps into excavated areas and conduct regular inspections of excavated areas and trenches.
	Use bird deterrent methods to minimise bird activity on the TSF.
	Install animal egress matting on the sides of the TSF and WSF.
Feral animals	Manage waste and water ponding to prevent the attraction and enhancement of feral animal populations.
	Monitor feral animal activity and implement control actions where necessary to prevent the build-up of feral animal populations.
Altered water regimes	Project infrastructure will be designed and constructed to minimise disturbance to existing surface water flows while preventing the potential for flooding. Culverts will be constructed at approximately 13 locations to aid in the maintenance of existing flows and rates and therefore minimise potential impacts to vegetation from localised flooding or drought.
Use of brackish water for dust suppression	All access roads and haul roads will be regularly sprayed with mildly saline groundwater to minimise dust suppression. All roads will be constructed to prevent water run-off into native vegetation, e.g. bunds and sumps will be installed at appropriate locations and intervals.
Atmospheric emissions	Emissions of dust/particulates, SO_2 and sulphuric acid mist will be minimised and managed in accordance with the Project Air Quality EMP (Appendix B).
Workforce management	Environmental awareness induction and education programs addressing the protection of flora and fauna and their habitat will be delivered to all workforce personnel. The workforce will be Fly-in-fly-out (FIFO) and restricted to accommodation camp and operations areas. Human access and activity will be subject to existing constraints applicable to Aboriginal Reserve 17614. Community and social programs - over the past decade the proponent (Metals X) has developed strong working relationships with the Traditional Owners of the land and local Aboriginal communities. This has included direct employment, community support and keeping the community informed of activities and progress through regular consultation.

15.4 Environmental offsets reporting form

An Environmental Offsets Reporting Form was prepared in accordance with the EPA template for this purpose (Table 15.4). This form is structured to address:

- Summary administrative information about the Project;
- The type of environmental assets affected by the Project;
- The potential for significant adverse environmental impacts related to the Project before mitigation measures are applied;
- Measures to avoid, minimise, rectify and reduce potential environmental impacts;
- Proposed environment offsets, in the event that significant residual impacts are predicted to occur; and
- Relevant data sources and evidence of stakeholder consultation, including details of specific environmental, technical or other relevant advice and information obtained to assist in the formulation of the offset in cases where a need for offsets is identified.

Table 14.4 EPA Environmental offset reporting form

Section A: Administrative information
Proposal or scheme name: The Wingellina Nickel Project (the Project) is located approximately 1,450 km east-northeast of Perth, in the far east of Western Australia near the South Australia and the Northern Territory borders. The Proponent for this project is Hinckley Range Pty Ltd (Hinckley Range), a wholly owned subsidiary of Metals X Limited.

Summary of proposal or scheme:
 	
The Project involves open pit mining of nickeliferous limonite ore from the Wingellina deposit at a rate of approximately 4.3 million tonnes per annum (Mtpa), and on-site processing using a high pressure acid leach (HPAL) process to produce an intermediate mixed nickel-cobalt hydroxide product. The estimated life of mine is 40 years based on current ore reserve estimates. The processed nickel-cobalt hydroxide will be transported to overseas markets, via road and rail to the Port of Darwin or the Port of Adelaide.
 	
The Project includes the following elements:
 	
• Open cut mine pits;
• Waste rock landforms and topsoil stockpiles;
• A tailings storage facility (TSF) and water storage facility (WSF). Tailings will be neutralised using locally sourced calcrete trucked in from South Australia;
• Associated mine infrastructure including: workshops and washdown areas, explosive storage magazine, service roads, airstrip (upgrade to existing), accommodation village, administration buildings, waste landfill, fuel storage area, co-generation power plant and power distribution network, septic waste treatment, reverse osmosis water treatment units;
• Water use:
  o ~12 GL/annum (with 0.3GL/annum from mine dewatering activities). Water will be sourced from the Officer Basin, 100 km to the southwest of the proposed mine operation, and supplemented from mine dewatering activities and TSF recovery; and
• Clearing footprint:
  o Up to 2,762 ha vegetation for mine operations area (i.e. mine pits, TSF and associated infrastructure) within a 5,875 ha development envelope;
  o Up to 211 ha vegetation for water supply borefield and pipeline within a 2,243 ha development envelope.

Section B: Type of environmental asset (s) – State whether Critical or High Value, describe the environmental values and attributes
The Project will not impact on any critical environmental assets. The Project will not impact on any high value environmental assets. The Project area is located outside of any proposed conservation estate. The habitats found in the Project area are considered to be widely represented throughout the surrounding region. The proposed mine operations area is located in the Mann-Musgrave subregion (CR1) of the Central Ranges bioregion. No ecosystems at risk have been identified in CR1 (Graham & Cowan 2001[4]). In general, altered fire regimes and the potential for intense wildfires pose the greatest risk to ecosystems of this region. Introduced grazers and predators pose the next greatest risk to flora and fauna. Introduction of weeds along roadsides and water courses also threaten pristine ecosystems of the region. The proposed mine operations area is located within the Ranges of the Western Desert (Place ID: 9861) – a vast area of about 8,016,568 hectares including a system of ranges with many gorges and valleys which is listed on the Register of the National Estate. This area comprises Aboriginal Reserve 17614 and has been determined to have Indigenous values of National Estate significance. Vegetation condition in the Project area has been assessed to vary from Excellent to Degraded. The main sources of disturbance are attributable to human activities (repeated fires) and grazing by feral camels. The introduced species *Cenchrus ciliaris* (Buffel Grass), *Cenchrus pennisetiformis* (Cloncurry Buffel Grass), *Acetosa vesicaria* (Ruby Dock), *Capsella bursa-pastoris* (Shepherd's Purse), *Malvastrum americanum* (Spiked Malvastrum), *Citrullus colocynthis* (Camel Melon), *Citrullus lanatus* (Pie Melon), *Tribulus terrestris* (Caltrop) and *Portulaca oleracea* (Common Purslane) have been recorded in the Project area. Biological surveys undertaken in the areas relating to the Project have recorded biodiversity values tabulated as follows:

[4] Graham D & Cowan M 2001, Central Ranges 1 (CR1 – Mann-Musgrave Block subregion), in *A Biodiversity Audit of Western Australia's 53 Biogeographical Subregions in 2002*, Department of Conservation and Land Management, Perth

Value	Mine operations area (Tenement E69/535)	Borefield (Tenement L69/12) & pipeline route
Threatened Flora species, Threatened Ecological Communities and Priority Ecological Communities	None.	None.
Priority Flora	*Goodenia lunata* (Priority 1); *Menkea lutea* (Priority 1); *Calotis latiuscula* (Priority 3); and *Euphorbia inappendiculata* (Priority 1/2).	*Neurachne lanigera* (Priority 1); *Aristida jerichoensis* var. *subspinulifera* (Priority 1); *Calotis latiuscula* (Priority 3); *Goodenia modesta* (Priority 3); and *Stackhousia clementii* (Priority 1).
Conservation significant terrestrial fauna species (listed under the *Wildlife Conservation Act 1950*; Priority species recognised by the DPaW)	Australian Bustard (*Ardeotis australis*) (Priority 4).	Brush-tailed Mulgara (*Dasycercus blythi*) (Priority 4); Western Long-eared Bat (*Nyctophilus major tor*) (Priority 4); Australian Bustard (*Ardeotis australis*) (Priority 4); and Rainbow Bee-eater (*Merops ornatus*) (Schedule 3).
Short Range Endemic (SRE) taxa	Mygalomorph spiders and pseudoscorpion.	Four potential SRE species based on current taxonomic and distribution knowledge: *Synothele* sp. (mygalomorph spider); *Anidiops* sp. (mygalomorph spider); *Aname* sp. (mygalomorph spider); and *Urodacus yaschenkoi* (scorpion).

Subterranean fauna	No obligate subterranean fauna have been recorded in surveys of the proposed Wingellina mine pit or TSF areas. Subterranean habitats in the proposed mine operations area are small, unconsolidated sedimentary aquifers or fractured rock aquifers of low yield. A very low diversity and abundance of subterranean fauna species is associated with these habitats.	No obligate subterranean fauna have been recorded in surveys of the proposed borefield area.

Section C: Significant impacts (before mitigation measures are applied)

1. Vegetation clearing for mine operations area

Based on surveys completed to date, the Priority taxa *Goodenia lunata*, *Calotis latiuscula* and *Euphorbia inappendiculata* occur outside the proposed mining area development footprint. Some individuals of *Menkea lutea* have been recorded within the proposed development footprint; however these individuals only represent a small proportion of the wider local population, which is extensive throughout the southern sections of the Project area.

2. Vegetation clearing for borefield/pipeline area

Based on surveys completed to date, the Priority taxa *Neurachne lanigera*, *Aristida jerichoensis* var. *subspinulifera*, *Calotis latiuscula*, *Goodenia modesta* and *Stackhousia clementii* occur in proximity to the proposed Officer Basin borefield and pipeline route. However these will largely be avoidable through appropriate siting of the borefield and pipeline infrastructure.

3. Indirect impacts to vegetation

Indirect impacts associated with altered fire regimes, weed introduction/spread, and feral animal introduction/spread.

4. Impacts on terrestrial fauna

Potential impacts to conservation significant terrestrial fauna species include:

- Direct impacts of habitat removal;
- Direct impacts associated with vehicle interactions (increased traffic);
- Direct impacts associated with dust, noise and light emissions during operations;

- Direct impacts associated with the TSF, which has the potential to attract and trap birds and other fauna; and
- Indirect impacts associated with altered fire regimes, weed introduction/spread, feral animal introduction/spread, and human interactions.

5. Contamination of surface and groundwater

Contamination arising from spills and leaks (e.g. process reagents, hydrocarbons).

6. Decommissioning and closure related aspects associated with post-mining

Rehabilitation failure, owing to the presence of dispersive and sodic materials in mined substrates combined with inadequate materials handling and management procedures and inappropriate final landform design.

7. Aboriginal heritage

Two archaeological sites have been identified within the Project disturbance footprint. Approval has been sought under Section 18 of the *Aboriginal Heritage Act 1972* (WA) to disturb these sites.

8. Consequential impacts

Increased human pressures in a relatively undeveloped remote area including vehicle traffic and unregulated human use.

Section D: Mitigation measures

The Project will be subject to the Proponent's Environmental Policy (http://www.metalsx.com.au/about-us/corporate-responsibility/) and a comprehensive environmental management framework including the following key elements:

- Targeted flora surveys will be undertaken prior to clearing activities to ensure that flora of conservation significance are avoided wherever practicable. This will ensure that impacts are constrained to a small percentage of the wider local population of any affected taxa;
- Project EMPs developed as part of the Public Environmental Review documentation will be applicable to the construction and operations phases of the Project. These include specific measures for the protection of vegetation, flora, fauna habitat and species;
- A Project Mine Closure Plan prepared in accordance with the *Guidelines for Preparing Mine Closure Plans* (DMP/EPA 2011) as part of the Public Environmental Review documentation, which includes specific measures for materials characterisation and the development of suitable land rehabilitation methods;
- Controls on human activities/land use pressures through workforce education and management, and consultation with the local community;

- Workforce will be Fly-in-fly-out (FIFO) and restricted to accommodation camp and operations areas and comply with activity restrictions applicable to the surrounding land tenure (Aboriginal Reserve). No off road driving will be permitted; and
- Fire prevention and suppression measures, in accordance with safety requirements under the *Mines Safety and Inspections Act 1994* (WA) and the *Bushfires Act 1954* (WA).

Community and social programs:

- Over the past decade the Proponent has developed strong working relationships with the Traditional Owners of the land and local Aboriginal communities. Relationships with local people have been developed through direct employment, community support and keeping the community informed of activities and progress through regular consultation. A consultative and collaborative approach will be carried forward over the life of the Project. This will include fencing an important ethnographic site (a "billabong") near Wingellina, which has become badly degraded by camels. In addition to helping to protect environmental values, this fencing project will provide training and employment opportunities for the local community; and
- Support for biological surveys of the wider region, including but not limited to the provision of accommodation and logistics support for biological survey teams.

Section E: Significant residual impacts (describe all the significant adverse residual impacts that remain after all mitigation attempts have been exhausted)

The Project will not result in any significant adverse residual environmental impacts, as a result of the proposed mitigation measures described in Section D of this form.

Section F: Proposed offsets for each significant residual impact (identify direct and contributing offsets). Include a description of the land tenure and zoning / reservation status of the proposed offset site. Identify any encumbrances or other restrictions on the land that may impact the implementation of the proposed offset and provide evidence demonstrating how these issues have been resolved.

No offsets are proposed, on the basis that no significant adverse residual environmental impacts from the Project are anticipated.

Section G: Spatial data relating to offset site/s

Not applicable.

Section H: Relevant data sources and evidence of consultation

Over the period 2009 and 2013, a number of detailed studies have been undertaken by specialist consultants to identify environmental values in the Project area and inform environmental management and protection aspects of the Project. These are described in the Project PER document and include:

- Vegetation and flora assessments in accordance with EPA Position Statement No.2 (Protection of Native Vegetation), No.3 (Terrestrial Biological Surveys) and EPA Guidance Statement No.51 (Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment);
- Fauna assessments, including subterranean fauna, in accordance with EPA Guidance Statement No.54 (Subterranean fauna in groundwater and caves during impact assessment in WA), EPA Draft Guidance Statement No.54a (Sampling methods and survey considerations for subterranean fauna in WA), EPA Guidance Statement No.3 (Terrestrial Biological Surveys) and EPA Guidance Statement No.56 (Terrestrial fauna surveys for environmental impact assessment);
- Site and desktop assessments of hydrogeology and impacts of mining, surface water and stormwater management for the Wingellina Project; and
- Soils and waste characterisation assessments and mine closure planning in accordance with ANZMEC/MCA Strategic framework for mine closure, DITR Mine Rehabilitation, DMP Guidelines for preparing mine closure plans and EPA Guidance Statement No.6 (Rehabilitation of terrestrial ecosystems).

The Proponent has consulted with regulatory agencies and other key Project stakeholders, to ensure that any potential concerns are appropriately addressed (refer to Chapter 4 of the Project PER Document). Input from regulatory agencies has been sought throughout the development of the Project, and feedback and advice received during this consultation process has been incorporated into the design of the Project.

15.5 Predicted Environmental Outcome

The baseline biological values of the Project area have been assessed through a program of vegetation, flora and fauna surveys (Chapters 11 and 12). The Project will not impact on any critical or high value environmental assets or otherwise contravene the Clearing Principles of the EP Act.

A range of mitigation measures have been proposed to avoid and minimise environmental impacts associated with the Project. Under the Mine Closure Plan (Appendix J) disturbed areas will be rehabilitated with locally occurring native species progressively during the operational phase and post-mining. Further to these measures, Hinckley Range will:

- Provide support for biological surveys of the wider region. This could include but is not limited to the provision of accommodation and logistics support for biological survey teams; and
- Continue with the implementation of a range of social engagement activities with the Wingellina community. This will include fencing an important ethnographic site (a “billabong”) near Wingellina, which has become badly degraded by camels. In addition to helping to protect environmental values, this fencing project will provide training and employment opportunities for the local community.

Subject to the proposed mitigation and management measures, the Project is not expected to result in any significant residual environmental impacts and is therefore consistent with the EPA’s objective “t*o counterbalance any significant residual environmental impacts or uncertainty through the application of offsets*”.

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CHAPTER 16

CONCLUSIONS

16.0 CONCLUSIONS

This Environmental Review document provides:

- A description of the key components of the Project;
- A summary of the important physical, biological and social factors of the existing environment;
- A discussion of the extent of community and government stakeholder consultation;
- An evaluation of potential impacts of the Project on key environmental factors; and
- Strategies and measures to ensure environmental factors and values are protected and managed to an appropriate level, developed in accordance with relevant standards and guidelines.

In support of the PER process, a range of specialist environmental, health and heritage investigations relating to the Project have been completed in accordance with relevant standards and guidelines. The outcomes of these studies have been used to understand the potential environmental impact of the project and have informed the layout of the mine and process infrastructure to avoid or reduce any impact. Supporting reports of the relevant studies are included in the appendices to this assessment.

Hinckley Range is committed to sound environmental policies and practices and a process of continuous improvement in environmental performance. Project Environmental Management Plans have been prepared that address each key environmental factor. These plans includes measures to avoid, minimise and mitigate potential environmental impacts, as well as specifying monitoring and contingency actions applicable to the construction and operations phases of the Project. These will form part of a comprehensive Environmental Management System for the Project.

A Mine Closure Plan has been prepared which addresses requirements for the closure, decommissioning and rehabilitation of the Project area.

Hinckley Range has undertaken extensive consultation with regulatory agencies and other stakeholders, which has informed the design of the Project and the development of environmental impact mitigation and management strategies.

On the basis of the findings of the Environmental Review, if implemented in accordance with the proposed management measure, the Project is considered to be environmentally acceptable and consistent with the EPA's principles and objectives for environmental protection.

CHAPTER 17

REFERENCES

17.0 REFERENCES

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GOVERNMENT OF
WESTERN AUSTRALIA

Environmental Protection Authority

Mr Warren Hallam
Executive Director
Metals X Limited
GPO Box 2606
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Our Ref: *2014-0000863273*
Enquiries: *Tim Gentle, 6145 0809*
Email: *tim.gentle@epa.wa.gov.au*

Dear Mr Hallam

WINGELLINA NICKEL PROJECT, ASSESSMENT NUMBER 1986, PUBLIC ENVIRONMENTAL REVIEW

Thank you for your letter and the modified Environmental Scoping Document (ESD) dated 17 June 2014 for the above proposal.

I note you have accepted the Environmental Protection Authority's (EPA) proposed amendments but have included some additional changes as listed below.

1.3 summary of the proposal
In the previous version it was stated that:

> *"The mine has been designed to produce approximately 40,000 tonnes (t) of nickel and 3,000 t of cobalt metal in concentrate per annum for 40 years."*

In the version submitted the words "based on current reserves" have been added to the end of this sentence. It is preferred that these additional words be deleted as they introduce some ambiguity as to the scope of the proposal before the EPA.

Section 1.4 approvals history
The previous version stated that:

> *"The EPA has requested Hinkley Range prepare this ESD given the proposal's complexity and associated public interest".*

However, in the version you have submitted the wording after "ESD" has been omitted. It is preferred that the original wording be retained to reflect the wording of EPA Environmental Assessment Guidance 10 (page 4).

Rehabilitation and closure (integrating factor)
The previous version stated the following requirement:

> *"Identify relevant closure learnings from other comparable projects (eg Tropicana and Mt Keith)".*

However, in the current version the reference to the Tropicana and Mt Keith projects has been omitted. In considering your proposal, the EPA was of the view that it is critical that lessons be learned from other similar projects. The Tropicana project is relevant in terms of rehabilitation as it is also in a desert environment and dispersive soils are present. The Mt Keith project is relevant in terms of learnings from rehabilitation of the surface of the tailings storage facility (rock armouring as opposed to alternative methods). It is therefore preferred that the reference to the Tropicana and Mt Keith operations be retained.

The final paragraph (new wording) under this factor now states that:

> *"If there is potential for significant risks to human health or the environment, further work will be undertaken during the Detailed Feasibility Study to provide workable management measures to avoid those risks or to reduce or remediate to acceptable level to ensure a sustainable "walk-away" closure solution."*

However, if significant risks to human health or to the environment are identified, it is essential that information is provided in the PER document to show whether those risks are capable of being managed both during proposal implementation and post-closure. The following wording is therefore preferred:

> *"If there is potential for significant risks to human health or to the environment, further work will be undertaken to identify workable management measures to either avoid those risks or to reduce or remediate to acceptable levels to ensure a sustainable "walk-away" closure solution".*

Other matters
In regard to the factor "Amenity" the EPA has previously noted that the impacts of increased aircraft noise on the Wingellina community will need to be addressed. Consistent with advice received from the Department of Environment Regulation, the PER document will need to demonstrate that the proposal is capable of meeting relevant standards (AS 2021-2000 *Acoustics – Aircraft noise intrusion – Building siting and construction*).

The enclosed document has been amended to address the above issues. Subject to those amendments, and under delegated authority from the EPA, I approve the enclosed ESD (dated 4 July 2014) as providing an acceptable basis for the preparation of the PER document.

Guidelines for preparing a PER document are available on the EPA website (www.epa.wa.gov.au).

During the preparation of the PER you are encouraged to consult with the Principal Environmental Officer for the proposal Mr Tim Gentle, who can be contacted on telephone number 6467 0809.

Yours sincerely

Dr Paul Vogel
CHAIRMAN

11 July 2014

Encl. approved environmental scoping document

cc: Mr Adam Parker
SNC-Lavalin Australia Pty Ltd
Level 17, 191 St Georges Terrace
PERTH WA 6000

WINGELLINA NICKEL PROJECT

ENVIRONMENTAL SCOPING DOCUMENT

Rev	Date	Issued for	Prepared By	Reviewed By	Approved By
0	03/12/2013	Final Document for Issue	TF	AP	AP
1	08/01/2014	Revised Final Document for Issue	AP	AE	AP
2	05/02/2014	Revised document for EPA meeting	AK	AP	AP
3	07/03/2014	Revised document for EPA meeting	AK	AP	AP
4	13/06/2014	Revised document For EPA	AP	AF	AF
5	04/07/2014	EPA approved version			

REVISION CONTROL

☒ Coordinated Review

☐ Issued for use as Standard Specification

REVISION HISTORY

Revision	Pages Revised	Remarks
0	Various	Various amendments
1	Various	Various amendments in accordance with meeting with OEPA
2	Various	Various amendments in consultation with OEPA
3	Various	Include references to EAG's, statement of compliance with EAG's refinement in scope on advice from EPA
4	22, 23	Updated aspects of Mine Closure to be more specific as to the extent of work in the Mine Closure Plan and PER.

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1.0 INTRODUCTION

1.1 Purpose of Document

Hinckley Range Pty Ltd (Hinckley Range) proposes to develop the Wingellina Nickel Project (the Proposal) in Western Australia (Assessment No. 1986).

This Environmental Scoping Document (ESD) has been prepared to meet the requirements of the *Environmental Protection Act 1986* (EP Act). The EP Act requires that where a proposal is considered likely to have a significant environmental impact; it will be subject to an assessment by the EPA under section 38 of the EP Act. This proposal is to be assessed by way of a Public Environmental Review (PER).

Scoping is required to identify key issues, early in the assessment process. The ESD has been prepared with specific reference to the Environmental Protection Authority's (EPA's) Environmental Assessment Guidelines (EAG) 1, 6, 8, 9, 10 and Sections 10.2.3 and 10.2.4 of Western Australian EP Act *Environmental Impact Assessment Administrative Procedures 2012*.

The purpose of the ESD is to:

Detail the preliminary key environmental factors that will be addressed in the PER document.
Document and initiate the studies to be undertaken to define the environmental setting and enable EPA assessment.
Identify the milestones for the preparation of the PER document.
Identify the decision making authorities for the proposal.

The PER document is required to be prepared in accordance with the ESD. The proponent should ensure that the PER document focuses on the preliminary key environmental factors. The PER document should be prepared in accordance with relevant guidelines including section 10.2.4 of the Western Australian EP Act *Environmental Impact Assessment Administrative Procedures 2012*.

1.2 Proponent Details

The proponent of the Proposal is:

Hinckley Range Pty Ltd (a wholly owned subsidiary of Metals X Limited)
18-32 Parliament Place
West Perth, WA 6005
ABN 64 052 098 496
Phone: (08) 9220 5700

1.3 Summary of the Proposal

Hinckley Range proposes to develop the Wingellina Nickel Mine, located approximately 1,450 kilometres (km) east-northeast of Perth, Western Australia. **Figure 1** shows the location and the regional context of the Proposal.

The Proposal involves open pit mining of nickeliferous limonite ore from the Wingellina deposit at a rate of 4.34 million tonnes per annum (Mtpa), and on-site processing at a processing plant using a high pressure acid leach (HPAL) process, to produce an intermediate mixed nickel-cobalt hydroxide product. The mine has been designed to

produce approximately 40,000 tonnes (t) of nickel and 3,000 t of cobalt metal in concentrate per annum. The processed nickel- cobalt hydroxide will be transported to overseas markets, via road and rail to the Port of Darwin or the Port of Adelaide, following outcome of the definitive feasibility study. The transport Route is expected to follow existing road networks.

The proposal requires the construction of associated mine infrastructure; including, workshops, hardstand areas, administration buildings, access roads, borefield, laboratory, processing plant, explosive storage magazine, waste landfill, fuel storage, water storage, septic waste treatment, communications systems, roads, accommodation, co-generation power plant and tailings storage facility (TSF).

Construction of the mine and associated mine infrastructure will require clearing of approximately 2,205 ha of native vegetation within tenement E69/535. A further 211 ha of clearing, outside of this tenement, is required for raw water supply.

Twelve gigalitres (GL) per annum of water is required for the mine (dust suppression), operation of the plant and accommodation village. Water will be sourced from the Officer Basin, 100 km to the south of the proposed mine operation, and supplemented from mine dewatering activities, and TSF recovery. Dewatering will supply a maximum of 860 kL/d (0.3 GL/annum) and approximately 200 m^3/hr of water will be recycled from the TSF.

Tailings from the processing plant will be piped to the TSF at a rate of 5.0 Mtpa.

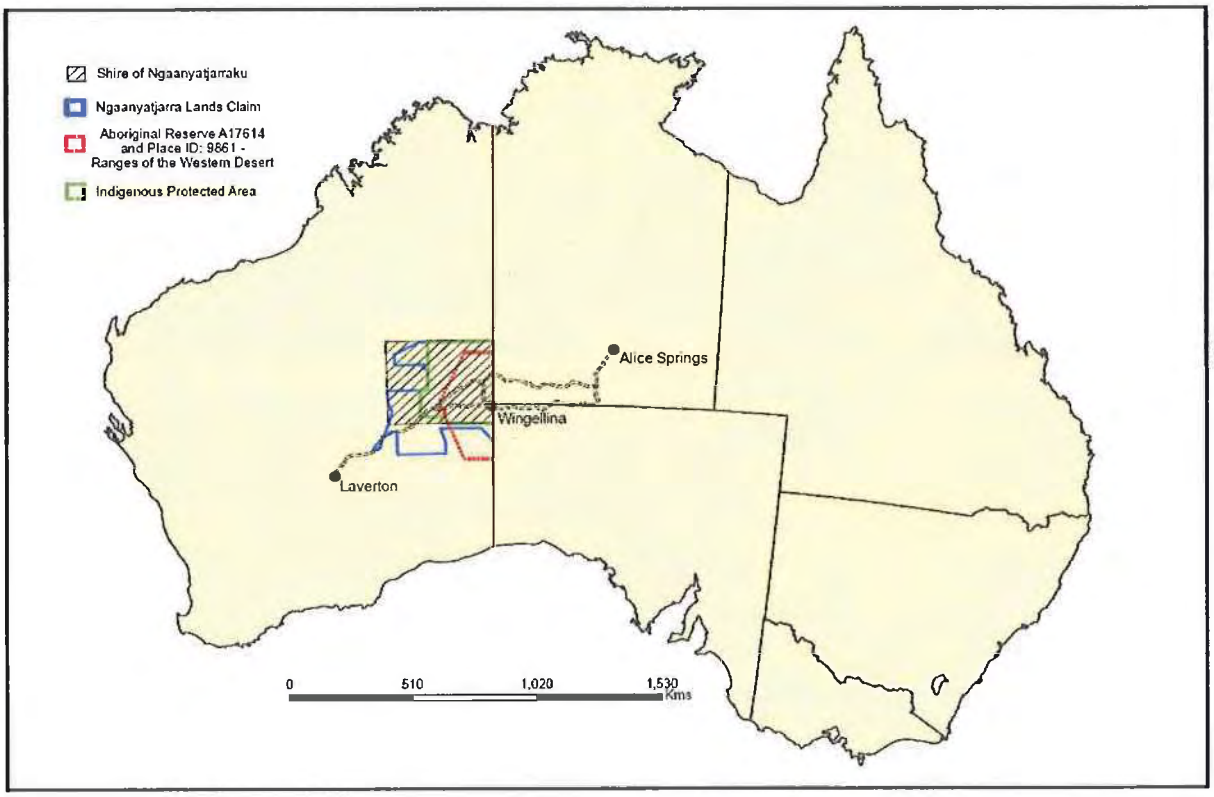


Figure 1: The Location and the Regional Context of the Proposal

Tailings will be neutralised using calcrete sourced from an existing quarry in South Australia, and trucked to the operation on existing roads.

A summary of the Key Proposal Characteristics is presented in **Table 1.**

Figures 2 and 2a illustrate the proposed development envelope of the mine operations and supporting infrastructure required for the Project.

Figures 3 and 3a depict the disturbance footprint of the implemented proposal and areas of impact. These figures also describe the special representation of the proposal elements listed in the Table 1 for; mining operations, borefield and pipelines.

A spatial dataset defining the elements of the Proposal has been lodged with this ESD.

The EPA has prepared *Environmental Assessment Guideline for Defining the Key Characteristics of a Proposal* (May 2012) (EAG 1) to define the Key Proposal Characteristics for the purposes of assessing the proposal and subsequent incorporation in the Ministerial approval statement.

Table 1: Key Proposal Characteristics

Summary of the Proposal

Proposal title	Wingellina Nickel Mine
Proponent name	Hinckley Range Pty Ltd (Hinckley Range)
Short description	This Proposal is to mine nickeliferous limonite ore from the Wingellina deposit, 1,450 km east-northeast of Perth, WA, including the construction of associated mine infrastructure (workshops, hardstand areas, administration buildings, access roads, borefield (as associated pipelines), laboratory, acid processing plant, explosive storage magazine, waste landfill, fuel storage, water storage, septic waste treatment, communications systems, roads, accommodation and co-generation power plant) and discharge waste to a Tailings Storage facility.

Physical Elements

Element	Location	Proposed Extent Authorised
1. Mining Pits	Figure 3	Clearing of no more than 610 ha within a 4,950 ha development envelope
2. Associated Mine Infrastructure (including HPAL processing plant)	Figure 3	Clearing of no more than 625 ha (excluding TSF and borefield) within a 4,950 ha development envelope.
3. Tailings Storage Facility & Evaporation Dam	Figure 3	Clearing of no more than 970 ha within a 4,950 ha development envelope
4. Raw Water Supply & pipeline	Figure 3a	Clearing of no more than 215 ha within a 2,243 ha development envelope.

Operational Elements

Element	Location	Proposed Extent Authorised
1. Ore Processing (including crushing and screening and the HPAL processing plant)	Figure 3	Treatment of no more than 4.34 Mtpa
2. Tailings Disposal	Figure 3	Disposal of no more than 5.0 Mtpa
3. Dewatering	-	Extraction of approximately 200 m3/hr
4. Groundwater abstraction	Figure 3a	Abstraction of no more than 12 gigalitres per annum

Figure 2: Project Development Envelope (excluding borefield and pipeline)

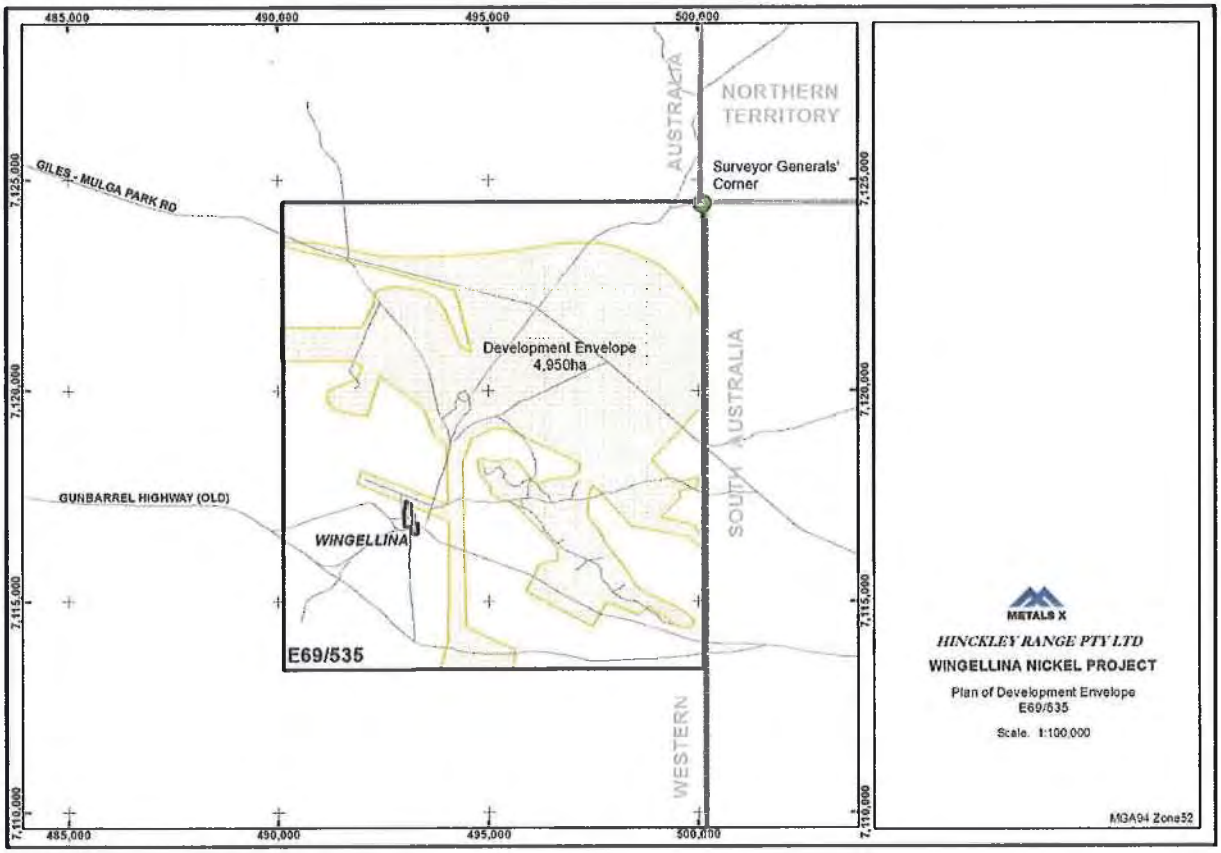


Figure 2a: Proposed Development Envelopes for Officer Borefield and Pipeline

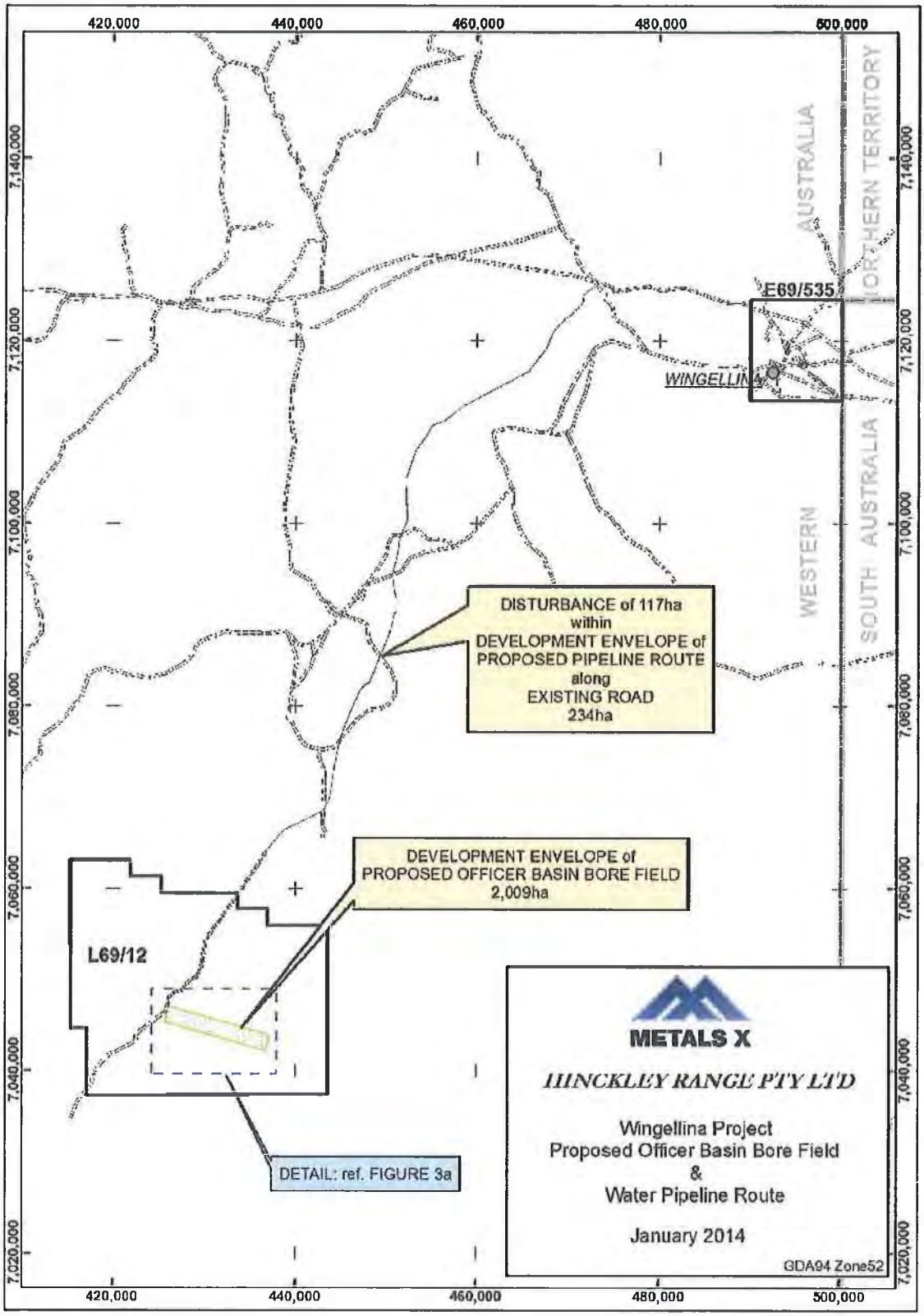


Figure 3: Disturbance Footprint of the Mine and Related Infrastructure (Excluding Borefield) Showing the Proposal Areas of Impact

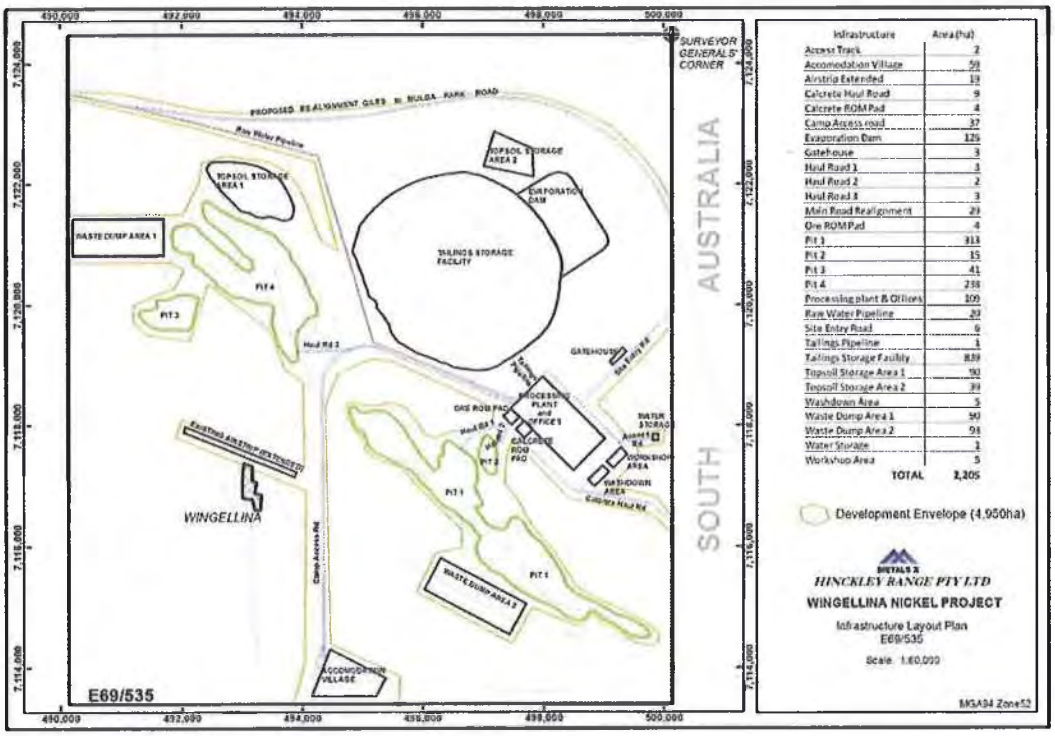
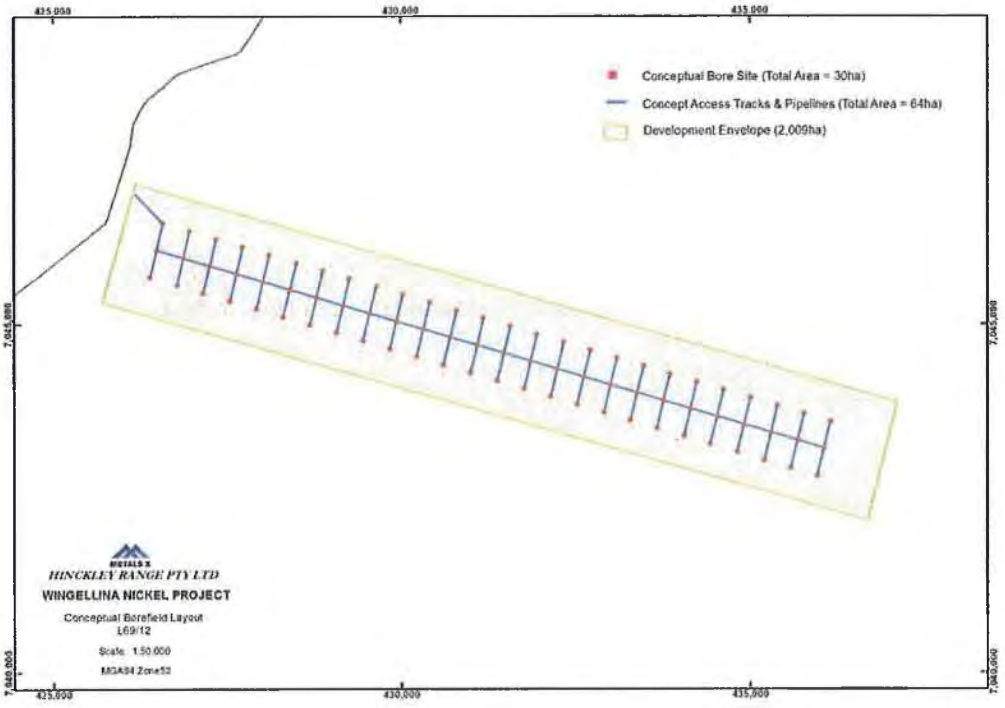


Figure 3a: Footprint of the Proposed Borefield Layout Showing the Areas of Impact



1.4 Approvals History

The environmental approvals of the Wingellina Nickel Project have been progressed by Hinckley Range since 2010. In March 2010, Hinckley Range referred the Wingellina Nickel Project to the EPA under Section 38 (Part IV) of the EP Act. On 22 March 2010 the EPA set the level of assessment for the Proposal at PER, with an eight weeks public review period. The basis of the referral was that the existing township of Wingellina was to be relocated away from operations.

Subsequently results of predictive modelling on air, noise and vibration indicate there is unlikely to be an impact on the current Wingellina Township during normal operations. As a result Hinckley Range has sought to have the Project assessed considering Wingellina as a sensitive receptor.

Hinckley Range remains committed to the orderly relocation of the existing Wingellina township but the separation of the environmental and town planning approvals will provide greater certainty on the Project should the planning approval process be protracted.

The EPA confirmed assessing the existing Wingellina Township as a sensitive receptor posed a significant change to the original referral, predominately due to the previously limited understanding of the impacts on the existing Wingellina Township and requested the proponent refer the new proposal to the EPA.

From the information provided in the Section 38 Referral, the EPA determined in November 2013 that the Project required assessment at the level of a PER, with eight weeks public review.

The EPA has requested Hinckley Range prepare this ESD, given the Proposal's complexity and associated public interest.

The Project was also referred at the Commonwealth level, to the Department of the Environment, who assessed the proposed mine site area is "Not a Controlled Action". The borefield and pipeline is to be assessed once these components of the Project have been finalised.

2.0 ENVIRONMENTAL FACTORS

2.1 Preliminary Key Environmental factors

The EPA has developed a set of environmental factors and objectives (*Environmental Assessment Guideline for Environmental factors and objectives* (EAG 8)). Key preliminary environmental factors for this Proposal were determined by the EPA at the time of its decision to assess the Proposal at the level of PER.

The PER will provide a detailed assessment of the preliminary key environmental factors. The preliminary key environmental factors and work required to be undertaken, are listed in Table 2, with consideration of the relevant EPA objectives.

Table 2 also identifies a list of policy documents that outline how the preliminary key environmental factors and scope of work relevant to the proposal are to be considered. The PER will assess the preliminary key environmental factors in a manner that is consistent with these documents.

Table 2: Preliminary Key Environmental Factors and scope of works relevant to the proposal

Air Quality	
EPA objective	To maintain air quality for the protection of the environment and human health and amenity.
Construction and Operational Phase and post closure	
Potential Impact	Dust impacts from the mine (nearest pit is approximately 2.1 kilometres (km) and the tailings storage facility is 3.4 km from the Township) and emissions from the processing plant on the Township of Wingellina (4.5 kilometres away) and proposed workers accommodation (5 kilometres away). Generation of greenhouse gas emissions (up to 520,000 t/annum).
Work and output required	Investigate and model impacts of dust from the mine (including tailings storage facility) as well as processing plant emissions (NO_x, SO_x, acid vapour) on the Wingellina community, transient communities, public areas and proposed workers accommodation. Address greenhouse gas emissions as per EPA guidance statement 12, in particular provide a greenhouse gas inventory and benchmarking against similar technologies producing similar products or their analogues. Discussion of mitigation measures taken/proposed to avoid, minimise, and reduce impacts/emissions. Provide an analysis of emissions intensity.(i.e. quantity of significant emissions per tonne of product produced) compared to published benchmarked best practice for equivalent plants and equipment. Explanation of best practice for managing air emissions. Describe the proposed management, monitoring and validation for all predictions for all significant emissions. Carry out air quality modelling in accordance with the Department of Environment (2006) *Air Quality Modelling Guidance Notes.* Cumulative air emission impacts should be modelled taking into account any locally significant emissions sources (i.e. existing power generator) and cumulative emissions. If the actual information is not available an estimate from an equivalent plant should be used. Prepare contingency plans for air emissions should predicted emissions be exceeded. Conduct consultation with stakeholders, record stakeholder comments and provide proponent responses.
Relevant policy/guidance documents	EPA Guidance Statement No. 3 *Separation Distance between Industrial and Sensitive Land Uses.* EPA Guidance Statement No. 12. *Minimising Greenhouse Gas Emissions.* *Clean Energy Act 2011.* *National Greenhouse and Energy Reporting Act 2007*

	Environmental Protection Regulations 1987 Australian Standard AS 2985 Workplace Atmospheres – Method for sampling and gravimetric determination of respirable dust. National Environmental Protection Council (Ambient Air Quality) Measure (NEPM) 2003. Department of Environment 2006 *Air Quality Modelling Guidance Notes* http://portal.environment.wa.gov.au/pls/portal/docs/PAGE/DOE_ADMIN/GUIDELINE_REPOSITORY/AIRQUALITYMODELLINGGUIDANCENOTES_MAR2006WEB.PDF Department of Environment and Conservation 2011 *A guideline for managing the impacts of dust and associated contaminants from land development sites, contaminated sites remediation and other related activities.*
Human Health	
EPA objective	To ensure that human health is not adversely affected.
Construction and Operational Phase and post closure	
Potential Impact	Reduced air quality in the location of the Wingellina town (population of 80-150), transient communities and mine workers accommodation (population of 1500 during construction and 500 during operation) from emissions from the HPAL Processing Plant and power station and generation of dust from mining, tailings storage and waste dumps. Potential impacts of toxic and/or bio-accumulating emissions.
Work and output required	Undertake a Health Impact Assessment and Health Risk Assessment on air emissions and potential for human health impacts from toxic, bio-accumulating emissions, to the requirements of the Department of Health. Develop an emissions inventory (based on similar operating processes and mining operations), identify exposure pathways, and provide interpretation of outputs from modelling data and comparison with published standards protective of public health. Provide a comprehensive baseline study of the health status of the Wingellina community. Provide information on the bioavailability of nickel and other metals of concern (eg hexavalent chromium) including management strategies for fugitive dust, including fibrous or asbestiform materials (adopting a risk-based approach in the event such materials are present) from the project, including from roads and from tailing storage facilities, during construction and operations, and post-closure. Discuss mitigation measures taken/proposed to avoid, minimise and reduce impacts. Identification of appropriate mitigations to reduce any identified or residual risks. Conduct consultation with stakeholders, record stakeholder comments and provide proponent responses. Comprehensive and meaningful consultation with the Wingellina community and Land Council is required.
Relevant policy/guidance documents	Department of Health 2008, *Health Risk Assessment in WA*, taken from http://www.public.health.wa.gov.au/cproot/1499/2/Health_Risk_Assessment.pdf, April 2008. Department of Health 2010, *Health Risk Assessment (Scoping) Guidelines*, taken

	from http://www.public.health.wa.gov.au/cproot/3087/2/HRA_Scoping.pdf, July 2010. Department of Health 2013, *Guidance Note on Public Health Risk Management of Asbestiform Minerals Associated with Mining* taken from http://www.public.health.wa.gov.au/cproot/5387/2/Guidance%20Note%20on%20Public%20Health%20Risk%20Management%20of%20Asbestos%20Associated%20with%20Mining%20Activities.pdf July 2013 Department of Mines and Petroleum, 2010, *Management of fibrous materials in Western Australian Mining Operations* http://www.dmp.wa.gov.au/documents/Factsheets/MSH_G__ManagementOfFibrousMinerals.pdf Department of Health, undated, *Public Health Consultation: A Guide for Developers* taken from http://www.public.health.wa.gov.au/cproot/1503/2/Public_Health_Consultation_Guide.pdf enHealth (2012), *Environmental Health Risk Assessment – Guidelines for Assessing Human Health Risks from Environmental Hazards, 2012.* EPA Guidance Statement No. 3 *Separation Distance between Industrial and Sensitive Land Uses.*
Heritage	
EPA objective	To ensure that historical and cultural associations are not adversely affected.
Construction and Operational Phase and post closure	
Potential Impact	Disturbance of archaeological and ethnological sites and artefacts. Loss of access to areas for local Aboriginal cultural activities and traditional ways of living.
Work and output required	Consult with both the Ngaanyatjarra people and the Department of Aboriginal Affairs in regards to heritage matters. Undertake ethnographic surveys in consultation with local Ngaanyatjarra people and the Department of Aboriginal Affairs. Consult with local Ngaanyatjarra people to ascertain social and cultural associations with the land and enable identification of environmental impacts as they affect heritage and cultural matters, such as hunting, collection of bush tucker, and access to traditional water holes and ceremonial sites. Report on concerns raised and provide mitigations for management of any changes to cultural and heritage environments relevant to the proposed development. Discussion of mitigation measures taken/proposed to avoid, minimise and reduce impacts. Discussion of potential impacts on Aboriginal cultural and heritage matters and how these impacts will be managed. Conduct consultation with stakeholders, in particular the Wingellina community and Department of Aboriginal Affairs, record stakeholder comments and provide proponent responses.
Relevant policy/guidance documents	EPA Guidance Statement No. 41 *Assessment of Aboriginal Heritage.* *Aboriginal Heritage Act 1972*

	Department of Aboriginal Affairs *Aboriginal Heritage Due Diligence Guidelines, Version 3, 2013*
Amenity (noise, light and vibration)	
EPA objective	To ensure that impacts to amenity are reduced as low as reasonably practicable.
Construction and Operational Phase	
Potential Impact	Noise, light and vibration from the mine, processing plant and power station impacting on Wingellina community (distance 4.4 kilometres) and mine workers accommodation area (distance 5 kilometres). Impacts from an increase in aircraft noise on the Wingellina community.
Work and output required	Assess the visual impacts, of; the proposal (including mine, tailings storage, waste dumps and processing plant) on the local community, from local view sheds. Assess impacts of light overspill on the local community. Propose measures / design considerations to reduce and manage impacts from light overspill. Provide a map showing the locations of all noise sensitive receptors affected or likely to be affected by the Project. Investigate sources of noise from the Project and estimate sound power levels based on best practice. Model predicted noise impacts on the Wingellina Community and proposed mine workers accommodation to assess whether noise from the proposal can be managed to comply with Noise Regulations at identified receptors. Provide noise, air blast and ground vibration predictions for sensitive receivers in relation to the Project operations. Noise impact assessment including ambient noise measurements at all neighbouring noise sensitive premises, should be conducted by strictly following the Section 5 Detailed Assessment procedure set out it EPA Guidance No. 8. Assessment of predicted noise on the Wingellina community from the airstrip expansion and the increase in aircraft movement. Demonstrate that the proposal can meet applicable Australian standard for aircraft noise (AS 2021-2000 *Acoustics – Aircraft noise intrusion – Building siting and construction*, Appendix D). The methodology for assessing noise impacts from the airstrip expansion should be selected in consultation with the OEPA and the Department of Environment Regulation Noise Branch. Use the outcomes of the Noise Impact Assessment to discuss how noise from the Project activities can be managed to comply with the Environmental Protection (Noise) Regulations 1997. Cumulative noise impacts should be modelled taking into account any locally significant emissions sources (i.e. power generator). If the actual information is not available an estimate from an equivalent plant should be used. Modelling information should demonstrate that the proponent can demonstrate whether they can meet the *Environmental Protection (Noise) Regulations 1997*. Discussions of mitigation measures taken/proposed to avoid, minimise and reduce impacts.at boundaries, including local sources influencing the analysis. In the situation that noise control measures are required, details of the design of the noise controls and their incorporation into the noise modelling to demonstrate compliance. Develop and document measures to mitigate impacts to amenity based on

	proponent responses.
Relevant policy/guidance documents	AS 2021-2000 *Acoustics – Aircraft noise intrusion – Building siting and construction (Appendix D).* EPA Guidance Statement No. 3. *Separation Distance between Industrial and Sensitive Land Uses* Guidance Statement No. 8. *Environmental Noise*, May 2007. Environmental Protection Regulations (Noise)1997. Australian Standard AS 2436 - 1981 Guide to Noise Control on Construction, Maintenance and Demolition Sites. *Dangerous Goods Safety Act 2004* and Regulations (2007). Australian Standard 1940 - 2004: The storage and handling of flammable and combustible liquids. Guidance Note S301, Storage of Dangerous Goods Licensing and Exemptions (DoCEP 2006). Dangerous Goods Safety (Storage and Handling of Non-explosives) Regulations 2007. Dangerous Goods Safety (Explosives) Regulations 2007.
Hydrological Processes	
EPA objective	To maintain the hydrological regimes of groundwater and surface water so that existing and potential uses, including ecosystem maintenance, are protected.
Construction and Operational Phase and post-closure	
Potential Impact	The abstraction of water from the proposed borefield and dewatering may result in impacts to groundwater dependent ecosystems and stygofauna. Impacts to existing and potential users as a result of abstraction of water.
Work and output required	Determine and identify the location of potential water resources available to meet water requirements for the proposal for life of mine. Discuss the results from hydrogeological investigations and modelling to provide predictions of hydrogeological change and impact as a result of abstraction and dewatering. Assess the effects of the borefield on the groundwater quality and quantity of the area and means through which water use can be minimised. Assess groundwater drawdown including from dewatering, associated with the proposal. Discussion of proposed management, monitoring and mitigation methods to be implemented. Assess any impacts to existing users resulting from the proposed abstraction of groundwater and dewatering of pit water. Discuss mitigation measures to be implemented at the tailings storage facility to prevent groundwater contamination. Discussions of mitigation measures taken/proposed to avoid, minimise and reduce impacts. Conduct consultation with stakeholders, in particular the Wingellina community,

	record stakeholder comments and provide proponent responses.
Relevant policy/guidance documents	*Rights in Water and Irrigation Act 1914.* Department of Water. *Water Quality Protection Guidelines No. 1. Water Quality Management in Mining and Mineral Processing: An Overview*, 2000. Department of Water. *Western Australian Water In Mining Guideline* May 2013. ANZECC/ARMCANZ Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC and ARMCAZ 2000). Department of Water. *Field Sampling Guidelines.* National Water Commission 2012 *Australian groundwater modelling guideline.*
Flora and Vegetation	
EPA objective	To maintain representation, diversity, viability and ecological function at the species, population and community level.
Construction and Operational Phase and post closure	
Potential Impact	The proposal involves the clearing of up to 2,416 ha of native vegetation, including clearing for the mine, haul road, tracks, borefield, pipelines, accommodation camp, waste dumps and TSF. Indirect impacts on flora and vegetation may result from dust deposition, altered fire patterns, spread of weeds, altered water regimes and accelerated erosion/soil loss. Loss of biological diversity and reduced regional representation of flora and vegetation communities from direct and indirect impacts. Loss of conservation significant flora from direct and indirect impacts.
Work and output required	Undertake flora and vegetation surveys in accordance with EPA Guidance Statement 51 to define vegetation communities, including groundwater dependent vegetation, and locations of conservation significant species within the mine site area, borefield and service corridors. Surveys should be conducted during the optimal period for detection and identification of the range of flora likely to be occur. Optimal survey timing may vary from year to year but surveys should be undertaken 6-8 weeks after the occurrence of major "break of season" rainfall event. Provide a detailed description of the extent of clearing associated with the Project, including hectares of each vegetation community disturbed within the mine site area. Analyse and describe impacts to flora and vegetation, with reference to flora and vegetation identified and mapped during vegetation and flora surveys of the mine site and Officer borefield. Provide information on the impact to the extent and quality of flora and vegetation in the local and regional context, including impacts to flora and vegetation of conservation significance. Assess groundwater drawdown associated with the proposal and discuss any impacts to groundwater-dependent vegetation, expected as a result of the proposal operations. Discussions of mitigation measures taken/proposed to avoid, minimise and reduce impacts including environmental offsets (if necessary). Discussion of proposed management, monitoring and mitigation methods to be implemented. Conduct consultation with stakeholders, record stakeholder comments and provide

	proponent responses.
Relevant policy/guidance documents	Position Statement No. 2 *Environmental Protection of Native Vegetation in Western Australia* (2000). Position Statement No. 3 *Terrestrial Biological Surveys as an Element of Biodiversity Protection in Western Australia*, March 2002. EPA Guidance Statement No. 51. *Terrestrial Flora and vegetation Surveys for Environmental Impact Assessment* (2004). Department of Water. *Western Australian Water In Mining Guideline*, May 2013. EPA. *Checklist for documents submitted for EIA on marine and terrestrial biodiversity*. Policy Statement No 9 - *Conserving Threatened Species and Ecological Communities* (CALM 2003). *Wildlife Conservation Act 1950.* *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).* Environmental Protection (Clearing of Native Vegetation) Regulations 2004. EPA. *Checklist for documents submitted for EIA on marine and terrestrial biodiversity*. Australian Government, National Waster Commission (2011) S Richardson (SKM), E Irvine (SKM), R Froend (Edith Cowan University), P Boon (Dodo Environmental), S Barber (SKM), B Bonneville (SKM) (2011) *Australian groundwater-dependent ecosystems toolbox part 1: assessment framework.*
Terrestrial Fauna	
EPA objective	To maintain representation, diversity, viability and ecological function at the species, population and assemblage level.
Construction and Operational Phase and post closure	
Potential Impact	The proposal involves the clearing of not more than 2,416 ha of native vegetation which provides habitat for fauna. Vegetation clearing may result in loss or fragmentation of fauna habitat and consequential displacement of fauna. Construction of a 135 km water pipeline and increased vehicle traffic may impact upon fauna. Death or injury of fauna may also occur during clearing and construction and from ongoing operations. Increased numbers of predators such as cats and dogs attracted to the accommodation village and rubbish dumps. Increased numbers of grazing animals attracted by new water sources Death of animals and birds from drinking contaminated water from TSF and other sources. Construction and operation of the proposal has the potential to cause indirect impacts through impacts of weeds and obstruction of fauna movements due to increased presence of human activity.

Work and output required	(1) Undertake a Level 2 fauna survey of the mine proposal area including habitat assessment. (2) Undertake a Level 1 fauna survey of the pipeline corridor, including habitat assessment. Survey to include both a desktop study and a basic ground truthing through a reconnaissance survey. Surveys should be conducted for different faunal groups during the optimal periods as outlined in Table 2 in the fauna Technical Guide. Consultation with traditional owners in relation to fauna surveys. Assess potential impacts to vertebrate fauna and Short Range Endemic invertebrate species (SRE's), with consideration made to findings from fauna surveys of the Project areas. Discussion of conservation significant fauna species recorded in the proposal area or likely to occur in the proposal area. Discussion of potential direct and indirect impacts, and protection of, Specially Protected (Threatened) fauna, consistent with the provisions of the *Wildlife Conservation Act 1950. A targeted survey may be required if conservation significant fauna are found.* Discussions of mitigation measures taken/proposed to avoid, minimise and reduce impacts including environmental offsets (if necessary). Discussion of proposed management, monitoring and mitigation methods to be implemented. Conduct consultation with stakeholders, record stakeholder comments and provide proponent responses.
Relevant policy/guidance documents	EPA Guidance Statement No. 20. *Sampling of Short Range Endemic Invertebrate Fauna for Environmental Impact Assessment in Western Australia*, 2009. EPA Guidance Statement No. 56. *Terrestrial Fauna Surveys for Environmental Impact Assessment in WA*, 2004. Position Statement No. 3. *Terrestrial Biological Surveys as an Element of Biodiversity Protection*, March 2002. EPA and Department of Conservation Technical Guide – *Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment*, September 2010. *Wildlife Conservation Act 1950.* EPA. *Checklist for documents submitted for EIA on marine and terrestrial biodiversity*. *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).* Environment Protection and Biodiversity Conservation Regulations 2000, Schedule 4. Department of Water (2013) WA Water in Mining Guideline. Report No 12 *Table parts A5-7, B10-11, C5-6.*

Subterranean Fauna	
EPA objective	To maintain representation, diversity, viability and ecological function at the species, population and assemblage level.
Construction and Operational Phases	
Potential Impact	Potential direct and indirect impacts on habitat of stygofauna and troglofauna. This includes effects of groundwater drawdown including dewatering on stygofauna, excavation of habitat of troglofauna, and possible indirect effects from clearing of surface vegetation.
Work and output required	Surveys of all areas likely to be directly or indirectly impacted by the proposal are to be undertaken in accordance with Environmental Assessment Guideline (EAG) No. 12 (EPA 2013) and Guidance Statement 54a (EPA 2007). The results of the level 1 study will be used to determine whether further survey will be undertaken in accordance with criteria in EPA (2013) and EPA (2007). <u>Stygofauna</u> Level 1 study and description of the potential impacts from water abstraction from the borefield and determination of the likely presence of subterranean fauna (stygofauna) habitat. <u>Troglofauna</u> Conduct a Level 1 survey according to the criteria in EAG No.12 to determine if limestone, karst, calcrete or other suitable geology likely to provide habitat for troglofauna is present in the area proposed to be mined. If habitat suitable for troglofauna is present a Level 2 survey consistent with criteria in EAG No.12 and Guidance Statement 54a should be conducted. For both stygofauna and troglofauna, a description of boreholes sampled will be provided together with maps showing their location indicating bores sampled including those where no specimens were recorded. Mapping should show the extent of known or predicted subterranean fauna habitat and the extent of impact area including drawdown contours. Results of the studies should include discussion of potential impacts (direct and indirect, including from dewatering associated with the proposal, to subterranean fauna (both stygofauna and troglofauna) as a result of the proposal, the regional context of the project. Discussions of mitigation measures taken/proposed to avoid, minimise and reduce impacts. Discussion of proposed management, monitoring and mitigation methods to be implemented for subterranean fauna. Conduct consultation with stakeholders, record stakeholder comments and provide proponent responses. Complete the biodiversity checklist.
Relevant policy/guidance documents	EPA (2013) *Environmental Assessment Guidelines for Consideration of subterranean fauna in environmental impact assessment in Western Australia*. EAG No.12. Environmental Protection Authority, Perth. Guidance Statement No. 54a *Sampling methods and survey considerations for*

	subterranean fauna in Western Australia July 2007. DOW (2013) *Western Australia Water in Mining Guideline*. May 2013. *Environment Protection and Biodiversity Conservation Act 1999*. Checklist for documents submitted for EIA on marine and terrestrial biodiversity. Richardson, S et al. (2011) *Australian groundwater-dependent ecosystems toolbox, parts 1 and 2*. Waterlines report No 67 and 70, National Water Commission, Canberra. Department of Water (2013) *WA Water in Mining Guideline*. Report No 12 *Table parts A5-7, B10-11, C5-6*.
Rehabilitation and Closure (Integrating factor)	
EPA objective	To ensure that premises are closed, decommissioned and rehabilitated in an ecologically sustainable manner, consistent with agreed outcomes and land uses, and without unacceptable liability to the State.
Construction and operational phase, closure phase and post-closure	
Potential Impact	The abundance of clays throughout the profile is likely to be highly-dispersive. The variability of water holding characteristics of the sub-surface soils has the potential to affect rehabilitation outcomes. Potential risk of ongoing dust lift-off / erosion / pollution from the tailings storage facility (TSF) and waste dumps if they are not closed progressively and sustainably rehabilitated. If the TSF and or waste dumps are to be closed by rock armouring, sustainable closure may fail if there is an inadequate supply of suitable geochemically inert and competent rock. Potential for acid drainage from the tailings storage facility (acid will be used in ore processing). There may be potential for increased soil toxicity due to the dispersion and re-deposition of fine-grained ore materials by wind and mine-site traffic. Lateritic nickel and similar ore-types often contain weakly adsorbed metals such as nickel, hexavalent chromium and cobalt. In this case the metals would be in a bioavailable form and mining may lead to increased quantities being taken up from the soil by plant species and potentially entering local food-webs (including bush tucker). Based on the geology of the area there would appear to be minimal risk of acid drainage, however there may be potential for neutral (metalliferous) and/or saline mine drainage. Potential risks to humans and fauna from mine pits and mine pit lakes. . Through processes such as oxidation reactions on exposed pit walls and evaporative concentration, pit lake(s) which form after mine closure may develop elevated concentrations of metals, salt or other inorganic constituents. In addition, outflow of pit water may affect the quality of surrounding groundwater.

Work and output required	Submit with the PER a project-specific mine closure plan compliant with the Department of Mines and Petroleum (DMP)/EPA 2011 *Guidelines for Preparing Mine Closure Plans*. Consistent with the DMP/EPA Guidelines, the mine closure plan provided with the PER document needs to contain workable solutions to all significant closure risks. Identify all stakeholders and their role in the mine closure process. Conduct consultation with stakeholders, in particular the Wingellina community, record stakeholder comments and provide proponent responses. Discuss mitigation measures taken/proposed to avoid, minimise and reduce impacts and (if necessary) environmental offsets. Assess potential risks associated with decommissioning and closure of the Wingellina Project, including unplanned or temporary closure. Identify artificial landforms to remain within the mine site area, post closure and provide a diagram indicating their locations. Characterise physical and chemical properties of materials based on representative sampling. An assessment on total metals within the ore, waste rock and tailings materials will be evaluated to determine potential for bio-availability of metals. The total metal values above the Ecological and Baseline Investigation Levels will be captured within the Mine Closure Plan Risk Assessment and appropriate mitigations identified. Additional testing methodology (if required) will be selected in consultation with the Department of Environment Regulation (Contaminated Sites Branch) and documented in the PER. Desktop study of successful and unsuccessful rehabilitation strategies and outcomes in similar climates, geologies and vegetation types. Include a discussion of the different available methodologies and success rates for rehabilitation of the various proposed disturbance types including: • created landforms (e.g. waste rock dumps, tailings storage facility). • short-term disturbances (e.g. borrow pits and access tracks). • long-term disturbances (e.g. construction camp, permanent accommodation village and administration buildings). • linear and/or fragmentation disturbances (e.g. roads, powerlines, bore fields). Identify relevant closure learnings from other comparable projects (eg Tropicana and Mt Keith). Propose workable site-specific mine closure methods for post-mining land forms including waste dumps, TSF and mine pits. Identify workable methods for managing dispersive, sodic or saline materials, if present, and any other problem materials (e.g. fibrous or asbestiform materials) identified through materials characterisation. Identify materials for closure of the TSF and waste dumps. If rock armouring is to be used, is there sufficient competent and geochemically inert rock available and, given the quantities required, will it be economically feasible to transport the rock to the TSF? Will there be additional significant environmental impacts from quarrying the rock? Based on learnings from other projects in similar environment, propose workable rehabilitation and revegetation techniques appropriate to this arid desert environment and the soils present at the site. Describe site specific contingencies to make landforms safe, stable and non-polluting in the event of unexpected or temporary closure.

	Extending the hydrological processes work and outputs from hydrogeological investigations and modeling assess hydrogeological change from closing the water supply borefield and discontinuing dewatering as follows: (1) Predict rates of groundwater recovery following cessation of pumping from the water supply borefield and discontinuing pit dewatering; (2) Assess the potential for processes such as groundwater inflow, changes in pH, and/or evaporative concentration which may develop after closure, and the risk (if any) of the development of harmful concentrations of metals or other inorganic constituents in the pit lakes over time; (3) Calculate seepage velocity and flow directions based on the conceptual hydrogeology and groundwater model particle tracking to estimate the magnitude and direction of potential contamination from the mine pit(s) after mine closure and risk (if any) of contamination plumes; (4) Evaluate the risk that water remaining in the pit after closure, and/or any water flowing or seeping out of the pit over time, will have a significant impact on human health, wildlife, surrounding ground or surface water, or on water holes or other water sources of significance to Aboriginal people; and (5) Outline the process for developing a strategy for decommissioning of water assets associated with the water supply borefield, water storage facilities, and the dewatering system when no longer required; If there is potential for significant risks to human health or the environment, further work will be undertaken to identify workable management measurers to either avoid those risks or to reduce or remediate to acceptable levels to ensure a sustainable "walk-away closure solution".
Relevant policy/guidance documents	DMP/EPA *Guidelines for Preparing Mine Closure Plans*, June 2011. DMP 2013 *Tailings Storage Facilities in Western Australia – Code of Practice* http://www.dmp.wa.gov.au/documents/Code_of_Practice/MSH_COP_TailingsStorageFacilities.pdf EPA Environmental Protection Bulletin No. 19 *EPA Involvement in Mine Closure*, July 2013. Department of Health 2013, *Guidance Note on Public Health Risk Management of Asbestiform Minerals Associated with Mining* taken from http://www.public.health.wa.gov.au/cproot/5387/2/Guidance%20Note%20on%20Public%20Health%20Risk%20Management%20of%20Asbestos%20Associated%20with%20Mining%20Activities.pdf July 2013 Department of Mines and Petroleum, 2010, *Management of fibrous materials in Western Australian Mining Operations* http://www.dmp.wa.gov.au/documents/Factsheets/MSH_G ManagementOfFibrousMinerals.pdf Department of Water. *Western Australian Water In Mining Guideline* May 2013. National Water Commission. *Australian groundwater modeling guidelines*, Waterlines Report No. 82, June 2012, Strategic Framework for Mine Closure (ANZMECC/MCA 2000). Oldham CE 2013 *Environmental sampling and modelling for the prediction of long-term water quality of mine pit lakes*, The University of Western Australia Publishing, Perth

	International Network For Acid Prevention 2012, *Global Acid Rock Drainage Guide (GARD Guide)*. Note this publication is relevant to both acid drainage and to neutral (metalliferous) and saline drainage. Department of Industry, Tourism and Resources 2007, *Managing Acid and Metalliferous Drainage, Leading Practice Sustainable Development Project for the Mining Industry*. International Council on Mining and Metals 2008, *Planning for Integrated Mine Closure*. CRC-CARE. *Guidance document for the revegetation of land contaminated by metal(loid)s*, Technical Report No. 20, March 2012 EPA Guidance Statement No. 6. *Rehabilitation of Terrestrial Ecosystems.*
Offsets (Integrating Factor)	
EPA objective	To counterbalance any significant residual environmental impacts or uncertainty through the application of offsets.
Potential impacts	Potential significant residual impacts on vegetation, flora, fauna habitat and species of State and National significance.
Work required	Examination of significant residual impacts and, if required, development of a draft program of environmental offsets. Inclusion in the PER of a completed Environmental Offsets Reporting Form and any offsets required and proposed. Conduct consultation with stakeholders, record stakeholder comments and provide proponent responses.
Relevant policy/guidance documents	EPA (2006) Position Statement 9: Environmental Offsets. EPA (2008) Environmental Protection Bulletin No. 1 – Environmental Offsets – Biodiversity. EPA (2008) Guidance Statement No. 19 – Environmental Offsets – Biodiversity. Government of Western Australia (2011) WA Environmental Offsets Policy. EPA (2013) EPA Offsets Reporting Form.

2.2 Factors Not Requiring Further Evaluation in the PER Document

Consistent with the EPA's Significance Framework (EAG 9), Hinckley Range will only be required to undertake further studies to address the preliminary key environmental factors identified in this ESD.

Environmental factors likely to be affected by the Proposal that are not significant or can be managed to meet the EPA's objectives are identified below. These environmental factors were not identified by the EPA as preliminary key environmental factors at the time of its decision to assess the Proposal at the level of PER.

These environmental factors will not be evaluated in the PER document:

- Landforms

- Terrestrial Environmental Quality
- Inland Waters Environmental Quality

If, during the preparation of the PER document, other potential environmental factors are identified, the OEPA will be consulted.

3.0 ASSESSMENT MILESTONES

EPA Environmental Assessment Guideline for Timelines for EIA of Proposals (EAG 6) addresses the responsibilities of proponents and the EPA for achieving timely and effective assessment of proposals.

The timeline proposed by Hinckley Range for the submission of Project assessment documents is provided in Table 3 and has been agreed upon by the EPA.

Table 3: Milestones for the project

Key Stage of Proposal	Agreed Milestone
ESD document submitted to EPA	07 March 2014
EPA approval of the ESD Document	30 June 2014
First draft of the PER Document submitted to EPA	11 Sept 2014
OEPA provides comment on first draft PER Document	6 weeks 23 Oct 2014
Revised PER Document submitted to EPA	31 Oct 2014
EPA authorises release of PER Document	2 weeks 17 Nov 2014
Hinckley Range releases approved PER Document	24 Nov 2014
Public Review of PER Document	8 weeks 30 Jan 2015

4.0 DECISION MAKING AUTHORITIES

Key Decisions Making Authorities (DMAs) identified for this Project are identified in the table below. These DMAs are constrained from making any decision that could have the effect of causing or allowing the Proposal to be implemented. DMA's may undertake parallel processing of approvals, up to the point of their decision.

Table 4: Decision Making Authorities

Decision Making Authority	Relevant Legislation
Department of Mines and Petroleum (DMP)	*Mining Act 1978.*
Minister for Water (c/- Department of Water)	*Rights in Water and Irrigation Act 1914.*
Minister for Aboriginal Affairs	*Aboriginal Heritage Act 1972.*
Department of Environment Regulation (formerly DEC)	*Environmental Protection Act 1986 (Part V).*
Department of Health	*Health Act 1911.*
Shire of Ngaaanyatjarraku	*Local Government Act 1995*

5.0 PREPARATION OF THE ENVIRONMENTAL REVIEW DOCUMENT

The PER will be prepared in accordance with this ESD and EPA's Guide to Preparing a Public Environmental Review.

When the EPA is satisfied with the standard of the environmental review document it will provide a written sign-off, giving approval to advertise the document for public review. The review document may not be advertised for release before written approval is received.

The proponent is responsible for advertising the release and availability of the PER document in accordance with the guidelines which will be issued to the proponent by the OEPA. The EPA will be consulted on the timing and details for advertising the document.

This ESD will be included as an appendix to the PER.

WINGELLINA NICKEL PROJECT

SECTION 43A APPLICATION

CHANGE IN PROJECT LAYOUT

Rev	Date	Issued for	Prepared By	Reviewed By	Approved By
0	18/02/2015	For Issue	AP	DH	AF

REVISION CONTROL

☐ Coordinated Review

☒ Issued for use

REVISION HISTORY

Revision	Pages Revised	Remarks

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1.0 INTRODUCTION

Hinckley Range Pty Ltd (the Proponent) proposes to develop the Wingellina Nickel Project (the Project) in the Central Musgrave area of Western Australia. The Proponent is a wholly owned subsidiary of Metals X Limited (Metals X).

The Project was referred to the Environmental Protection Authority (EPA) in September 2013 under section 38 (Part IV) of the *Environmental Protection Act 1986* (EP Act). In November 2013 the EPA determined that the Project required formal assessment under the EP Act and set a Public Environment Review (PER) level of assessment with an eight week public review period. An Environmental Scoping Document (ESD) was prepared and approved by EPA on 4 July 2014. At the present time the Project is under assessment by the EPA.

This document describes changes to the Project layout and development envelope, as described in the original Key Characteristics for the Wingellina Nickel Project (the Project), for assessment under Section 43A of the *Environmental Protection Act 1986* (EP Act). Section 43A allows the EPA to consent to the proponent changing a proposal while it is being assessed without a revised proposal being formally referred, if the Authority considers that the change is unlikely to significantly increase any impact that the proposal may have on the environment.

Specifically the Proponent is seeking to increase the area of disturbance from 2,205 hectares (ha) to 2,762 ha, with a subsequent increase in the development envelope from 4,950 ha to 5,875 ha on tenement E69/535.

2.0 RATIONALE FOR CHANGE

The Project layout and key characteristics included in the referral were based on outputs from a Pre Feasibility Study (PFS) completed for the Project in 2008. At the time that the Project was referred to the EPA in 2013, no further work on the engineering and mine design had been undertaken since the PFS was completed.

Consistent with the requirements set out in the Project ESD, further studies and investigations relating to mine closure planning were completed in 2014. The findings of these studies and investigations have had the following implications for the proposed Project layout:

- Reconsideration of the originally proposed Tailings Storage Facility (TSF) design and associated review of the proposed Central Thickened Discharge (CTD) process for managing tailings. This included consideration of available metallurgical data, closure principles and operational controls from existing mines with similar tailings material. The findings suggest that a traditional 'paddock style' facility is preferable to CTD for the purposes of meeting operational and closure objectives. Further metallurgical test work will be undertaken as part of the Definitive Feasibility Study to confirm the final TSF design;
- The design capacity of the evaporation ponds has been increased to provide additional surety for operational controls on water management and sufficient capacity to store a 1:100 year, 72 hour duration rainfall event;
- Additional provision has been made for topsoil storage close to the major landforms, such as the TSF and waste rock dumps. This will enable topsoil to be stockpiled closer the point of end use, contributing to improved efficiency and efficacy of topsoil use in rehabilitation;

- Further waste rock characterization has confirmed that sufficient suitable materials are available for closure requirements. However different waste rock types will need to be actively managed through the life of mine, including segregation and stockpiling for target end uses. Consequently, provision has been made to accommodate a larger footprint for waste rock storage areas; and
- Improved planning of the internal road network around the mine and mining operations.

In aggregate, the Project layout has been amended to improve the capacity of the mine to meet sustainable closure objectives at the end of its operational life. A larger disturbance footprint than originally proposed is necessary to accommodate new landform domains, with associated adjustment to the proposed development envelope.

3.0 ORIGINAL PROJECT DESCRIPTION

3.1 Project Overview

The Project involves open pit mining of nickeliferous limonite ore from the Wingellina deposit at a rate of >4 million tonnes per annum (Mtpa), and on-site processing at a processing plant using a high pressure acid leach (HPAL) process, to produce an intermediate mixed nickel-cobalt hydroxide product. The estimated mine production capacity is approximately 40,000 tonnes (t) of nickel and 3,000 t of cobalt metal in concentrate per annum for 40 years.

The following supporting infrastructure is included in the Project: administration buildings, HPAL processing plant, tailings storage facility (TSF), fuel storage, workshops, laboratory, internal service roads, explosive storage magazine, waste landfill, septic waste treatment, communications systems, gas fired co-generation power plant and workforce accommodation village. The existing Wingellina airstrip will be upgraded to cater for a fly-in-fly-out (FIFO) workforce.

Tailings from the HPAL processing plant will be piped to the TSF at a rate of up to 5.0 Mtpa. Tailings will be neutralised using calcrete sourced from an existing quarry in South Australia, and trucked to the operation on existing roads.

Approximately 12 gigalitres (GL) per annum of water is required for the operation of the mine, processing plant and accommodation village. Water will be sourced from the Officer Basin, 100 km south of the proposed mine, and piped to the mining area where it will be supplemented with ore-body dewatering volumes and recovery from the TSF. Two reverse osmosis (RO) units will be used to generate water for potable use and the HPAL processing plant.

The processed nickel-cobalt hydroxide will be transported via road and rail to the Port of Darwin or the Port of Adelaide for delivery to overseas markets. The transport route is expected to follow existing road networks. A preferred transport route will be selected based on the outcomes of the DFS.

The originally estimated disturbance footprint of the mine and associated mine infrastructure was up to 2,205 ha within a 4,950 ha development envelope contained within tenement E69/535; and an additional up to 215 ha associated with the borefield and pipeline development. Figures 3.1 and 3.2 show the Project development envelope and the calculated disturbance footprint respectively (as referred).

Figures showing the layout of the proposed bore field have not been reproduced in this application, as this aspect of the proposed development remains unchanged.

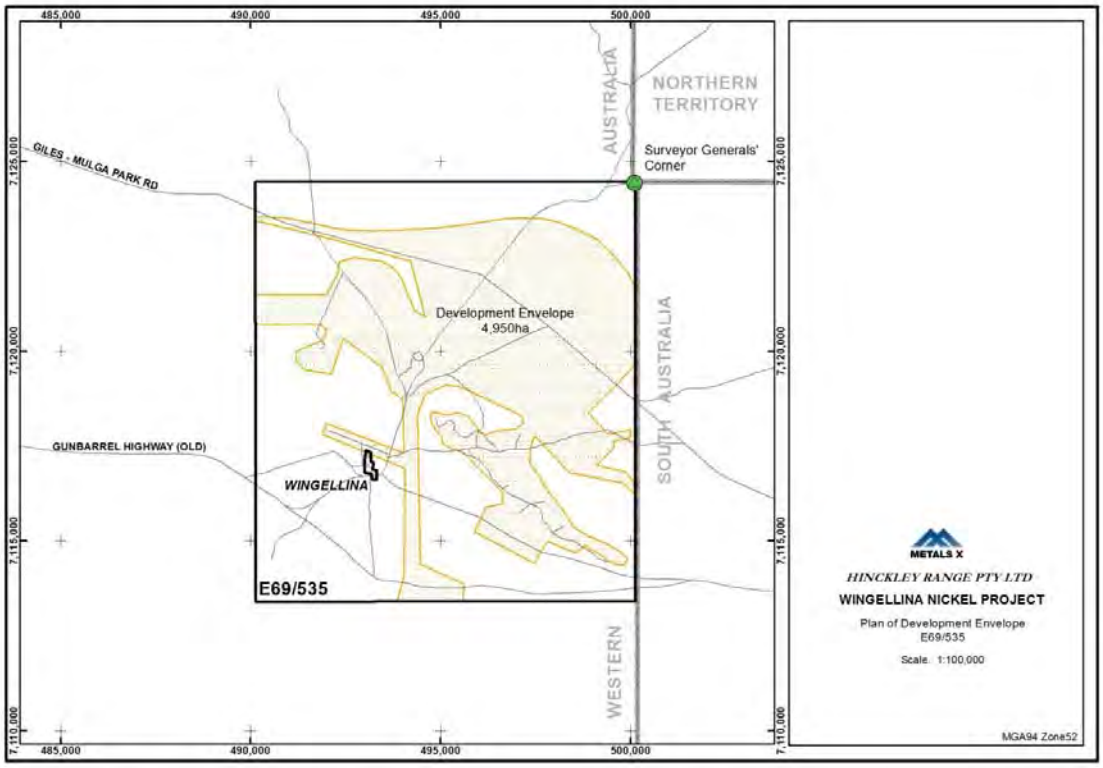


Figure 3.1 Project development envelope – mining area (excluding borefield and pipeline)

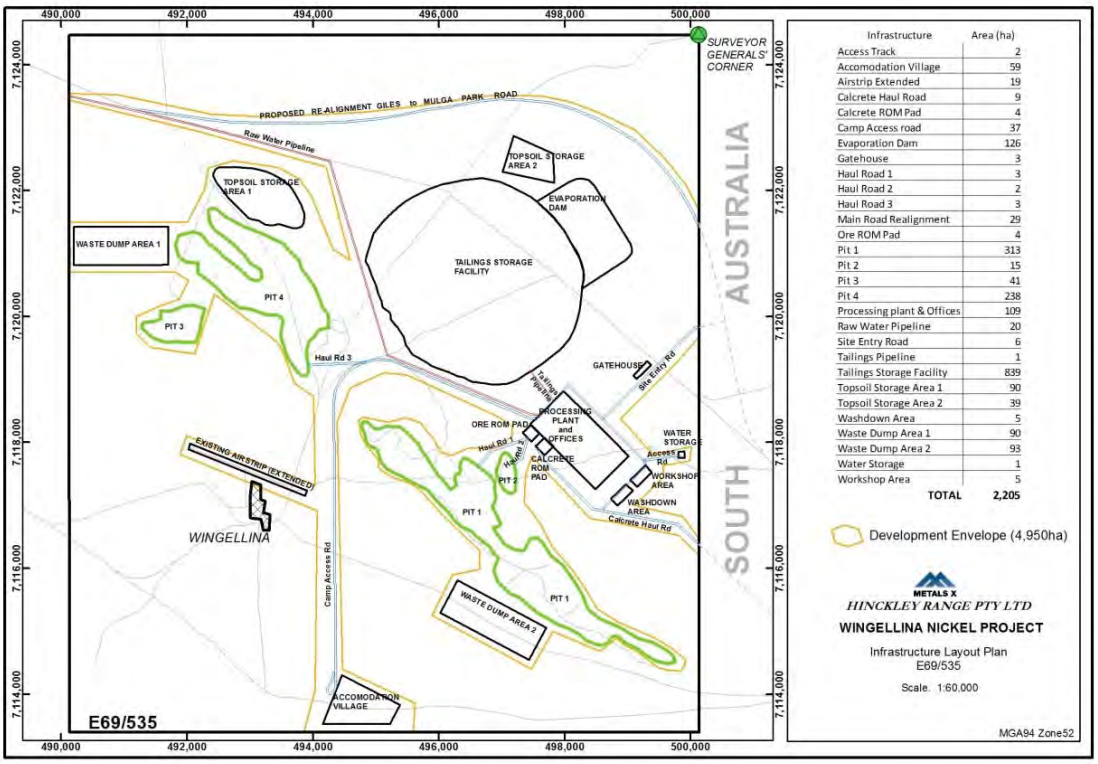


Figure 3.2 Disturbance footprint of the proposed mine, HPAL processing plant and supporting infrastructure

3.2 Key characteristics

A summary of the key characteristics of the Project (as referred) is presented in Table 3.1.

Table 3-1 Key characteristics of the Wingellina Nickel Project (as originally referred)

Summary of the Proposal

Proposal title	Wingellina Nickel Mine.
Proponent name	Hinckley Range Pty Ltd.
Short description	This Proposal is to mine nickeliferous limonite ore from the Wingellina deposit located approximately 1,400 km east-northeast of Perth, and use a HPAL process to produce a mixed nickel-cobalt hydroxide product for export to overseas markets.

Disturbance Footprint

Element	Location	Description
Mining pits	Figure 3.1	Clearing of no more than 610 ha within a 4,950 ha development envelope.
Supporting mine infrastructure (including HPAL processing plant)	Figure 3.1	Clearing of no more than 625 ha (excluding TSF and borefield) within a 4,950 ha development envelope.
Tailings Storage Facility (including evaporation dam)	Figure 3.1	Clearing of no more than 970 ha within a 4,950 ha development envelope.
Raw water supply & pipeline from the Officer Basin		Clearing of no more than 215 ha.

Operational Elements

Element	Location	Description
Life of project (mine production)		Greater than 40 years (continual operation).
Size of orebody		Up to 180 million tonnes.
Depth of mine pits		Up to 110 metres.
Watertable depth in mining area		Approximately 30 to 50 metres. Ore body dewatering will be required to access the deeper parts of the deposit.
Mine operation		24 hour per day operations, Monday to Sunday.

Element	Location	Description
Processing plant		HPAL process, with in-feed of up to 4.5 million tonnes per year to produce an intermediate mixed nickel-cobalt hydroxide product.
Supporting infrastructure		Refer to Figure 3.2. Major components include: • Waste dumps; • Topsoil stockpiles; • Tailings storage facility; • Administration buildings; • Workshops; • Explosive storage magazine; • Waste landfill; • Fuel storage area; • Service roads (internal); • Co-generation power plant and power distribution network; • Airstrip (upgrade to existing); • Accommodation village; • Septic waste treatment; and • Reverse osmosis water treatment units.
Maximum ore mining rate		Up to 4.5 million tonnes per year.
Tailings Disposal		Up to 5 million tonnes per year.
Dewatering		Up to 0.5 gigalitres per year.
Water Supply: Groundwater abstraction from Officer Basin		Up to 12 gigalitres per year.

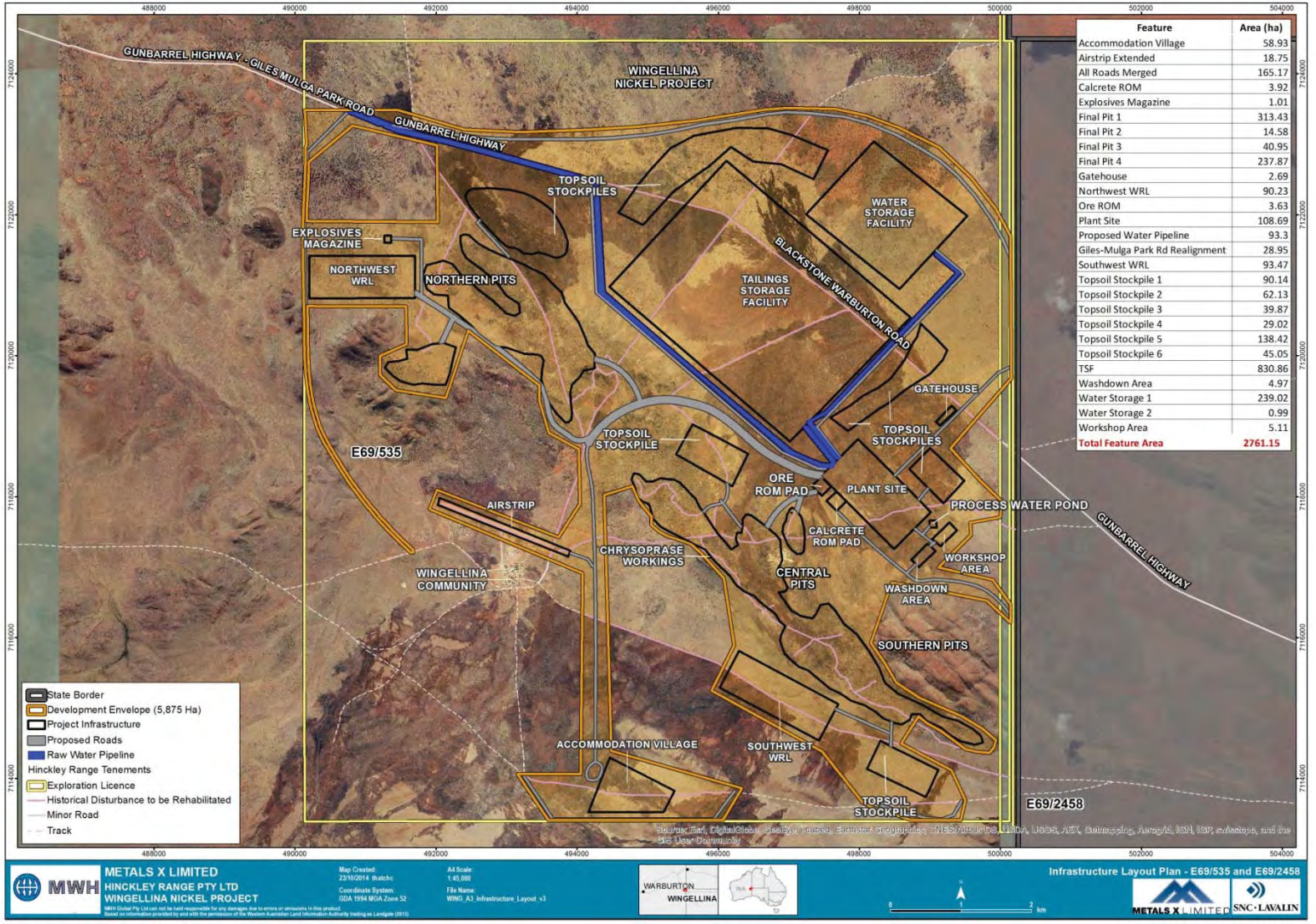
4.0 DETAILS OF THE PROPOSED CHANGE

The proposed amendments to the key characteristics of the Project are presented in Table 4.1. The revised preliminary site plan showing the major project components and key environmental features is shown on Figure 4.1.

No changes to the layout of process infrastructure or mining operations are proposed, with the only change seeking an additional 557 ha of disturbance to native vegetation within a larger development envelope.

Table 4-1 Revised Disturbance Footprints for each Element

Element	Location	Revised Description	Proposed change
Mining pits	Figure 4.1	Clearing of no more than 607 ha within a 5,875 ha development envelope.	Disturbance area for this element is essentially unchanged (decrease of approximately 2 ha); however a 925 ha increase in the defined development envelope is required to cover changes in the mine layout.
Supporting mine infrastructure (including HPAL processing plant)	Figure 4.1	Clearing of no more than 496 ha (excluding TSF and borefield) within a 5,875 ha development envelope.	An increase of 459 ha in proposed disturbance to allow for additional roads for the safe operation of the mine and additional topsoil stockpiles required for mine rehabilitation.
Top soil and waste rock landforms	Figure 4.1	Clearing of no more than 588 ha within a 5,875 ha development envelope. [Note that these elements were included within "supporting infrastructure" in the referral and a disturbance footprint defined in Figure 3.2.]	
Tailings Storage Facility. (including water storage / evaporation pond)	Figure 4.1	Clearing of no more than 1,070 ha within a 5,875 ha development envelope.	An increase of the proposed disturbance footprint of 100 ha as a result of change to tailings and return water storage design.
Raw water supply & pipeline from the Officer Basin		Clearing of no more than 215 ha within a 2,243 Ha development envelope.	Unchanged.



Feature	Area (ha)
Accommodation Village	58.93
Airstrip Extended	18.75
All Roads Merged	165.17
Calcrete ROM	3.92
Explosives Magazine	1.01
Final Pit 1	313.43
Final Pit 2	14.58
Final Pit 3	40.95
Final Pit 4	237.87
Gatehouse	2.69
Northwest WRL	90.23
Ore ROM	3.63
Plant Site	108.69
Proposed Water Pipeline	93.3
Giles-Mulga Park Rd Realignment	28.95
Southwest WRL	93.47
Topsoil Stockpile 1	90.14
Topsoil Stockpile 2	62.13
Topsoil Stockpile 3	39.87
Topsoil Stockpile 4	29.02
Topsoil Stockpile 5	138.42
Topsoil Stockpile 6	45.05
TSF	830.86
Washdown Area	4.97
Water Storage 1	239.02
Water Storage 2	0.99
Workshop Area	5.11
Total Feature Area	**2761.15**

Figure 4.1 Revised Layout and Disturbance Footprint of the proposed Wingellina Nickel Project mining area

5.0 SIGNIFICANCE OF THE CHANGE

The approved ESD identified nine key environmental factors for more detailed consideration in the PER document, as follows:

- Air Quality,
- Human health,
- Heritage,
- Amenity (noise, light and vibration),
- Hydrological processes,
- Flora and vegetation,
- Terrestrial fauna,
- Subterranean fauna,
- Rehabilitation and closure; and
- Offsets.

The relevant environmental factors identified in the ESD which may be impacted by the identified change to disturbance areas are discussed below.

5.1 Heritage

The proposed Project layout has taken due consideration of the ethnographic and archaeological values of the Wingellina area. Ten ethnographic exclusion zones within tenement E69/535 have been identified in consultation with the Traditional Owners.

Proposed changes to the development envelope and disturbance areas have maintained avoidance of all of the identified heritage exclusions zones, so this factor remains unaffected. This was discussed with a senior representative of the Wingellina Community in November 2014.

5.2 Flora

Up to an additional 557 ha of clearing in the proposed mining area (E69/535) has been identified, taking the total disturbance of native vegetation from 2,205 up to 2,762 ha. The original level 1 and level 2 floristic surveys undertaken by Outback Ecology Services in 2008 and 2010 covered the entire tenement area including the additional areas of disturbance. The majority of the vegetation in the proposed clearing footprint is surveyed was classified as good to excellent or pristine condition; however the affected vegetation types are widespread outside the tenement and proposed clearing footprint (Figures 5.1 and 5.2).

Comparison of the clearing impact of the changed site layout on each of the surveyed vegetation communities is described in Table 5.1. The proposed increase in disturbance is within existing survey areas, and assessment of environmental impacts on the diversity of flora and vegetation can be accommodated by the current scoping requirements.

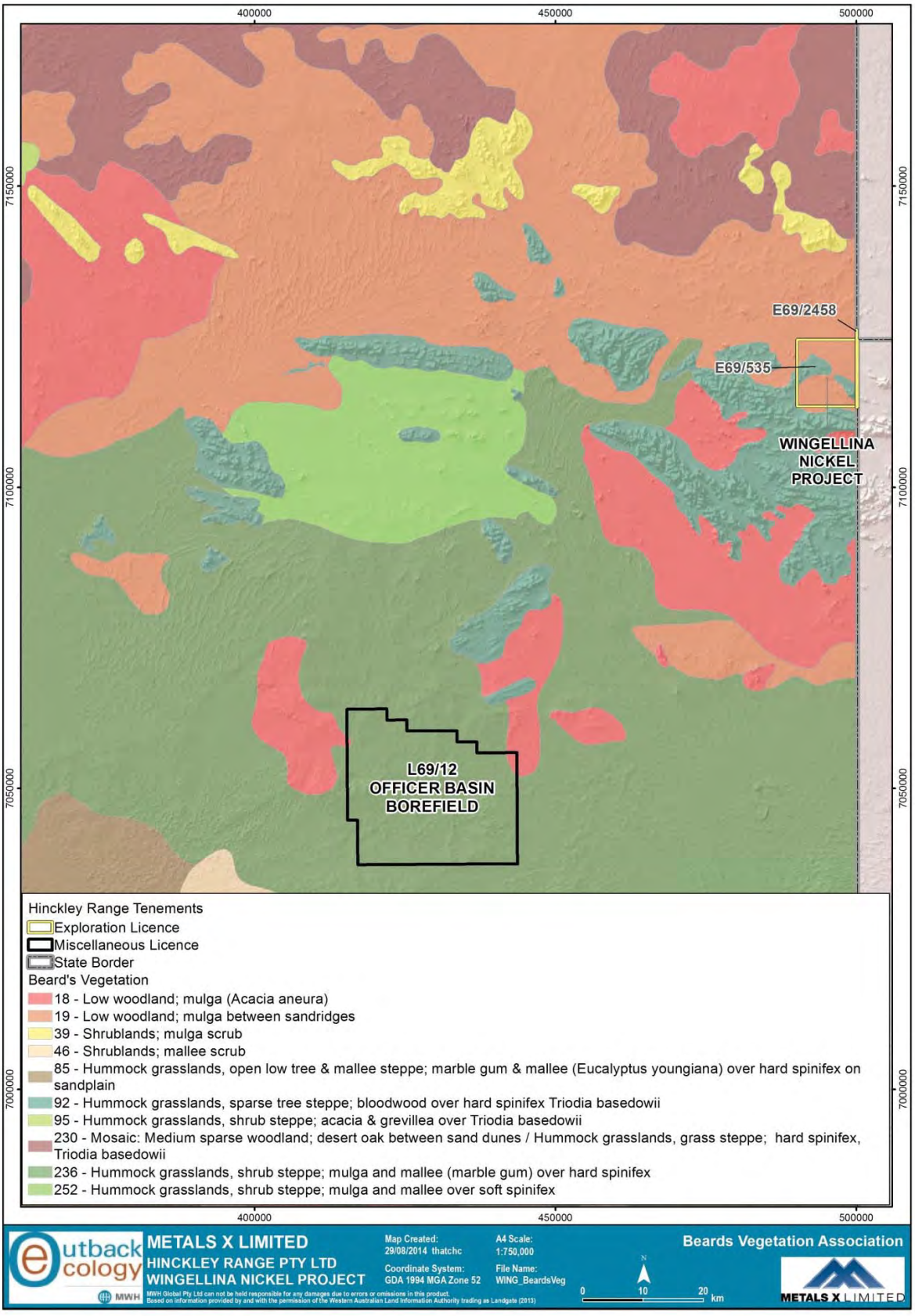


Figure 5.1 Regional vegetation associations

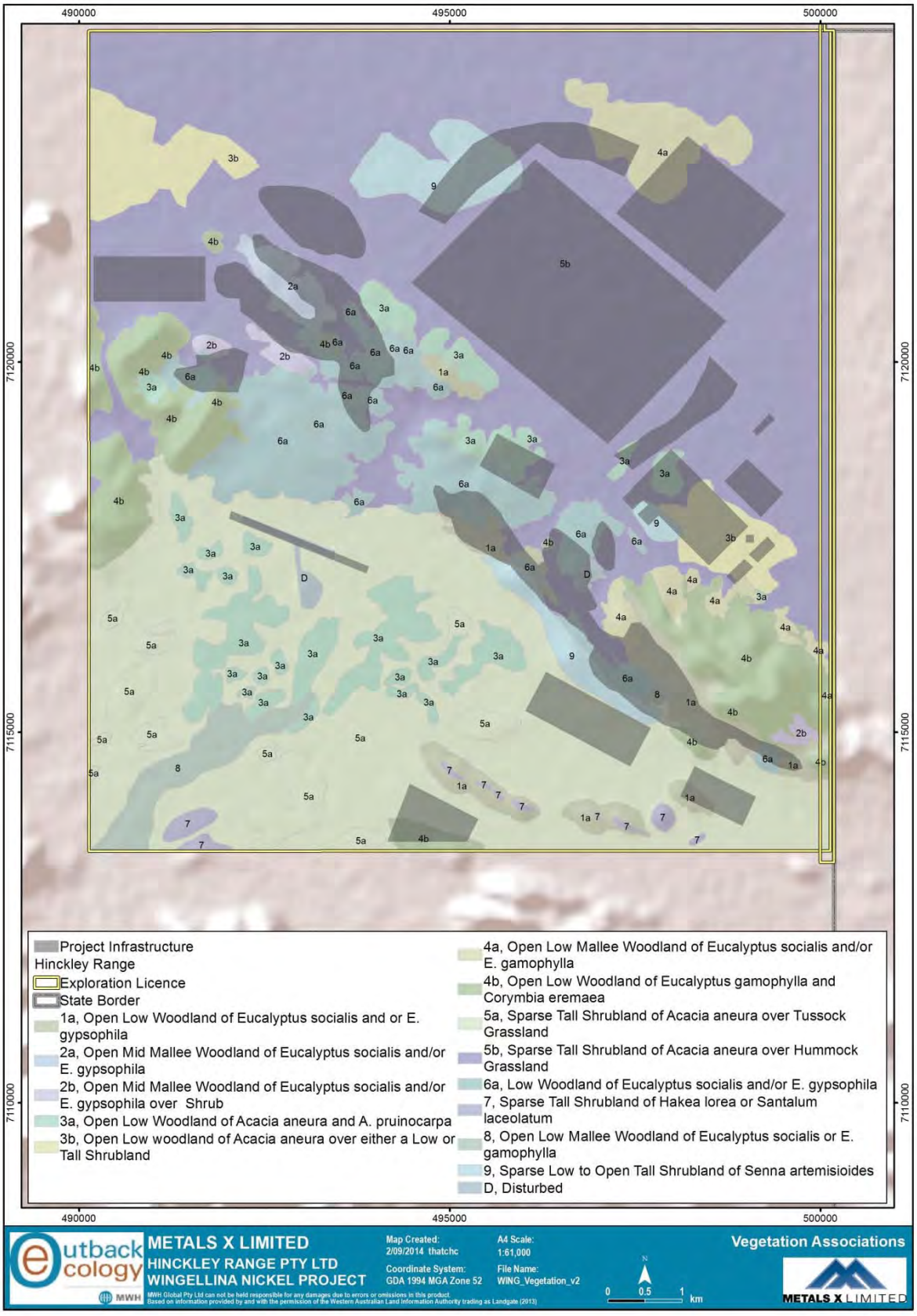


Figure 5.2 Local surveyed vegetation associations and mine layout

Table 5-1 Comparison of the percentage disturbance of surveyed vegetation communities associated with the revised project layout

Broad Floristic Formation (and Vegetation Communities)	Landscape Position	Area within tenement E69/535	Area (ha) within original floristic Assessment	Area (ha) within new disturbance footprint	% change of disturbance footprint
1a. Eucalyptus Open Low Woodland Open Low Woodland of *Eucalyptus socialis* and or *E. gypsophila*	Slopes	325.8	126.2	124.2	-0.6%
2a. Eucalyptus Open Mid Mallee Woodland Open Mid Mallee Woodland of *Eucalyptus socialis* and/or *E. gypsophila*	Slopes	76.3	40.4	8.3	-42.1%
2b. Eucalyptus Open Mid Mallee Woodland Open Mid Mallee Woodland of *Eucalyptus socialis* and/or *E. gypsophila* over Shrubland	Plains	49.3	3.0	46.9	89.0%
3a. Mulga Open Low Woodland Open Low Woodland of *Acacia aneura* and *A. pruinocarpa*	Slopes	564.8	42.5	57.9	2.7%
3b. Mulga Open Low Woodland Open Low woodland of *Acacia aneura* over either a Low or Tall Shrubland	Plains	350.7	58.8	80.5	6.2%
4a. Eucalyptus Open Low Mallee Woodland Open Low Mallee Woodland of *Eucalyptus socialis* and/or *E. gamophylla*	Plains	296.7	23.6	70.1	15.7%

Broad Floristic Formation (and Vegetation Communities)	Landscape Position	Area within tenement E69/535	Area (ha) within original floristic Assessment	Area (ha) within new disturbance footprint	% change of disturbance footprint
4b. Eucalyptus Open Low Mallee Woodland Open Low Woodland of *Eucalyptus gamophylla* and *Corymbia eremaea*	Plains	684.7	8.4	43.3	5.1%
5a. Mulga Sparse Tall Shrubland Sparse Tall Shrubland of *Acacia aneura* over Tussock Grassland	Plains	2,594.2	199.7	200.9	0.05%
5b. Mulga Sparse Tall Shrubland Sparse Tall Shrubland of *Acacia aneura* over Hummock Grassland	Plains	4,882.3	1,825.1	1794.1	-0.6%
6. Eucalyptus Low Mallee Woodland Low Mallee Woodland of *Eucalyptus socialis* and *E. gypsophila*	Slopes	740.1	195.4	213.4	2.4%
7. Hakea Sparse Tall Shrubland Sparse Tall Shrubland of *Hakea lorea*	Hill Top/ Ridge Line	52.4	0	0.3	0.6%
8. Eucalyptus Open Low Mallee Woodland Open Low Mallee Woodland of *Eucalyptus socialis* or *E. gamophylla*	Plains	157.9	7.0	6.9	-0.06%
9. Senna Sparse Low to Tall Open Shrubland Sparse Low to Open Tall Shrubland of *Senna artemisioides*	Plains	291.7	41.3	96.8	19.0%

Broad Floristic Formation (and Vegetation Communities)	Landscape Position	Area within tenement E69/535	Area (ha) within original floristic Assessment	Area (ha) within new disturbance footprint	% change of disturbance footprint
Sub-totals (by landscape position)	Plains	9354	2167	2340	1.85%
	Slopes	1660	404	404	Nil
	Hill Top/ Ridge Line	52	0	0.3	0.6%
Existing Disturbed Land		17	17	17	Nil
Total (including existing disturbed land)		**11,083**	**2,572** [1]	**2,762**	**1.7%**

5.3 Terrestrial Fauna

The proposed change to the Project layout will result in clearing of a further 557 ha of vegetation habitat, within the boundary of the original surveys. The habitat types and fauna assemblage recorded in the Project area are unchanged and are considered unexceptional with respect to biodiversity values, habitat values or regional conservation significance. The wider region has been subject to minimal human development, and similar habitat is extensive outside the Project area. Several conservation significant species that are considered likely to occur in the Project area all have widespread distributions outside the Project area and are not considered to have any specific reliance on habitat within the Project area.

Given the current level of disturbance in the immediate vicinity of the Project area associated with local hunting practices and altered fire regimes, the revised clearing footprint is unlikely to significantly impact on habitat connectivity for the locally occurring fauna assemblage. As a result no additional impact on terrestrial fauna is expected over and above that proposed by the original referral.

[1] NOTE: The original floristic assessment was based on a site layout from 2010 PFS which had identified a 2,572 ha project footprint in tenement E69/535. The 2013 referral had a reduced disturbance footprint of 2,205 ha, based on the project disturbance footprint as depicted in Figure 3-2. The figures quoted in Table 5-1 are based on the direct comparison of the original floristic assessment and the current revised disturbance footprint.

5.4 Closure

A risk based assessment of decommissioning, mine closure and rehabilitation was undertaken as part of closure planning investigations for the Project. This included additional sodicity and dispersion tests and compilation of an initial inventory of suitable materials available for closure. This identified larger area's were required for topsoil storage than originally proposed as well as a review of the proposed tailings storage design.

The findings confirmed sufficient waste rock material would be available to meet closure requirements, but needed to be segregated and carefully managed throughout the life of the project so as to be available for rehabilitation. The area required for topsoil storage increased by 275 ha and these have been located close to landforms which will require future rehabilitation.

These changes are required to ensure the project can meet EPA closure objectives.

6.0 CONCLUSION

Changes to the site layout have been made subsequent to the Project referral submitted to the EPA in September 2013. These changes have been informed by studies and investigations relating to mine closure and rehabilitation.

The changes have resulted in the boundary of the proposed development envelope within tenement E69/535 being modified and the area increased from 4,950 to 5,875 ha. Within the proposed development envelope, the proposed disturbance footprint has been increased from 2,205 to 2,762 ha.

The additional areas of disturbance identified are within current flora and fauna and heritage survey boundaries and will not impact on any of these values. The majority of the vegetation in the revised clearing footprint is in good to excellent to pristine condition; however the affected vegetation types are widespread outside the proposed clearing footprint.

It is the view of Hinckley Range these changes are necessary, and will improve mine closure outcomes whilst not materially changing the impact of the Project on environmental factors and values. Consideration of the impact assessment can be covered within the current environmental scoping for the PER.

Appendix B

Wingellina Nickel Project

Environmental Management Plans

REV 0

August 2015

REVISION HISTORY

Rev	Date	Issued for	Prepared By	Reviewed By	Approved By
A	24/09/2014	Draft version developed as a supporting document for the Wingellina Nickel Project Public Environmental Review.	D.Huxtable	A.Parker	
0	7/08/2015	Updated Air Quality and the Flora Management Plans to include specific controls on air monitoring and control of Buffel Grass.	D.Huxtable	A.Parker	

Introduction

Hinckley Range Pty Ltd (Hinckley Range) proposes to develop the Wingellina Nickel Project (the Project) in the Central Musgrave area of Western Australia. The Project involves open pit mining of nickeliferous limonite ore from the Wingellina deposit and on-site processing using a high pressure acid leach (HPAL) process, to produce an intermediate mixed nickel-cobalt hydroxide concentrate. The anticipated mine life is >20 years at a mining rate of >4 million tonnes per annum (Mtpa). The nickel-cobalt hydroxide concentrate will be transported to overseas markets, via road and rail to the Port of Darwin or the Port of Adelaide. The preferred transport route is expected to follow existing road networks, and will be determined following the outcome of a definitive feasibility study.

The Project was referred to the Environmental Protection Authority (EPA) in September 2013 under section 38 (Part IV) of the *Environmental Protection Act 1986* (EP Act). In November 2013 the EPA determined that the Project required formal assessment under the EP Act and set a Public Environment Review (PER) level of assessment with an eight week public review period. An Environmental Scoping Document (ESD) for the Project, setting out the acceptable basis (form, content and timing) for the preparation of the PER documentation, was approved by the EPA on 4 July 2014.

Environmental management plans

This document includes environmental management plans (EMPs) applicable to the construction and operations phases of the Project, which address the following environmental factors:

- Air quality;
- Cultural heritage;
- Amenity (noise and vibration);
- Hydrological processes;
- Flora and vegetation;
- Fauna; and
- Waste.

The EMPs have been prepared in accordance with the commitments made in the Project Environmental Scoping Document (ESD) and PER document.

It is anticipated that the EMPs may be further developed consistent with Ministerial Conditions, requirements under Part V *Environmental Protection Act 1986* (WA), and the Mining Proposal approval process under the *Mining Act 1978* (WA). The EMPs will be continually reviewed and updated as necessary within the overall environmental management system (EMS) adopted for the Project.

A separate Mine Closure Plan has also been prepared that addresses environmental management commitments post mining and processing.

Wingellina Project
Air Quality Management Plan

Rev 0

24 July 2015

Introduction

This Environmental Management Plan (EMP) provides the framework for the management of environmental impacts to air quality associated with the Wingellina Nickel Project (the Project). It has been prepared in accordance with the commitments made in the Public Environmental Review (PER) document for the Project.

The scope of this EMP includes construction and operations activities related to the Wingellina mines, ore processing facility and supporting infrastructure. This EMP is a component of the overall Environmental Management System (EMS) for the Project.

Objective

This EMP has been developed to address the following EPA objective for air quality:

To maintain air quality for the protection of the environment and human health and amenity.

Specific objectives for the management of air quality associated with the Project are:

- To ensure that atmospheric emissions do not impact on environmental values, or the health, welfare and amenity of the population and land uses; and
- To use all reasonable and practicable measures to minimise airborne dust.

Regulatory context

Applicable legislation, standards and guidelines	Regulatory requirements
Environmental Protection Act 1986	Part V Works Approval and Operating Licence.
Environmental Protection Regulations 1987	Monitoring equipment and procedures.
National Greenhouse and Energy Reporting Act 2007	Annual reporting of energy consumption, Scope 1 (direct) emissions and Scope 2 (indirect) emissions.
Mining Act 1978	Mining Proposal. Tenement Conditions.
Ministerial Statement	To be specified following the conclusion of the PER process.

Sensitive Receptors

The following sensitive receptors have been identified in the Project area:

- The Wingellina Aboriginal community (town of Wingellina);
- Accommodation camp;
- Aboriginal heritage sites (including ethnographic heritage exclusion zones); and
- Flora and fauna of conservation significance.

Potential environmental impacts

Potential impacts on air quality include:

- Reduced air quality in the location of the Wingellina town, transient communities and mine workers accommodation from emissions from the HPAL Processing Plant and power station and generation of dust from mining, tailings storage and waste dumps;
- Potential impacts of toxic and/or bio-accumulating emissions; and
- Emission of greenhouse gases (fuel usage by vehicles, mobile plant and equipment, electrical energy usage, use of explosives).

Air quality targets

Project air quality goals have been developed taking into consideration National Environment Protection Measures (NEPMs), the *Environmental Protection (Kwinana) (Atmospheric Wastes) Policy 1999* (TPS[1] concentrations) and the Californian Office of Environmental Health and Hazard Assessment (OEHHA) limit of 100 µg/m3 over a 1-hour averaging period for sulphuric acid mist. These goals will be regularly reviewed, taking into consideration ongoing air quality monitoring results and Part V works approvals and operating licences. Background air quality data is described in the PER document.

Air quality will be monitored in order to detect any exceedences of the Project air quality goals.

Project air quality goals

Pollutant	Averaging Period	Maximum Concentration		Goal
		(ppm)	(µg/m^3)	Maximum allowable exceedences
Carbon Monoxide	8-hour	9.0	11,240	1 day a year.
Nitrogen Dioxide	1-hour 1-year	0.12 0.03	246 62	1 day a year. None.
Photochemical	1-hour	0.10	214	1 day a year.

[1] total suspended particulates

Pollutant	Averaging Period	Maximum Concentration		Goal
		(ppm)	($\mu g/m^3$)	Maximum allowable exceedences
Oxidants (as ozone)	4-hours	0.08	171	1 day a year.
Sulphur Dioxide	1-hour 1-day 1-year	0.20 0.08 0.02	570 228 60	1 day a year. 1 day a year. None.
Nickel	1-year		0.003	None.
Lead	1-year	-	0.5	None.
Particles as PM_{10}	1-day	-	50	5 days a year.
Advisory Reporting Standards and Goal				
Particles as $PM_{2.5}$	1-day 1-year	- -	25 µg/m3 8 µg/m3	Goal is to gather sufficient data nationally to facilitate a review of the advisory reporting standard as part of the review of this Measure scheduled to commence in 2005.
Any further parameters specified in the Part V operating licence (e.g. TPS, sulphuric acid mist)				TBC. Nominal target 90 $\mu g/m^3$ over a 24-hour averaging period for TPS. Nominal target 100 $\mu g/m^3$ over a 1-hour averaging period for sulphuric acid mist.

Management

Potential impact	Action(s)	Timing	Responsibility
Increased dust levels on-site causing : • Smothering of vegetation; • Disturbance to workers at accommodation camp; and • Reduced amenity.	• Minimise clearing ahead of mining to ALARP[2]; • Progressively rehabilitate mined areas; • Utilise existing cleared tracks where possible; • Seal high usage roads; • Implement vehicle speed limits to reduce dust; • Use water carts to suppress dust on cleared areas; and • Where practicable, orient stockpiles parallel to the predominant wind direction	Construction and Operations.	Environmental Superintendent.
	• Visual monitoring of dust levels will be ongoing to ensure timely response to excessive dust; and • Analyse monitoring results against Wingellina targets and adapt mitigation measures as required.		
Increased dust levels off-site causing reduced amenity and human health risks.	• Set air quality targets for sensitive receptors; • Using HVAS monitor for Ni concentration in dust, at mine and sensitive receptors; • Maintain a community complaints register; and • Analyse monitoring results against Wingellina targets and adapt mitigation measures as required.	Construction and Operation.	Environmental Superintendent.
Local area pollution from dust generated from TSF.	• Set air quality targets for the TSF; and • Establish operating practices for the TSF that minimise dust generation potential.	Operation	Environmental Superintendent

[2] As low as reasonably practicable

Potential impact	Action(s)	Timing	Responsibility
Emission of atmospheric wastes to the atmosphere from the processing plant (e.g. SO_2, sulphuric acid mist).	• Set air quality targets for the processing plant. • Implement emission reduction controls in order to achieve air quality targets.	Operation.	Environmental Superintendent.
Greenhouse gas emissions.	• Monitor greenhouse gas emissions. • Implement continual improvements to reduce emissions, by increasing efficiency and applying efficient technologies.	Construction and Operations.	Environmental Superintendent.

Monitoring

Aspect	Parameter	Frequency	Location	Responsibility
Air quality - dust	Dust levels (PM_{10}) as per Part V operating licence.	As per Part V operating licence.	Mine site Plant site Sensitive receptors	Environmental Superintendent
Air Quality – Ni concentration in dust	Analysis of total Ni n dust.	As per Part V operating licence (monthly).	Mine site Plant site Sensitive receptors	Environmental Superintendent
Air quality – toxics (e.g. SO_2, sulphuric acid mist)	As per Part V operating licence.	As per Part V operating licence.	As per Part V operating licence	Environmental Superintendent
Greenhouse gas emissions	Greenhouse gases in accordance with the *National Greenhouse and Energy Reporting Act 2007.*	Ongoing.	Project area	Environmental Superintendent

Contingency actions

Trigger	Actions	Responsibility
Project air quality target exceeded (NO_x, SO_x, PM_{10} and Ni)	Investigate the cause, review and update controls as necessary to avoid unacceptable impacts to air quality. Report incident to relevant authorities in accordance with licence conditions.	Environmental Superintendent

Trigger	Actions	Responsibility
Air quality complaint received	Investigate the cause, review and update controls as necessary to avoid air quality complaints. Contact the complainants. Advise them of the source of the incident and mitigation measures enacted. Record all complaints in the Project Incident Management System.	Environmental Superintendent
Dry, windy conditions	Increase dust suppression activities (e.g. water application). Evaluate the need to delay activities contributing to emissions (e.g. dust generating activities) until more favourable conditions return.	Environmental Superintendent
Greenhouse emissions exceed annual target	Determine cause and establish new annual targets if required.	Environmental Superintendent

Records, reporting and review

The Environmental Superintendent shall ensure all air quality monitoring records are maintained in accordance with the EMS Records Procedure.

The Environmental Superintendent will ensure that copies of all documentation relating to incidents/non-compliances are maintained in accordance with the EMS Records Procedure, including corrective actions taken to address incidents/non-compliances.

The Air Quality EMP will be reviewed annually with updates to be approved by the Mine Manager.

Greenhouse gas emissions resulting from construction and operations activities will be reported under the National Greenhouse and Energy Reporting Act 2007.

Dust sampling regime and analysis to be carried in accordance with the relevant Australian Standards and EPA approved methodology and results compared with existing WA health guidelines.

Air quality monitoring and management activities may be reported in the Annual Environmental Report (AER), submitted in accordance with tenement conditions.

Wingellina Project

Cultural Heritage Management Plan

Rev 0

24 September 2014

Introduction

This Environmental Management Plan (EMP) provides the framework for the management of environmental impacts to heritage associated with the Wingellina Nickel Project (the Project). It has been prepared in accordance with the commitments made in the Public Environmental Review (PER) document for the Project.

The scope of this EMP includes construction and operations activities related to the Wingellina mines, ore processing facility and supporting infrastructure. This EMP is a component of the overall Environmental Management System (EMS) for the Project.

Objective

This EMP has been developed to address the EPA objective for heritage:

To ensure that historical and cultural associations are not adversely affected.

Regulatory context

Applicable legislation, standards and guidelines	Regulatory requirements
Aboriginal Heritage Act 1972 (WA)	s15 places to which the Act applies or might reasonably be suspected to apply must be reported to the Registrar of Aboriginal Sites. s18 Ministerial consent for the disturbance of Aboriginal sites.
Ministerial Statement	To be specified following the conclusion of the PER process.
Department of Aboriginal Affairs *Aboriginal Heritage Due Diligence Guidelines, Version 3, 2013*	Provides general guidance on compliance with the *Aboriginal Heritage Act 1972* (WA), undertaking heritage surveys, heritage risk assessment and community consultation approaches.

Aboriginal Community

The Wingellina Aboriginal community is located within the Project area, at the site of the historic Wingellina exploration camp, and has a population size of 60 to 100 people. The Aboriginal people still maintain many of their traditional activities such as ceremonies, hunting and gathering bush tucker. The majority of the town's residents are Pitjantjatjara speakers.

Potential environmental impacts

The heritage values of the Project area have been determined through a series of archaeological and ethnographic surveys described in the PER document.

Potential impacts to heritage values include:

- Disturbance of archaeological and ethnological sites and artefacts; and
- Loss of access to areas for local Aboriginal cultural activities and traditional ways of living.

Ten ethnographic heritage exclusion zones within the Project area have been demarcated by the Traditional Owners in which access by Project personnel is forbidden (Figure 1). Approximately 13.5 km^2, or 12% of the tenement is excluded from any exploration or development activities.

Thirty five archaeological sites including a variety of artefact scatters, quarries or knapping areas and sites containing grindstones and stone structures have been identified in the Project area and immediate surrounds.

Two archaeological sites, located to the north of the central pits, will need to be disturbed during the construction phase of the Wingellina Project (Figure 1). Approval to disturb these sites is being sought under Section 18 of the *Western Australian Heritage Act 1972*.

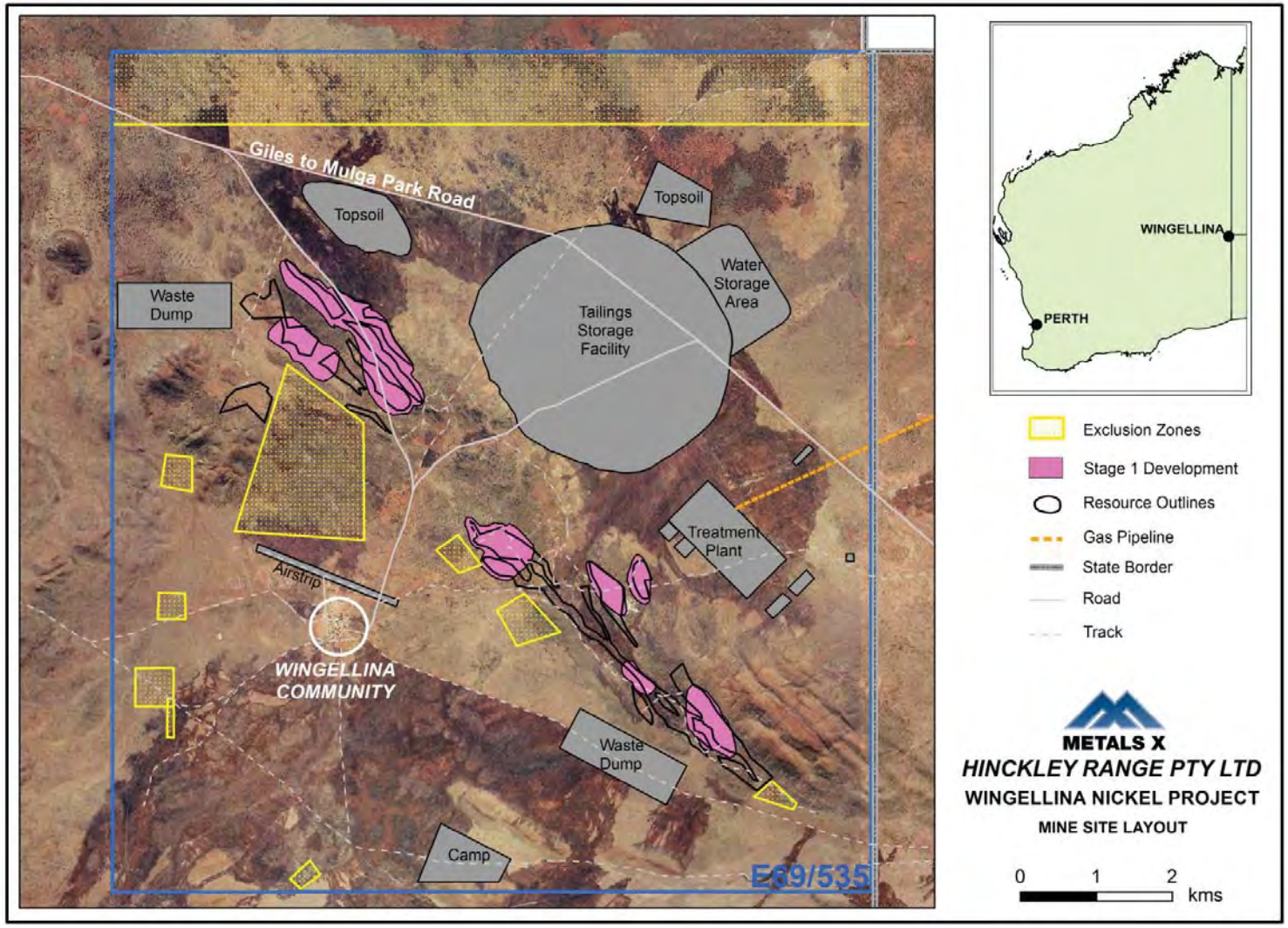


Figure 1 Wingellina Nickel Project Exclusion Zones

Management

Potential impact	Action(s)	Timing	Responsibility
Accessing ethnographic heritage exclusion zones	Signage and exclusion barriers installed and maintained to guide avoidance of ethnographic heritage exclusion zones.	Life of mine.	Environmental Superintendent
	Cultural awareness induction and education programs will be delivered to all workforce personnel, in concert with senior Ngaanyatjarra Lands People.	Ongoing.	Environmental Superintendent
Disturbance to heritage sites	Maintain a Register of heritage sites for the Project area.	Ongoing.	Environmental Superintendent
	Consult with the Traditional Owners. Obtain approval for disturbance under s18 of the *Aboriginal Heritage Act 1972* (WA).	Prior to site disturbance.	Environmental Superintendent
	Ensure that heritage sites are recognised as sensitive environmental receptors in Project EMPs addressing other environmental factors (e.g. from dust, surface water diversion drainage).	Construction and Operations.	Environmental Superintendent
Inadequate community engagement	Prepare and implement a Contracting and Procurement Policy that requires consideration of the cultural concerns of the Ngaanyatjarra Lands People in the delivery of goods and services to the Project.	Construction and Operations.	Environmental Superintendent

Monitoring

Aspect	Parameter	Frequency	Location	Responsibility
Register of heritage sites	Spatial location of sites	Register updated with new sites as necessary. Register annually reviewed.	Site locations to be recorded in Register and GIS mapping software.	Environmental Superintendent
Register of staff induction and education programs (heritage)	Attendance records	All new staff and site visitors[3] to be inducted.	Project site.	Environmental Superintendent

Contingency actions

Trigger	Actions	Responsibility
Unauthorised access of ethnographic heritage exclusion zones.	Investigate the cause, review and update controls as necessary to prevent future unauthorised access. Inform Traditional Owners. Record all unauthorised access incidents in the Project Incident Management System.	Environmental Superintendent
Unauthorised disturbance of heritage sites.	Investigate the cause, review and update controls as necessary to prevent future unauthorised access. Inform Traditional Owners. Comply with the *Aboriginal Heritage Act 1972* (WA). Record all heritage site disturbances in the Project Incident Management System.	Environmental Superintendent

[3] company personnel who are in the Agreement Area for an aggregate of more than 45 days

Records, reporting and review

The Environmental Superintendent shall ensure that relevant Project registers and cultural heritage monitoring records are maintained in accordance with the EMS Records Procedure, and that any reporting requirements under the *Aboriginal Heritage Act 1972* (WA) are met.

The Environmental Superintendent will ensure that copies of all documentation relating to incidents/non-compliances are maintained in accordance with the EMS Records Procedure, including corrective actions taken to address incidents/non-compliances.

The Cultural Heritage EMP will be reviewed annually with updates to be approved by the Mine Manager.

Wingellina Project
Amenity (Noise and Vibration) Management Plan

Rev 0

24 September 2014

Introduction

This Environmental Management Plan (EMP) provides the framework for the management of environmental impacts to amenity (including noise and vibration) associated with the Wingellina Nickel Project (the Project). It has been prepared in accordance with the commitments made in the Public Environmental Review (PER) document for the Project.

The scope of this EMP includes construction and operations activities related to the Wingellina mines, ore processing facility and supporting infrastructure. This EMP is a component of the overall Environmental Management System (EMS) for the Project.

Objective

This EMP has been developed to address the EPA objective for amenity:

To ensure that impacts to amenity are reduced as low as reasonably practicable.

Specific objectives for the management of noise are:

- Ensure that noise emissions, both individually and cumulatively, meet appropriate criteria and do not adversely impact on the social surroundings;
- Ensure design and procurement processes incorporate measures for minimising noise emissions during construction and operations;
- Ensure that all reasonable and practicable measures are undertaken during construction and operations to minimise noise emissions; and
- Ensure that noise impact complies with the requirements of the *Environmental Protection (Noise) Regulations 1997*.

Regulatory context

Applicable legislation, standards and guidelines	Regulatory requirements
Environmental Protection Act 1986	Part V Works Approval and Operating Licence.
Environmental Protection (Noise) Regulations 1997	Regulation 8, Assigned noise levels at noise sensitive premises.
Environmental Protection Regulations 1987	Monitoring equipment and procedures.
Mining Act 1978	Mining Proposal. Mine Closure Plan. Tenement Conditions.
Ministerial Statement	To be specified following the conclusion of the PER process.
EPA Guidance Statement No. 8 Environmental Noise	Guidance regarding the *Environmental Protection (Noise) Regulations 1997.*
AS 2021-2000 Acoustics - Aircraft noise intrusion – Building siting and construction	Guidance on the siting and construction of buildings in the vicinity of airports to minimize aircraft noise intrusion.
AS 2436-2010 Guide to Noise Control on Construction, Maintenance and Demolition Sites	Noise minimisation through construction planning.
Australian Standard (AS) 2187.2-2006 Explosives – Storage and use (Use of explosives)	Specified vibration levels.

Assigned Noise Levels

The following noise levels are based on Regulation 8 of the Noise Regulations, applicable during the operations phase.

Type of premises receiving noise	Time of day	Assigned level (dB)		
		$L_{A\ 10}$	$L_{A\ 1}$	$L_{A\ max}$
Noise sensitive premises: highly sensitive area.	0700 to 1900 hours Monday to Saturday	45 + influencing factor	55 + influencing factor	65 + influencing factor
	0900 to 1900 hours Sunday and public holidays	40 + influencing factor	50 + influencing factor	65 + influencing factor
	1900 to 2200 hours all days	40 + influencing factor	50 + influencing factor	55 + influencing factor
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays	35 + influencing factor	45 + influencing factor	55 + influencing factor
Noise sensitive premises: any area other than highly sensitive area.	All hours	60	75	80
Commercial premises.	All hours	60	75	80
Industrial and utility premises other than those in the Kwinana Industrial Area.	All hours	65	80	90

Potential environmental impacts

Potential impacts on amenity include:

- Noise from the mine, processing plant and power station impacting on sensitive receptors;
- Impacts from an increase in aircraft noise on the Wingellina community; and
- Airblast and ground-borne vibration from blasting impacting on sensitive receptors.

Sensitive Receptors

Noise and vibration from the project has the potential to impact Wingellina Township, Kalka community and mine workers accommodation area. Wingellina Township is located within 3 km of the orebody and Kalka community is approximately 16 km to the south east (Figure 1).

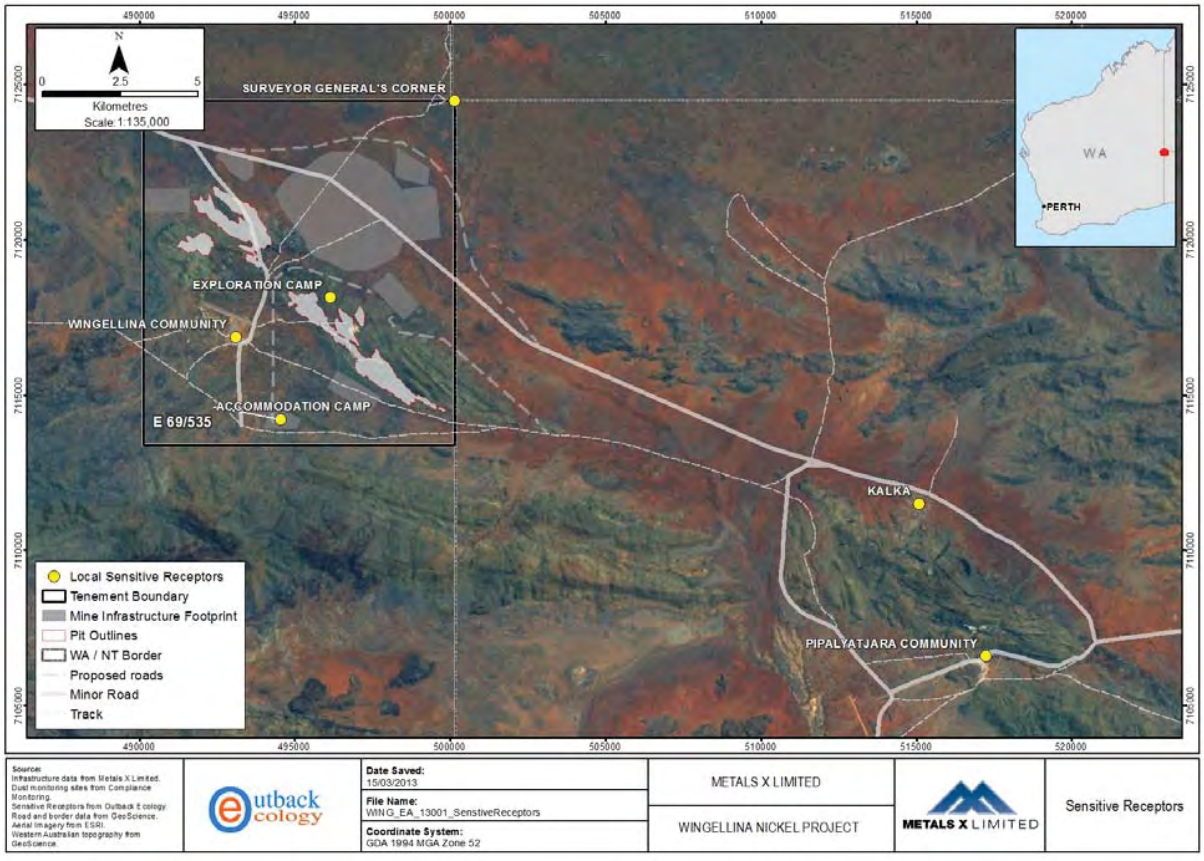


Figure 1 Sensitive receptors for noise impacts

Noise Management

Potential source	Action	Timing	Responsibility
Construction work	Construction work shall be carried out in accordance with control of environmental noise practices set out in Section 6 of AS 2436-1981 Guide to Noise Control on Construction, Maintenance and Demolition Sites.	Construction	Construction Manager
Mobile equipment and plant operation	All employees and contractors will undergo induction and periodic awareness training that will include noise management responsibilities.	Construction and operation	Environmental Superintendent
Mobile equipment and plant operation	Ensure design and procurement processes incorporate measures for minimising noise emissions.	Construction and operation	Design Engineers and Procurement Manager
Mobile equipment and plant operation	Ensure all noise control devices on equipment are operating correctly.	Construction and operation	Maintenance Engineer
Mobile equipment and plant operation	Implement a scheduled program of preventative maintenance of all plant machinery to prevent increased noise levels due to faulty plant and equipment.	Construction and operation	Maintenance Engineer
	Operate earth moving machinery in accordance with Part V operating licence.		
Mobile equipment and plant operation	Specify the allowable noise levels of site machinery.	Construction and operation	Environmental Superintendent
Mobile equipment and plant operation	Establish a community complaints system to record noise related complaints.	Construction and operation	Environmental Superintendent

Vibration Management

Potential source	Action	Timing	Responsibility
Blasting	Ensure that vibration related complaints are captured within the Project Incident Management System.	Operation	Environmental Superintendent
Blasting	Investigate any vibration complaints and implement appropriate mitigation measures if required.	Operation	Mine Manager

Monitoring

Noise will be monitored near noise sensitive receptors:

- To determine the effectiveness of this management plan and enable its continuous improvement; and
- To assess and demonstrate compliance with assigned noise levels.

The monitoring methods will be consistent with current industry standards and practices.

Aspect	Parameter	Frequency	Location	Responsibility
Noise	As per Part V operating licence for Wingellina	As per Part V operating or Wingellina	As per Part V operating for Wingellina	Environmental Superintendent

Contingency actions

Trigger	Actions	Responsibility
Noise complaint	Investigate the cause of the excessive noise, monitor if required and mitigate as appropriate.	Area Manager
Vibration complaint	Investigate the cause of the reported vibration, monitor if required and mitigate as appropriate.	Area Manager
Exceedance of assigned noise levels	Investigate the cause of the noise exceedance and mitigate as appropriate.	Area Manager

Records, reporting and review

The Environmental Superintendent shall ensure all amenity monitoring records are maintained in accordance with the EMS Records Procedure, and that reporting requirements of the Part V operating licence are met.

The Environmental Superintendent will ensure that copies of all documentation relating to incidents/non-compliances are re maintained in accordance with the EMS Records Procedure, including corrective actions taken to address incidents/non-compliances.

The Amenity (Noise and Vibration) EMP will be reviewed annually with updates to be approved by the Mine Manager.

Wingellina Project
Hydrological Processes Management Plan

Rev 0

24 September 2014

Introduction

This Environmental Management Plan (EMP) provides the framework for the management of environmental impacts to hydrological processes, including surface water and groundwater regimes, associated with the Wingellina Nickel Project (the Project). It has been prepared in accordance with the commitments made in the Public Environmental Review (PER) document for the Project.

The scope of this EMP includes construction and operations activities related to the Wingellina mines, ore processing facility and supporting infrastructure. This EMP is a component of the overall Environmental Management System (EMS) for the Project.

Objective

This EMP has been developed to address the EPA objective for surface water and groundwater:

To maintain the hydrological regimes of groundwater so that existing and potential uses, including ecosystem maintenance, are protected.

Specific objectives for the management of hydrological processes associated with the Project are:

- Minimise the adverse effects of the abstraction and release of water on environmental, social and cultural values;
- Ensure that the mining activity does not adversely affect the quality and quantity of water available to other existing and potential groundwater users; and
- Maximise efficient water use.

Regulatory context

Applicable legislation, standards and guidelines	Regulatory requirements
Rights in Water and Irrigation Act 1914	Groundwater Abstraction Licence.
Environmental Protection Act 1986	Part V Works Approval and Operating Licence.
Mining Act 1978	Mining Proposal. Tenement Conditions.
Dangerous Goods Safety (Storage and Handling of Non-explosives) Regulations 2007	Licence for storing dangerous goods. Maintenance requirements for dangerous goods storage facilities.
Environmental Protection (Rural Landfill) Regulations (2002)	Requirements for landfill construction and operation.
Ministerial Statement	To be specified following the conclusion of the PER process.

Potential environmental impacts

- Groundwater drawdown associated with abstraction for water supply and mine pit dewatering. Modelling studies of drawdown extent have been completed by Rockwater Pty Ltd and are described in the PER document. In the case of the north-western and south-eastern pits, which are the deepest, drawdowns of up to two metres are predicted to extend up to one kilometre from the pit margins, but elsewhere the drawdowns are much more restricted.
- Groundwater mounding due to seepage from the TSF and waste storage facilities. Infiltration from the TSF and WSF may increase the water table height by 10 meters or more for approximately one kilometre from the boundary of these facilities. Potential contaminants associated with potential seepage from the TSF include magnesium, calcium and manganese.
- Contamination of groundwater, arising from:
    - Spillages and infiltration of hydrocarbons through inappropriate refueling and/or servicing. Potential contamination sources include the mine workshop, vehicle wash down bays and refueling areas;
    - Discharge of nutrient laden treated wastewater from the WWTP; and
    - Infiltration of contaminants associated with waste disposal facilities.
- The development and abstraction of water from the Central Officer Basin borefield will result in a cone of depression which is narrow and steep sided close to the production bore. Recharge of the aquifer is predicted to be minimal and a zone of drawdown is expected to persist within the aquifer following the cessation of abstraction activities.

The major process reagents for the Project stored on-site include:

- Sulphur 360,000 t/yr;
- Magnesia 35,000 t/yr;
- Calcrete 860,000 t/yr;
- Sodium metabisulphite (SMBS) 18,040 t/yr;
- Flocculants 2,700 t/yr; and
- Quicklime 32,000 t/yr.

Sulphur is converted to sulphuric acid for the HPAL. On site storage of up to 25,000 tonnes of reagent is equivalent to up to six days of process consumption.

Management

Potential impact	Action	Timing	Responsibility
Drawdown	Aquifers will be monitored on an ongoing basis so impacts to water levels can be detected.	Refer to Monitoring section	Environmental Superintendent
Contamination of surface water and groundwater	Collection of baseline groundwater data.	Construction and operations	Environmental Superintendent
	Aquifers will be monitored on an ongoing basis so impacts to water chemistry can be detected.	Refer to Monitoring section	Environmental Superintendent
	Ad-hoc servicing of vehicles will only be undertaken by trained personnel using spill trays and in close proximity of spill cleanup kits.	Construction and operations	Construction/ Operations and Maintenance Managers
	The main fuel storage, fuelling and servicing area will be bunded and lined to prevent infiltration of spills. The bund will discharge to an oily water separator.	Construction and operations	Project / Construction Manager
Contamination of surface water and groundwater	Wash downs will be undertaken using quick break detergents at a properly constructed wash down bay, which discharges to a sediment settlement sump/oily water separator.	Construction and operations	Maintenance Manager
	Waste disposal areas will be constructed outside of known drainage lines and with contained drainage that discharges via a sediment sump/oily water separator.	Construction and operations	Project / Construction Manager

Potential impact	Action	Timing	Responsibility
	Landfills will be constructed with the requirements of the *Environmental Protection (Rural Landfill) Regulations (2002).*	Construction and operations	Project / Construction Manager
	Contaminated stormwater will be retained on site where practicable.	Construction and operations	Operations Managers
	Storage and management of chemicals and hydrocarbons will be in accordance with relevant regulatory requirements and industry guidelines.	Construction and operations	Plant Manager
	Surface water runoff from process plant and sulphur handling areas will be captured and diverted to the process plant containment pond.	Operations	Plant Manager
	Wastewater will be collected by a sewer and passed to an activated sludge package system.	Construction and Operations	Project and Construction Manger
	Tailings material will be neutralised prior to discharge to the TSF and treated with SMBS to remove hexavalent chromium.	Operations	Environmental Superintendent
Disrupted surface flow regime	All site infrastructure will be constructed to minimise disruption to surface water flow, reduce the potential for flooding of infrastructure, and minimise the risk of groundwater contamination.	Construction and operations	Environmental Superintendent

Monitoring

Aspect	Parameter	Frequency	Location	Responsibility
Groundwater levels	Depth to water levels.	Monthly.	All dewatering production bores.	Environmental Superintendent
Groundwater quality	As per EP Act Part V operating Licence.	As per EP Act Part V operating Licence.	As per EP Act Part V operating Licence.	Environmental Superintendent
	As per the Groundwater Abstraction Licence.	As per the Groundwater Abstraction Licence.	As per the Groundwater Abstraction Licence.	Environmental Superintendent
Groundwater abstraction	Abstraction volumes.	As per the Groundwater Abstraction Licence.	As per the Groundwater Abstraction Licence.	Environmental Superintendent

Contingency actions

Trigger	Actions	Responsibility
Poor water quality detected by monitoring.	Investigate possible cause. Make changes to improve water quality as per licence requirements.	Environmental superintendent

Records, reporting and review

The Environmental Superintendent shall ensure all bore monitoring records are maintained in accordance with the EMS Records Procedure, and that reporting requirements of the Groundwater Operating Strategy (GWOS) to the Department of Water (DoW) are met.

The Environmental Superintendent will ensure that copies of all documentation relating to incidents/non-compliances are maintained in accordance with the EMS Records Procedure, including corrective actions taken to address incidents/non-compliances.

The Groundwater EMP will be reviewed annually with updates to be approved by the Mine Manager.

Groundwater monitoring and management activities may be reported in the Annual Environmental Report (AER), submitted in accordance with tenement conditions.

Wingellina Project
Flora and Vegetation Management Plan

Rev 1

7 August 2015

Introduction

This Environmental Management Plan (EMP) provides the framework for the management of environmental impacts to flora and vegetation associated with the Wingellina Nickel Project (the Project). It has been prepared in accordance with the commitments made in the Public Environmental Review (PER) document for the Project.

The scope of this EMP includes construction and operations activities related to the Wingellina mine pits, ore processing facility and supporting infrastructure. This EMP is a component of the overall Environmental Management System (EMS) for the Project.

Objective

This EMP has been developed to address the EPA objective for flora and vegetation:

To maintain representation, diversity, viability and ecological function at the species, population and community level.

Specific objectives for the management of fauna associated with the Project are:

- Minimise vegetation clearing;
- Protect flora and vegetation of conservation significance; and
- Prevent the introduction and spread of weeds.

Regulatory context

Applicable legislation, standards and guidelines	Regulatory requirements
Wildlife Conservation Act 1950 (WA)	Protection of native flora, including rare and endangered species.
Environmental Protection Act 1986 (WA)	Part V Works Approval and Operating Licence.
Environmental Protection (Clearing of Native Vegetation) Regulations 2004	Application and approval for clearing of native vegetation for mineral activities.
Bushfires Act 1954 (WA)	Fire management.

Applicable legislation, standards and guidelines	Regulatory requirements
Mines Safety and Inspections Act 1994 (WA)	Fire management.
Mining Act 1978 (WA)	Mining Proposal. Tenement Conditions.
Ministerial Statement	To be specified following the conclusion of the PER process.

Significant flora and vegetation

The flora and vegetation values of the Project area (minesite, borefield and associated pipeline and track) were assessed through a combination of desktop studies and field surveys in 2002, 2008, 2010 and 2011, which are described in the PER document.

No DRF, TEC or PEC's occur in the Project area. Four Priority taxa are known to occur in the Project mine site area including *Menkea lutea* (Priority 1), *Goodenia lunata* (Priority 1), *Euphorbia inappendiculata* (Priority 3) and *Calotis latiuscula* (Priority 3). The locations of recorded Priority flora are shown in Figure 1.

Four Priority taxa are known to occur in proximity to the Officer Basin borefield area and pipeline route including *Aristida jerichoensis* var. *subspinulifera* (Priority 1), *Calotis latiuscula* (Priority 3), *Goodenia modesta* (Priority 3) and *Stackhousia clementii* (Priority 1). The locations of recorded Priority flora are shown in Figure 2.

Significant weed species

Buffel Grass (*Cenchrus ciliaris*) is a priority weed species for monitoring and management in the Project area. Buffel Grass is one of the most significant weeds of arid Australia (Biosecurity SA 2012[4]):

- 'Buffel Grass is arguably the single greatest invasive species threat to biodiversity across the entire Australian arid zone, and without active management it will continue to invade a wide range of native habitats to the extent that it would replace many native species in those habitats';
- '[Buffel Grass] readily invades intact native vegetation, out-competes native species and increases fire frequency and intensity. It is a 'transformer weed', as it can transform the basic attributes of habitats, changing ecosystems irreversibly'; and
- 'Prevention is the most cost-effective means of control. It is important therefore to keep currently uninfested areas free of Buffel Grass, particularly near high value assets'.

[4] Biosecurity SA (2012) *South Australia Buffel Grass Strategic Plan: A plan to reduce the weed threat of buffel grass in South Australia*. Government of South Australia

Vegetation surveys of borefield and pipeline route areas completed in the period 2010-2012 indicated that these areas are largely free of Buffel Grass. Preventing the spread of Buffel Grass into the pipeline route and borefield areas is a key management objective, to be achieved through:

- Effective vehicle hygiene and quarantine for vehicles and equipment travelling between the minesite, pipeline route and borefield areas; and
- Early detection and control of Buffel Grass in the pipeline route and borefield areas.

Potential environmental impacts

Potential impacts to flora and vegetation include:

- The proposal involves the clearing of up to 2,500 ha of native vegetation, including clearing for the mine, haul road, tracks, borefield, pipelines, accommodation camp, waste dumps and TSF. Clearing requirements for the borefield area will be minimal, with clearing required for the upgrade of the access road and construction of the production bores.
- Indirect impacts on flora and vegetation may result from:
    - introduction and/or spread of weeds;
    - altered fire regimes;
    - altered water regimes;
    - use of brackish water for dust suppression;
    - dust deposition; and
    - accelerated erosion/soil loss.
- Loss of biological diversity and reduced regional representation of flora and vegetation communities from direct and indirect impacts.
- Loss of conservation significant flora from direct and indirect impacts.

Figure 1 Locations of recorded Priority flora in the Wingellina Project minesite area

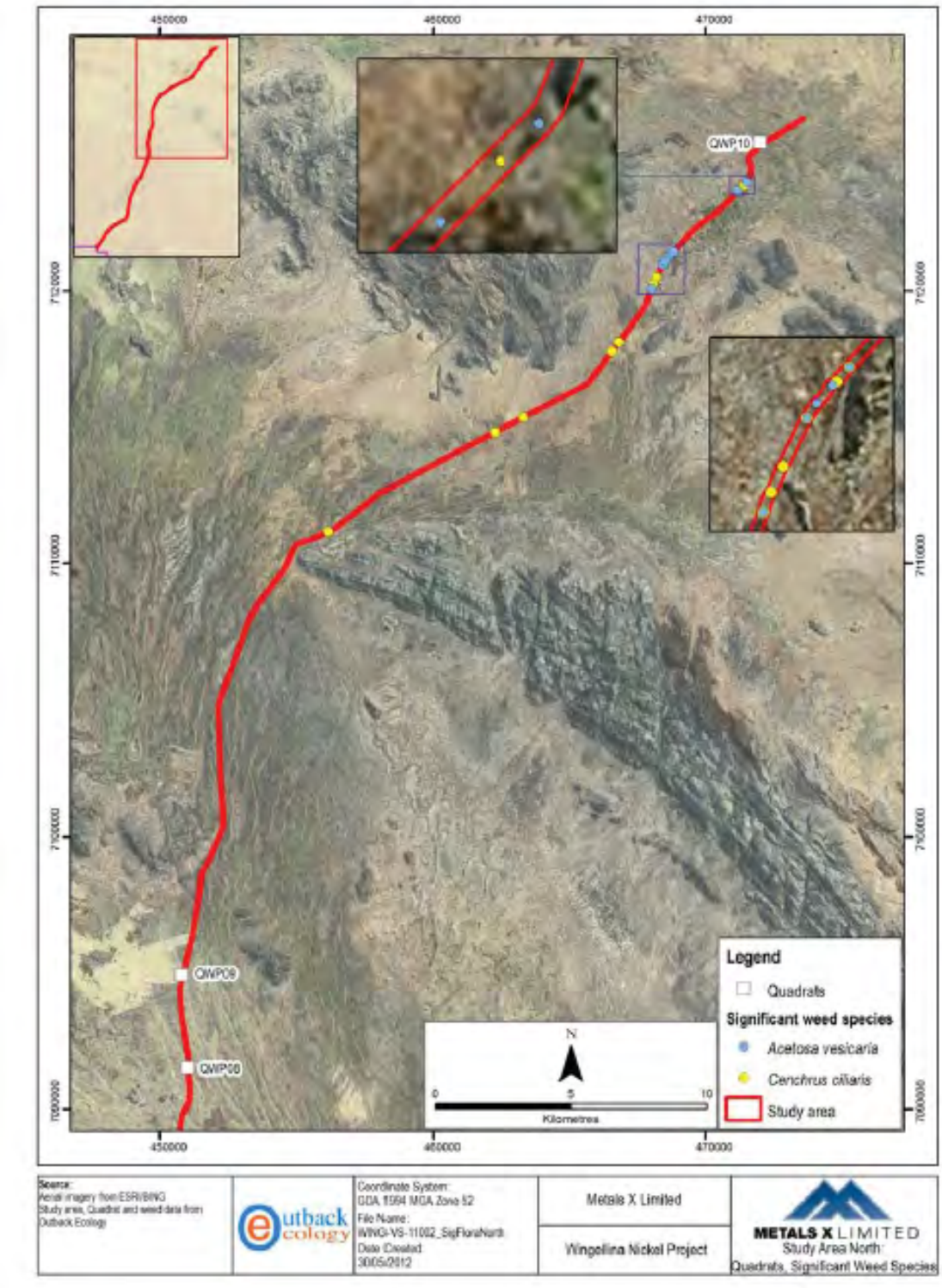


Figure 2a **Locations of recorded Priority flora and significant weed species in the Officer Basin borefield area and pipeline route (north section)**

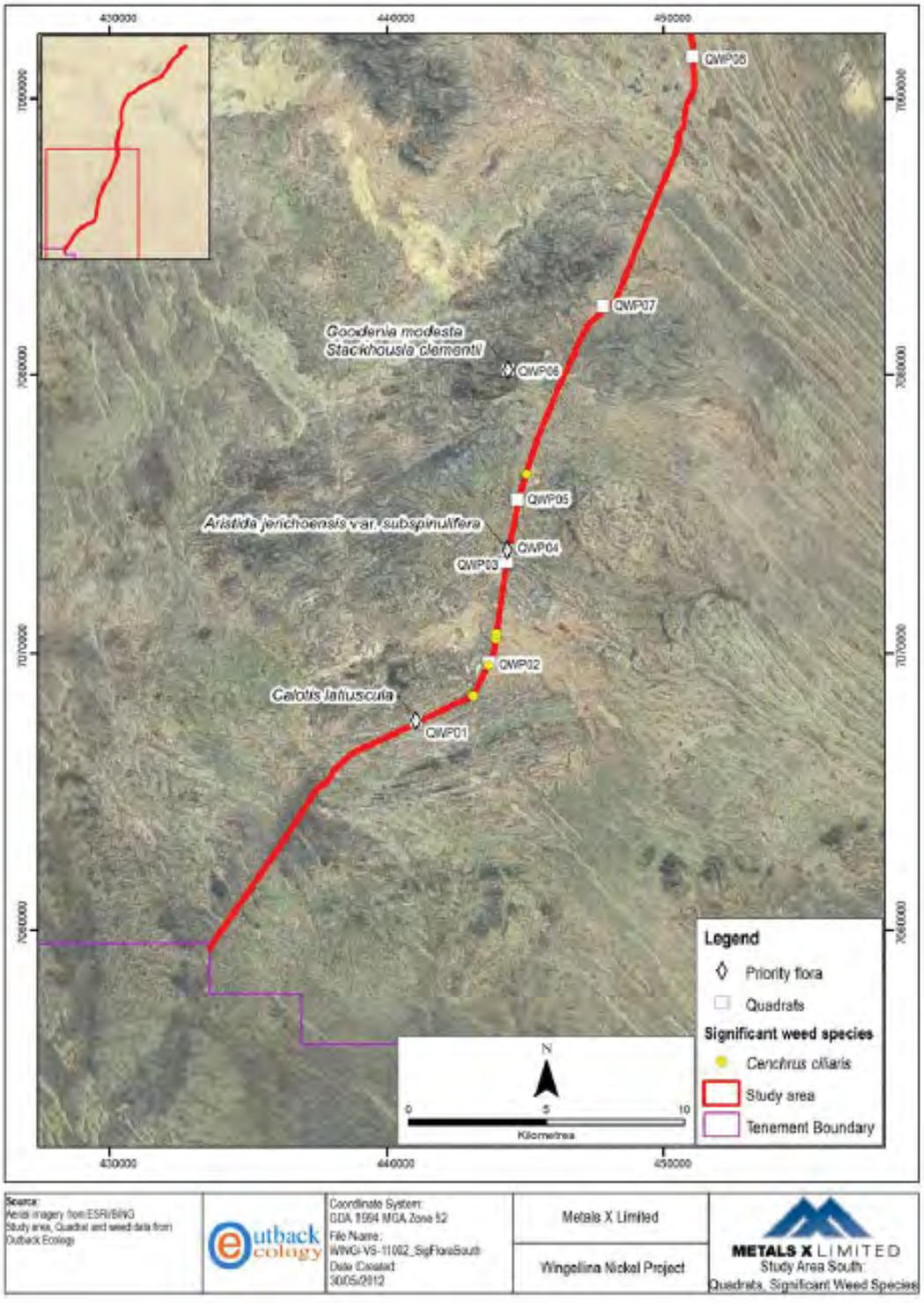


Figure 2b Locations of recorded Priority flora and significant weed species in the Officer Basin borefield area and pipeline route (north section) Management

Potential impact	Action(s)	Timing	Responsibility
Vegetation clearing	Minimisation of clearing footprints during final design including the avoidance of drainage line and ridgeline vegetation where possible.	Prior to ground disturbance, and during construction and operations	Environmental Superintendent
	Mine planning to include progressive clearing and rehabilitation to minimise the amount of bare soil at any one time.	Construction and Operations	Environmental Superintendent
	Implementation of clearing procedures to prevent accidental clearing of vegetation.	Construction and Operations	Environmental Superintendent
Disturbance of significant flora and vegetation	Locations of Priority flora outside the development footprint will be demarcated and access/clearing prevented.	Construction and Operations	Environmental Superintendent
	The condition of Priority flora in the Project area will be regularly monitored.	Operations	Environmental Superintendent
Introduction and/or spread of weeds	Vehicles will be confined to authorised tracks and roads.	Operations	Environmental Superintendent
	All vehicles arriving on-site and/or post-use in any weed affected areas (for example following spraying operations) will be required to undertake a washdown at a designated washdown location to remove weed seeds and/or other weed propagules.	Construction and Operations	Environmental Superintendent
	Weed populations in the Project area will be mapped, with regular inspections of priority areas. The weed mapping will be updated on an annual basis.	Construction and Operations	Environmental Superintendent
	Control of weeds will be undertaken using herbicides, direct removal or other methods as appropriate in order to prevent the spread of weeds and protect environmental values in the Project area. Weed infested topsoil stockpiles will be regularly monitored and treated.	Construction and Operations	Environmental Superintendent

Potential impact	Action(s)	Timing	Responsibility
	Priority control of Buffel Grass Priority will be given to preventing the spread of Buffel Grass, and early detection and eradication of new infestations that become established on otherwise healthy sites. Treated areas will be revisited after rain to eradicate new Buffel Grass seedlings and previously undetected plants. Buffel Grass re-grows quickly after a fire, and has a propensity to return at greater densities following a fire disturbance. Targeted surveys for Buffel Grass following fire events in the Project area will be undertaken, and control measures implemented if required.	Construction and Operations	Environmental Superintendent
	Feral herbivores will be excluded from the Project area, including rehabilitated sites.	Construction and Operations	Environmental Superintendent
Altered fire regimes	A Fire Management Plan will be developed for the Project and will include development and identification of the following responses and procedures: • Safe work procedures and permitting for welding and grinding work; • Personnel fire hazard procedures; • Fire response vehicles; • Bushfire contingency plans; • Emergency fire response procedures; and • Installation of fire breaks where necessary.	Construction and Operations	Environmental Superintendent

Potential impact	Action(s)	Timing	Responsibility
	The use of fire for hunting will not be permissible within the mine site Project area.	Construction and Operations	Environmental Superintendent
Altered water regimes	Project infrastructure will be designed and constructed to minimise disturbance to existing surface water flows while preventing the potential for flooding. Culverts will be constructed at approximately 13 locations to aid in the maintenance of existing flows and rates and therefore minimise potential impacts to vegetation from localised flooding or drought.	Construction and Operations	Environmental Superintendent
Use of brackish water for dust suppression	All access roads and haul roads will be regularly sprayed with mildly saline groundwater to minimise dust suppression. All roads will be constructed to prevent water run-off into native vegetation, e.g. bunds and sumps will be installed at appropriate locations and intervals.	Construction and Operations	Environmental Superintendent
Dust deposition	Dust emissions will be managed in accordance with the Project Air Quality EMP.	As per Project Air Quality EMP	As per Project Air Quality EMP
Workforce training and inductions	Environmental awareness induction and education programs addressing flora and vegetation will be delivered to all workforce personnel.	Construction and Operations	Environmental Superintendent

Monitoring

Aspect	Parameter	Frequency	Location	Responsibility
Vegetation clearing	Spatial location and extent of clearing.	Ongoing	Project area	Environmental Superintendent
Disturbance of Significant Flora Species	Persistence and health of Priority flora.	Annually	Recorded Priority flora populations	Environmental Superintendent
Weeds	Weed species and their extent in the Project area.	Ongoing	Project area	Environmental Superintendent
Vegetation health	Visual assessment of vegetation health where exposed to dust, fire disturbance, altered water regimes.	Ongoing	Project area	Environmental Superintendent
Rehabilitation monitoring	In accordance with Mine Closure Plan.	In accordance with Mine Closure Plan.	Rehabilitated areas	Environmental Superintendent

Contingency actions

Trigger	Actions	Responsibility
Unauthorised vegetation clearing	Investigate the cause, review and update controls as necessary to prevent future unauthorised access. Inform relevant regulatory authorities. Record all unauthorised access incidents in the Project Incident Management System.	Environmental Superintendent
Disturbance of Significant Flora Species	Investigate the cause, review and update controls as necessary to prevent future unauthorised disturbance. Inform relevant regulatory authorities. Record all unauthorised access incidents in the Project Incident Management System.	Environmental Superintendent
New weed species detected in Project Area	Investigate the cause, review and update controls as necessary to prevent future weed incursions where reasonably practicable. Record all unauthorised access incidents in the Project Incident Management System.	Environmental Superintendent

Trigger	Actions	Responsibility
Spread of invasive weed species	Investigate the cause, review and update controls as necessary to prevent future weed spread where reasonably practicable. Record all unauthorised access incidents in the Project Incident Management System.	Environmental Superintendent
Poor rehabilitation results	Investigate the cause, review and update rehabilitation practices. Undertake further works in the area if required.	Environmental Superintendent

Records, reporting and review

The Environmental Superintendent shall ensure all flora and vegetation monitoring records are maintained in accordance with the EMS Records Procedure.

The Environmental superintendent will ensure that copies of all documentation relating to incidents/non-compliances are re maintained in accordance with the EMS Records Procedure, including corrective actions taken to address incidents/non-compliances.

The Flora and Vegetation EMP will be reviewed annually with updates to be approved by the Mine Manager.

Flora and vegetation monitoring and management activities may be reported in the Annual Environmental Report (AER), submitted to DMP in accordance with tenement conditions.

Annual Clearing Reports will be submitted to DMP in accordance with Clearing Permits.

Wingellina Project
Fauna Management Plan

Rev 0

24 September 2014

Introduction

This Environmental Management Plan (EMP) provides the framework for the management of environmental impacts to fauna associated with the Wingellina Nickel Project (the Project). It has been prepared in accordance with the commitments made in the Public Environmental Review (PER) document for the Project.

The scope of this EMP includes construction and operations activities related to the Wingellina mines, ore processing facility and supporting infrastructure. This EMP is a component of the overall Environmental Management System (EMS) for the Project.

Objective

This EMP has been developed to address the EPA objective for fauna:

To maintain representation, diversity, viability and ecological function at the species, population and assemblage level.

Specific objectives for the management of fauna associated with the Project are:

- Protect fauna of conservation significance; and
- Control feral animals.

Regulatory context

Applicable legislation, standards and guidelines	Regulatory requirements
Wildlife Conservation Act 1950 (WA)	Protection of native fauna, including rare and endangered species.
Environmental Protection Act 1986 (WA)	Part V Works Approval and Operating Licence.
Environment Protection and Biodiversity Conservation Act 1999 (Cmth)	Protection of matters of national environmental significance including rare and endangered fauna.
Bushfires Act 1954 (WA)	Fire management.
Mines Safety and Inspections Act 1994 (WA)	Fire management.

Applicable legislation, standards and guidelines	Regulatory requirements
Mining Act 1978	Mining Proposal. Tenement Conditions.
Ministerial Statement	To be specified following the conclusion of the PER process.

Significant fauna

The diversity and abundance of terrestrial fauna, short range endemics (SRE) and subterranean fauna in the Project area (mine site, and the borefield and associated pipeline and track) has been assessed through a series of desktop studies and surveys conducted between 2002 and 2012. These are described in the PER document.

Three vertebrate fauna species of conservation significance were recorded in the mine site area:

- Australian Bustard (*Ardeotis australis)* Priority 4;
- Western Long-eared Bat (*Nyctophilus major tor*) Priority 4; and
- Rainbow Bee-eater (*Merops ornatus*) Schedule 3; Migratory – EPBC Act.

Four vertebrate fauna species of conservation significance were recorded in the Officer Basin borefield area:

- Australian Bustard (*Ardeotis australis)* Priority 4;
- Brush-tailed Mulgara (*Dasycercus blythi*) Priority 4;
- Western Long-eared Bat (*Nyctophilus major tor*) Priority 4; and
- Rainbow Bee-eater (*Merops ornatus*) Schedule 3; Migratory – EPBC Act.

Other conservation significant species with the potential to occur in the Project area include:

- Mulgara (*Dasycercus cristicauda*) Vulnerable – WA; EPBC Act;
- Long-tailed Dunnart (*Sminthopsis longicaudata*) Priority 4;
- Striated Grasswren (*Amytornis striatus striatus*) Priority 4;
- Major Mitchell's Cockatoo (*Calcatua leadbeateri*) Schedule 4;
- Woma (*Aspidites ramsayi*) Schedule 4;
- Princess Parrot (*Polytelis alexandrae*) Priority 4; Vulnerable – EPBC Act;and
- Fork-tailed Swift (*Apus pacificus*) Schedule 3; Migratory – EPBC Act.

Surveys for short range endemics (SRE) suggest that the Project area supports a minimal amount of SRE habitat, as described in the PER document. The rocky escarpment habitat south of the mining area is a restricted habitat type potentially favoured by SREs; however this area is outside the Project disturbance footprint. Therefore this EMP does not include any special management provisions for SRE fauna.

Subterranean fauna survey findings demonstrated a very low diversity and abundance of subterranean fauna species associated with habitats in the Wingellina region, as described in the PER document. Therefore this EMP does not include any special management provisions for subterranean fauna.

Feral animals

Feral animals occurring in the Project area and surrounding environs include the Wild Dog (*Canis familiaris*), Feral Cat (*Felis catus*), European Rabbit (*Oryctolagus cuniculus*), One-humped Camel (*Camelus dromedarius*) and House Mouse (*Mus musculus*). Carnivorous species can predate or compete with native species; whilst herbivorous species can disturb vegetation, spread weeds and contribute to land degradation and erosion.

Potential environmental impacts

Potential impacts to fauna include:

- The proposal involves the clearing of not more than 2,416 ha of native vegetation which provides habitat for fauna. Vegetation clearing may result in loss or fragmentation of fauna habitat and consequential displacement of fauna;
- Construction of a 135 km water pipeline and increased vehicle traffic may impact upon fauna;
- Death or injury of fauna may also occur during clearing and construction and from ongoing operations;
- Increased numbers of predators such as cats and dogs attracted to the accommodation village and rubbish dumps;
- Increased numbers of grazing animals attracted by new water sources;
- Health impacts on animals and birds resulting from drinking contaminated water from the TSF and other sources;
- Noise and light emissions during operations have the potential to have localised impacts fauna behaviour, especially to bat species; and
- Construction and operation of the proposal has the potential to cause indirect impacts through impacts of weeds and obstruction of fauna movements due to increased presence of human activity.

Management

Potential impact	Action	Timing	Responsibility
Vegetation clearing	Minimisation of clearing footprints during final design including the avoidance of drainage line and ridgeline vegetation where possible.	Prior to ground disturbance, and during construction and operations	Environmental Superintendent
	Mine planning to include progressive clearing and rehabilitation to minimise the amount of bare soil at any one time.	Construction and Operations	Environmental Superintendent
	Implementation of clearing procedures to prevent accidental clearing of vegetation.	Construction and Operations	Environmental Superintendent
Vehicle collisions with fauna	Ensure vehicle speeds are controlled and that vehicles only use authorised access routes.	Construction and Operations	Environmental Superintendent
	Maintain a register of vehicle impacts on vertebrate fauna.	Construction and Operations	Environmental Superintendent
Fauna habitat degradation	Control fire sources during construction and ensure adequate firefighting equipment is available.	Construction and Operations	Environmental Superintendent
Animal entrapment and exposure to toxic substances	Minimise fauna mortality as a result of falling into excavated areas by minimising the trench/excavation area open at any given time, install escape ramps into excavated areas and conduct regular inspections of excavated areas and trenches.	Construction and Operations	Environmental Superintendent
	Use bird deterrent methods to minimise bird activity on the TSF.	Construction and Operations	Environmental Superintendent
	Install animal egress matting on the sides of the TSF and WSF.	Construction and Operations	Environmental Superintendent
Feral animals	Manage waste and water ponding to prevent the attraction and enhancement of feral animal populations.	Construction and Operations	Environmental Superintendent
	Monitor feral animal activity and implement control actions where necessary to prevent the build-up of feral animal populations.	Operations	Environmental Superintendent
Workforce training and inductions	Environmental awareness induction and education programs addressing fauna will be delivered to all workforce personnel.	Construction and Operations	Environmental Superintendent

Monitoring

Aspect	Parameter	Frequency	Location	Responsibility
Vegetation clearing	Spatial location and extent of clearing.	Ongoing	Project area	Environmental Superintendent
Disturbance of Significant Fauna Species	Significant fauna activity.	Ongoing	Project Area	Environmental Superintendent
Animal health	Animal interactions with TSF, WSF and processing facilities.	Ongoing	Project area	Environmental Superintendent
Feral animals	Feral animal activity.	Ongoing	Project area	Environmental Superintendent
Fauna habitat	Monitor the development of fauna habitat in rehabilitated areas.	In accordance with MCP.	In accordance with MCP.	Environmental Superintendent
Fauna diversity	Monitor the diversity of fauna recolonising rehabilitated areas.	In accordance with MCP.	In accordance with MCP.	Environmental Superintendent

Contingency actions

Trigger	Actions	Responsibility
Unauthorised vegetation clearing	Investigate the cause, review and update controls as necessary to prevent future unauthorised access. Inform relevant regulatory authorities. Record all unauthorised access incidents in the Project Incident Management System.	Environmental Superintendent
Disturbance of Significant Fauna species	Investigate the cause, review and update controls as necessary to prevent future unauthorised disturbance. Inform relevant regulatory authorities. Record all unauthorised access incidents in the Project Incident Management System.	Environmental Superintendent

Trigger	Actions	Responsibility
Animal become entrapped and/or exposed to toxic substances	Investigate the cause, review and update controls as necessary to prevent future entrapment and/or exposure. Inform relevant regulatory authorities. Record all unauthorised access incidents in the Project Incident Management System.	Environmental Superintendent
Feral animal activity is linked to environmental degradation within the Project area	Investigate the cause, review and update controls as necessary to minimise future damage by feral animals. Inform relevant regulatory authorities. Record all unauthorised access incidents in the Project Incident Management System.	Environmental Superintendent
Fauna recolonisation	Facilitate fauna recolonisiation in rehabilitated areas through use of appropriate rehabilitation methods.	Environmental Superintendent

Records, reporting and review

The Environmental Superintendent shall ensure all fauna monitoring records are maintained in accordance with the EMS Records Procedure.

The Environmental Superintendent will ensure that copies of all documentation relating to incidents/non-compliances are maintained in accordance with the EMS Records Procedure, including corrective actions taken to address incidents/non-compliances.

The Fauna EMP will be reviewed annually with updates to be approved by the Mine Manager.

Fauna monitoring and management activities may be reported in the Annual Environmental Report (AER), submitted in accordance with tenement conditions.

Wingellina Project

Waste Management Plan

Rev 0

24 September 2014

Introduction

This Environmental Management Plan (EMP) provides the framework for the management of environmental impacts relating to waste handling, storage and disposal at the Wingellina Nickel Project (the Project). It has been prepared in accordance with the commitments made in the Public Environmental Review (PER) document for the Project.

The scope of this EMP includes construction and operations activities related to the Wingellina mines, ore processing facility and supporting infrastructure. This EMP is a component of the overall Environmental Management System (EMS) for the Project.

Objective

This EMP has been developed to describe the waste management actions that must be followed to minimise environmental impacts associated with waste.

Specific objectives for the management of waste associated with the Project are:

- To prevent groundwater, surface water or soil contamination; and
- To prevent disturbance to amenity from unsightly refuse or odour.

Regulatory context

Applicable legislation, standards and guidelines	Regulatory requirements
Environmental Protection Act 1986 (WA)	Part V Works Approval and Operating Licence.
Environmental Protection Regulations 1987 (Part 6, Schedule 1 and Schedule 5) - storage, handling, transportation and Disposal	Tyre Disposal.
Mining Act 1978	Mining Proposal. Tenement Conditions.
Dangerous Goods Safety (Storage and Handling of Non-explosives) Regulations 2007	Safe storage, handling and transport of dangerous goods.

Applicable legislation, standards and guidelines	Regulatory requirements
AS1940 – 2004 The storage and handling of flammable and combustible liquids	Storage and handling of hydrocarbons.
Storage and handling of dangerous goods - Code of Practice	Reducing the risks associated with the storage and handling of explosive, flammable, combustible, spontaneously combustible, oxidising, water-reactive, toxic or corrosive goods.
Ministerial Statement	To be specified following the conclusion of the PER process.

Categories of waste

General waste:

- Inert and putrescible domestic waste (e.g. plastic, paper, workshop wastes and domestic solid wastes);
- Empty chemical containers and drums;
- Empty oil drums;
- Construction waste (e.g. wood, scrap metal, plastic pipes, tyres, rubber, batteries);
- Sewage and grey water;
- Hazardous substances;
- Hydrocarbons – approximately 200 kL/yr of waste hydrocarbons will be produced by the Project; and
- Plant maintenance related chemicals (insignificant in comparison to waste hydrocarbons).

Definitions:

Dangerous goods are classified on the basis of immediate physical or chemical effects, such as fire, explosion, corrosion and poisoning affecting property, the environment or people.

Hazardous substances are classified only on the basis of health effects — whether immediate or long-term (e.g. corrosives, poisons). Note, many hazardous substances are also classified as dangerous goods.

Potential environmental impacts

Potential impacts associated with waste handling, storage and disposal include:

- Contamination of groundwater, surface water and soil;
- Unsightly refuse;
- Objectionable odour;
- Impacts to fauna from ingestion of indigestible or poisonous material; and
- Increase in feral animals/vermin.

Management

Waste Type	Potential impact	Action	Timing	Responsibility
Putrescible domestic waste	Contamination of groundwater, surface water or soil.	Construct and operate putrescible landfill in accordance with the Environmental Protection (Rural Landfill) Regulations 2002.	Construction and Operation	Environmental Superintendent
Putrescible domestic waste	Increased vermin and odour.	Dispose of all putrescible domestic waste to the fenced landfill facility and cover with at least 200 millimetres of cover material at least weekly.	Construction and Operation	Environmental Superintendent
Inert and putrescible domestic waste	Contamination of groundwater, surface water or soil.	Minimise domestic and construction waste through avoidance, reuse and recycling where appropriate.	Construction and Operation	Procurement Manager / Environmental Superintendent
Inert and putrescible domestic waste	Contamination of groundwater.	Construct waste disposal areas outside of known drainage lines and with contained drainage that discharges via a sediment sump/oily water separator.	Construction and Operation	Environmental Superintendent

Waste Type	Potential impact	Action	Timing	Responsibility
Inert and putrescible domestic waste.	Contamination of groundwater, surface water or soil.	Manage the landfill in accordance with Part V operating licence.	Construction and Operation	Environmental Superintendent
Inert and putrescible domestic waste.	Unsightly refuse.	Maintain good housekeeping on site and dispose of all inert and putrescible domestic waste to the fenced landfill facility.	Construction and Operation	Environmental Superintendent
Inert waste (Tyres)	Unsightly refuse, poor housekeeping, unstable landforms.	Where possible return tyres to the supplier on back haulage or bury tyres with minimum cover and separation distances between tyres as per DER advice.	Operation	Environmental Superintendent
Batteries	Contamination of groundwater, surface water or soil.	Send offsite for recycling or disposal.	Operation	Workshop Manager
Empty chemical containers and drums	Contamination of groundwater, surface water or soil.	Where practicable return to the supplier or dispose of in accordance with material safety data sheet guidance.	Operation	Workshop/ Plant Manager
Empty oil drums	Contamination of groundwater, surface water or soil.	Where practicable return to the supplier or dispose of in accordance with material safety data sheet guidance.	Operation	Workshop Manager
Sewage and grey water	Contamination of groundwater, surface water or soil.	Manage in accordance with Part V operating licence.	Construction and Operation	Environmental Superintendent
Hydrocarbons	Contamination of groundwater, surface water or soil.	All waste hydrocarbons to be stored in accordance with AS1940.	Construction and Operation	Environmental Superintendent

Waste Type	Potential impact	Action	Timing	Responsibility
Hydrocarbons	Contamination of groundwater, surface water or soil.	Spill response equipment will be located in the vicinity of work areas, with site personnel trained in spill response management.	Construction and Operation	Environmental Superintendent
Hydrocarbons	Contamination of groundwater, surface water or soil.	Dispose of waste hydrocarbons through a licensed waste contractor.	Construction and Operation	Workshop Manager
Hazardous waste	Contamination of groundwater, surface water or soil.	Develop procedures for the correct handling, storage, spill management and clean-up of hazardous materials.	Construction and Operation	Environmental Superintendent
Hazardous waste	Contamination of groundwater, surface water or soil.	Design the unloading, storage and mixing facilities at the processing plant to include spill prevention and containment measures.	Construction	Design Engineer
Hazardous waste	Contamination of groundwater, surface water or soil.	Manage hazardous waste in accordance with the Dangerous Goods Licence.	Construction and Operation	Environmental Superintendent/ Safety Superintendent
Hazardous waste	Contamination of groundwater, surface water or soil.	Store and handle all hazardous waste in accordance with the Storage and handling of dangerous goods - Code of Practice and Part V operating licence requirements.	Operation	Environmental Superintendent/ Safety Superintendent

Waste Type	Potential impact	Action	Timing	Responsibility
Hazardous waste	Contamination of groundwater, surface water or soil.	Any spillages that arise in the process plant that cannot be recycled will be contained and neutralised prior to disposal in the Tailings Facility.	Operation	Process Plant Manager
Plant maintenance related chemicals	Contamination of groundwater, surface water or soil.	Dispose of in accordance with material safety data sheet guidance.	Operation	Environmental Superintendent
Waste hydrocarbons, chemicals, general refuse	Poisoning of wildlife.	Store all liquid wastes in sealed containers. Dispose of all inert and putrescible solid waste to the landfill managed in accordance with licence requirements.	Construction and Operation	Environmental Superintendent
Tailings	Contamination of groundwater or surface water.	Design and build the tailings dam to contain all tailings.	Construction	Design Engineer
Tailings	Contamination of groundwater or surface water.	Operate the process plant to minimise toxic element concentrations in process tailings.	Operation	Plant Manager
Tailings	Contamination of groundwater or surface water.	Operate the tailings dam to maintain sufficient freeboard to ensure that overtopping of the tailings dam is prevented.	Operation	Plant Manager

Monitoring

Aspect	Parameter	Frequency	Location	Responsibility
Groundwater	As per Part V operating licence.	As per Part V operating licence.	As per Part V operating licence	Environmental Superintendent
Effluent	As per Part V operating licence.	As per Part V operating licence.	Waste water treatment plant	Environmental Superintendent
Site inspections of work practices against this EMP	Work practices.	Weekly	Plant site and TSF	Environmental Superintendent
Tailings	Undertake regular visual inspections of the; • tailings delivery lines; • tailings deposition; • ponding on the TSF; • free board; • external TSF walls; and • record any problems noted.	As per Part V operating licence.	TSF	Environmental Superintendent

Contingency actions

Trigger	Actions	Responsibility
Exceed Part V operating licence requirement.	Investigate possible cause. Make changes to improve water quality or effluent sample quality as per licence requirements.	Environmental Superintendent
Work practices not in accordance with this EMP.	Investigate the cause, review and adjust work practices or this EMP as required.	Environmental Superintendent
Any problems with TSF operation.	Investigate the cause, review and adjust work practices as required.	Environmental Superintendent

Records, reporting and review

The Environmental Superintendent shall report any spills of environmentally hazardous chemicals in accordance with the Part V operating licence. The Environmental Superintendent shall ensure all waste management records are maintained in accordance with the EMS Records Procedure.

The Environmental Superintendent will ensure that copies of all documentation relating to incidents/non-compliances are maintained in accordance with the EMS Records Procedure, including corrective actions taken to address incidents/non-compliances.

The Waste EMP will be reviewed annually with updates to be approved by the Mine Manager.

Wingellina Nickel Project

Air Quality Assessment

Prepared by

Air Assessments

July 2013

Draft

Disclaimer and Limitation

Air Assessments will act in all professional matters as a faithful adviser to the Client and exercise all reasonable skill and care in the provision of its professional services.

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This report is based on the scope of services defined by the Client, budgetary and time constraints requested by the Client, the information supplied by the Client (and its agents), and methods consistent with the preceding.

Air Assessments has not attempted to fully verify the accuracy or completeness of the information supplied.

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Client: SNC-Lavalin Australia Pty Ltd.

Status	Version	Prepared by	Reviewed by	Submitted to Client	
				Copies	Date
Draft	1	Owen Pitts	David Pitt Environmental Alliances	Word	6 June 2011
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Glossary

Term	*Definition*
%	percent
$\mu g/m^3$	micrograms per cubic metre
µm	micro metre
<	less than
>	greater than
^0C	degrees Celsius
BoM	Bureau of Meteorology
CALPUFF	Californian Puff model
CO	Carbon monoxide
CO_2	Carbon dioxide
DEC	Department of Environment and Conservation
DEP	Department of Environmental Protection
e.g.	for example
EPA	Environmental Protection Agency
EPP	Environmental Protection Policy
MW	Megawatt
g/s	grams per second
i.e.	that is
km	kilometre
kW	kilowatt
m	metre
M	million
m/s	metres per second
m^3	cubic metres
m^3/s	cubic metres per second
mg	milligram
Mt	million tonnes
Mtpa	million tonnes per annum
NO_X	Oxides of nitrogen
NO	Nitric oxide
NO_2	Nitrogen dioxide
NEPM	National Environmental Protection Measure
NPI	National Pollution Inventory
NSW	New South Wales
PM	Particulate matter (fine dust)
$PM_{2.5}$ and PM_{10}	Particulate matter less than 2.5 or 10 microns, respectively
SO_2	Sulphur dioxide
TAPM	The Air Pollution Model
TEOM	Tapered Elemental Oscillating Microbalance
tpa	tonnes per annum
tph	tonnes per hour
TSP	Total Suspended Particulate
VKT	Vehicle Kilometres Travelled

1 Introduction

Hinckley Range Pty Ltd (Hinckley Range), a wholly owned subsidiary of Metals X Limited (Metals X), is proposing to develop the Wingellina Nickel Project at a site approximately 1,400 km east-northeast of Perth. The Project will involve open pit mining of nickeliferous limonite ore and on-site processing using a high pressure acid leach (HPAL) process to produce an intermediate mixed nickel-cobalt hydroxide product. The Project will produce approximately 4.3 million tonnes per annum (Mtpa), peaking within four years of operation, with concentrate transported to Adelaide and Darwin for export shipment to worldwide markets.

As part of the Environmental Assessment of the Project, SNC-Lavalin, have engaged Air Assessments to undertake the air quality assessment. The scope of the work includes:

- Analysis of the meteorology and ambient air data for the region;
- Development of a modelling system to predict concentrations and deposition of particulates;
- Prediction of ground level concentrations from the mining and plant operations; and
- Summarise the above in a stand alone report.

Note that this report does not include the estimation of greenhouse emissions which are detailed in Greenbase (2011).

2 Existing Environment

This section provides an overview of the meteorology and key atmospheric pollutants in the region and identifies the data which is suitable for use in the study.

2.1 Meteorology

2.1.1 Measurements Available

Meteorological measurements are available from the Giles weather station 130 km to the NNW of the site and from an air quality grade meteorological station installed at the project site. Details of the measurements undertaken at both sites are summarised in **Table 2-1**.

Table 2-1 Meteorological Monitoring in the Region

Monitoring Site	Easting (1) GDA94 (m)	Northing (1) GDA94 (m)	Comments	Parameters Measured	Period
BoM Giles	~429,600	~7,231,150	130km to the NNW Robust wind sensors but not Air Quality Grade	WS and WD at 10m, AT, RH, BP, SR, Rainfall	Long term
Wingellina	495,890	7,118,250	Air Quality Grade Instrumentation	WS and WD at 10m, AT at 2 and 10m, RH, BP, SR, Rainfall	Sept 2008 to Nov 2011

Notes:

1) Zone 52.
2) WS-wind speed; WD-wind direction; AT-air temperature; RH-relative humidity; BP-barometric pressure; SR-solar radiation.
3) The Wingellina weather station is located on a slight rise and therefore may record slightly higher winds than if on a flat area.

The Giles data is collected by the Bureau of Meteorology (BoM) as part of the national system of upper air recording stations. Of most importance for air quality, the surface (10 m) wind data are collected using a Synchrotac 706 wind sensor, which though appropriate for measuring typical and strong winds has a reasonably high stalling speed of 0.7 to 1.0 m/s. Therefore the sensor overstates the frequency of calm winds. The wind measurements at the site do, however, provide data over a long period which can be used to assess the annual variation of winds.

The Wingellina meteorological station was installed in September 2008, specifically for air quality modelling and includes instrumentation that meets the more rigorous demands for low wind speed measurements. In particular, the wind sensors (Climatronics F460) have very low stalling thresholds of 0.22 m/s. A photograph of the site is presented in **Figure 2-1**.

Figure 2-1 Wingellina meteorological station looking East - (The deposition gauge is located in the foreground)

Therefore for this study, the data collected at Wingellina has been as it used as it is considered to be the most representative of the site and also meets the requirements for air quality modelling.

2.1.2 Description of Meteorology of the Area

The general meteorology of the Wingellina site is similar to that of Giles, 130 km to the NNW. This climate has been described by the BoM (http://www.bom.gov.au/sa/giles/climate.shtml) as:

> *A dry climate, with hot summers and mild winters. Annual average rainfall is very low at 283 mm (Giles) with on average 48 days of rainfall with this falling during the warmer months of the year.*
>
> *The climate of the region is strongly influenced by a band of high pressure known as the sub-tropical ridge. For most of the year this ridge is located to the south allowing east to southeast winds to prevail. Occasionally during the cooler months the ridge moves north, allowing remnants of cold fronts to pass over the region. While most fronts bring little rain to Giles they are sometimes linked to cloud bands to the north-west which can produce significant rainfall. However, the highest rainfall occurs in the warmer months of November to March, when a trough of low pressure extends southwards from the heat low in the tropics, and tropical lows associated with the monsoon trough move southward into the region.*
>
> *January is the hottest month, with an average maximum temperature of 37.2° C.*
> *By contrast winters are mild, with July average maximum and minimum temperatures being 19.9°C and 6.8°C respectively. Cold wet days with maxima below 15.0°C occur about once*

every winter on average. The lowest maximum temperature recorded was 9.0°C on 1 August 1975. Frost days, that is, when overnight temperatures fall below 2.0°C, occur about twice a month in a typical winter. Such nights occur on clear nights following a day of cool southerly winds. While ground temperatures are generally below zero under these conditions, it is rare to see a ground frost, as the air is so dry. The lowest temperature recorded at Giles was –1.6°C and occurred on 23 June 1981.

The wettest months are November to March, with February being the wettest month with an average rainfall of 48.5 mm on five days. The heavier rainfall during these warmer months is caused by the periodic southward movement of the monsoon trough, and on occasion a rain depression from an ex-tropical cyclone. The highest daily rainfall, 271.2 mm, occurred on 22 February 1974, when a slow moving tropical low interacted with an upper level trough. The highest annual total was 843.4 mm in 2001, with 204mm falling in February (a rain bearing tropical depression which was formerly TC Vincent) and 327 mm in December (associated with the monsoon trough).

To underscore the extreme variation of the rainfall in the region, the lowest annual total was a mere 38 mm, and occurred in 1961.

2.1.3 Annual Variation in Winds between Wingellina and Giles

For the air quality modelling, 2009 has been used as a representative year. This is demonstrated in the wind roses from Giles (see **Figure 2-2**) showing the 2009 wind rose being very similar to the long term 2001 to 2010 wind rose.

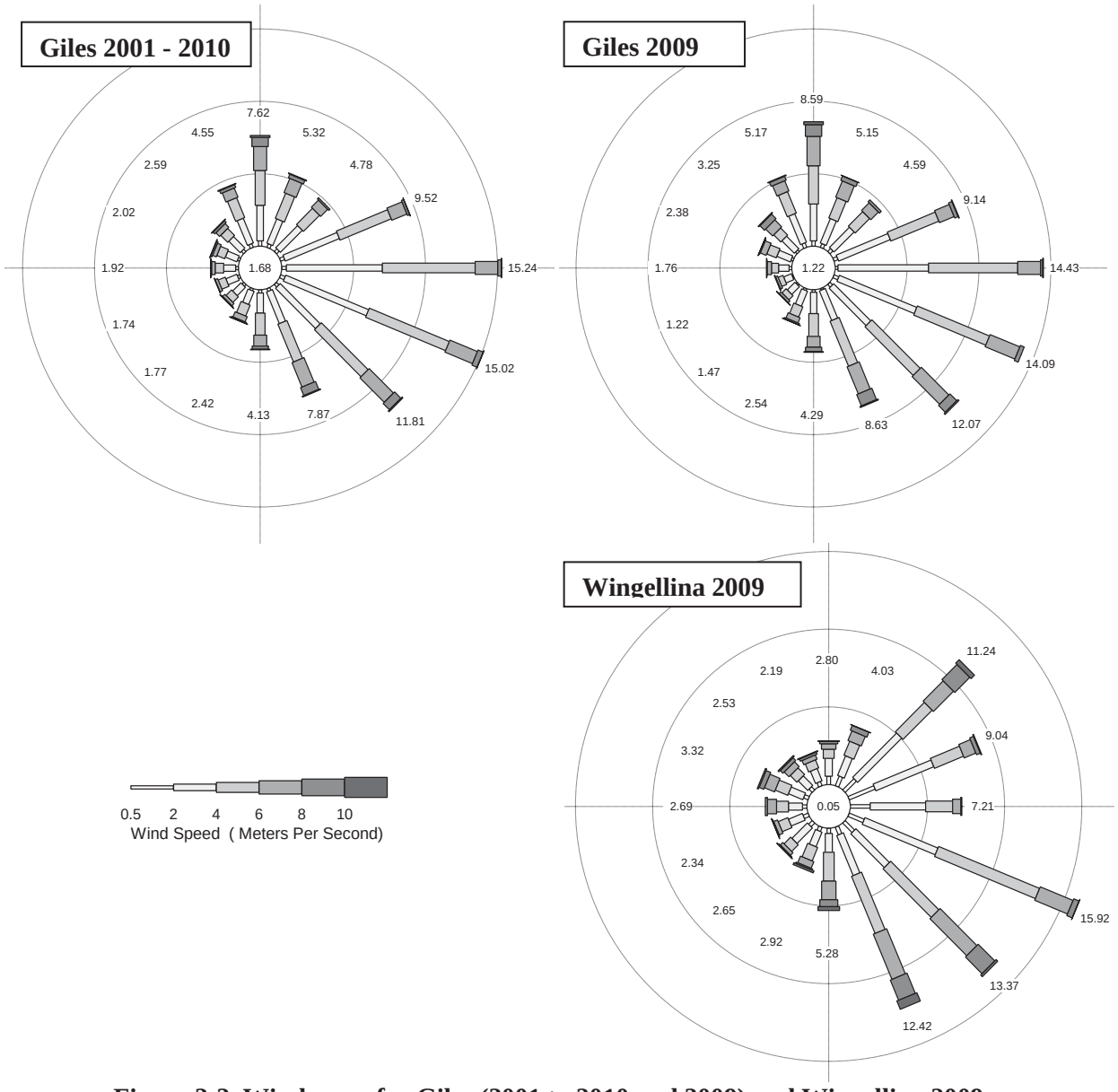

Figure 2-2 Wind roses for Giles (2001 to 2010 and 2009) and Wingellina 2009

Figure 2-2 also presents the 2009 wind rose at Wingellina. This shows similar wind roses, with at both sites, the winds being predominantly from the eastern half, with a low frequency of winds with a westerly component. Differences are however, the much lower frequency of northerly winds at Wingellina than recorded at Giles, with more frequent north easterly winds. Wingellina also has a lower frequency of calm conditions recorded, due to both the lower wind speed threshold of its more sensitive wind speed sensor and also as the Wingellina weather station is on a slight rise. Therefore the winds at this site may be slightly higher than would be recorded on a level area.

2.1.4 Seasonal and Hourly Wind Variation

Seasonal and time of day wind roses for 2009 at Wingellina are presented in **Figure 2-3** and **Figure 2-4**.

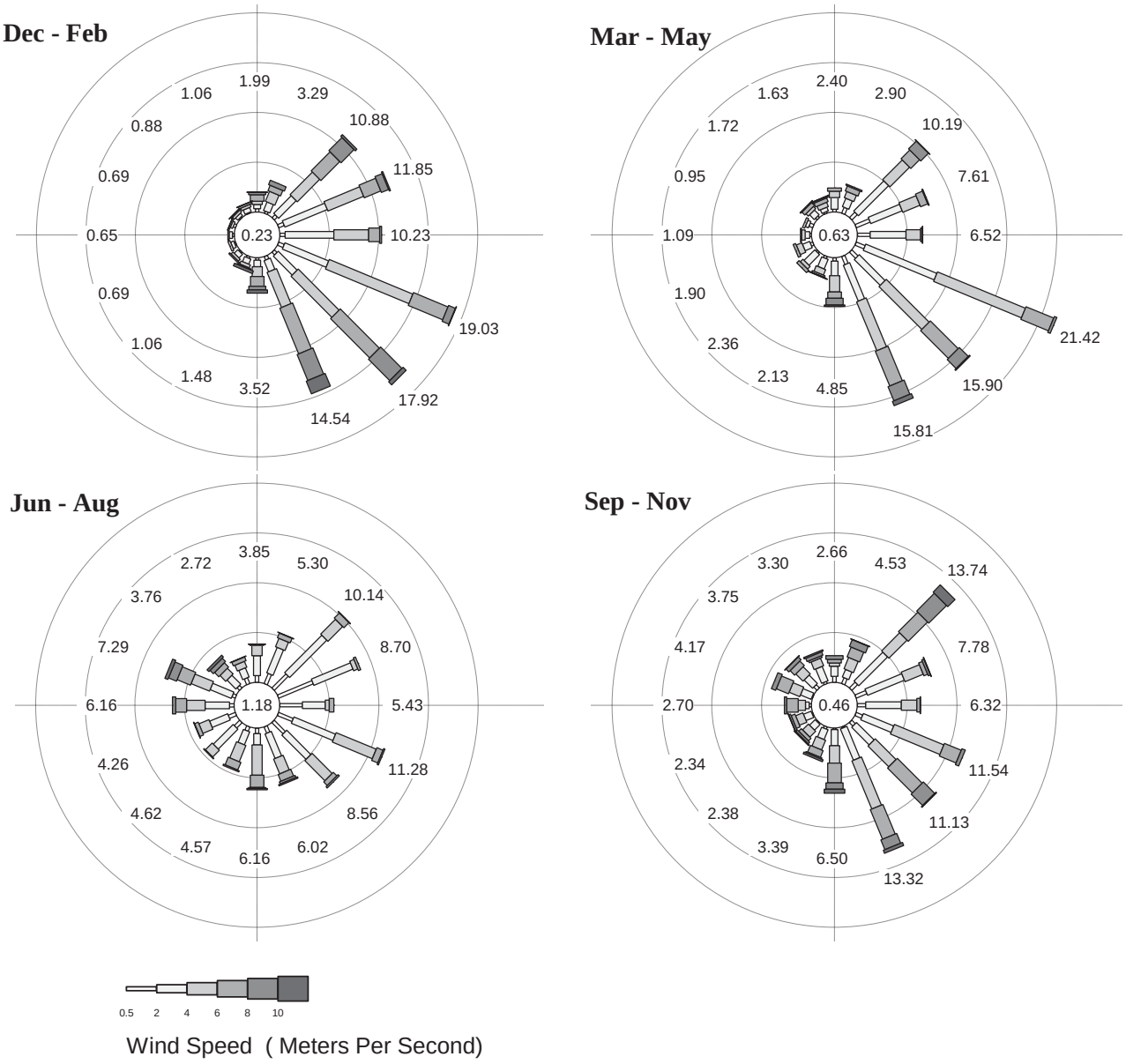

Figure 2-3 Seasonal wind roses for Wingellina for 2009

Figure 2-3 shows the seasonal variation in winds, with predominant easterlies in the summer months and negligible winds from the western half, whilst there is a more even distribution of winds in the winter months (e.g. June to August).

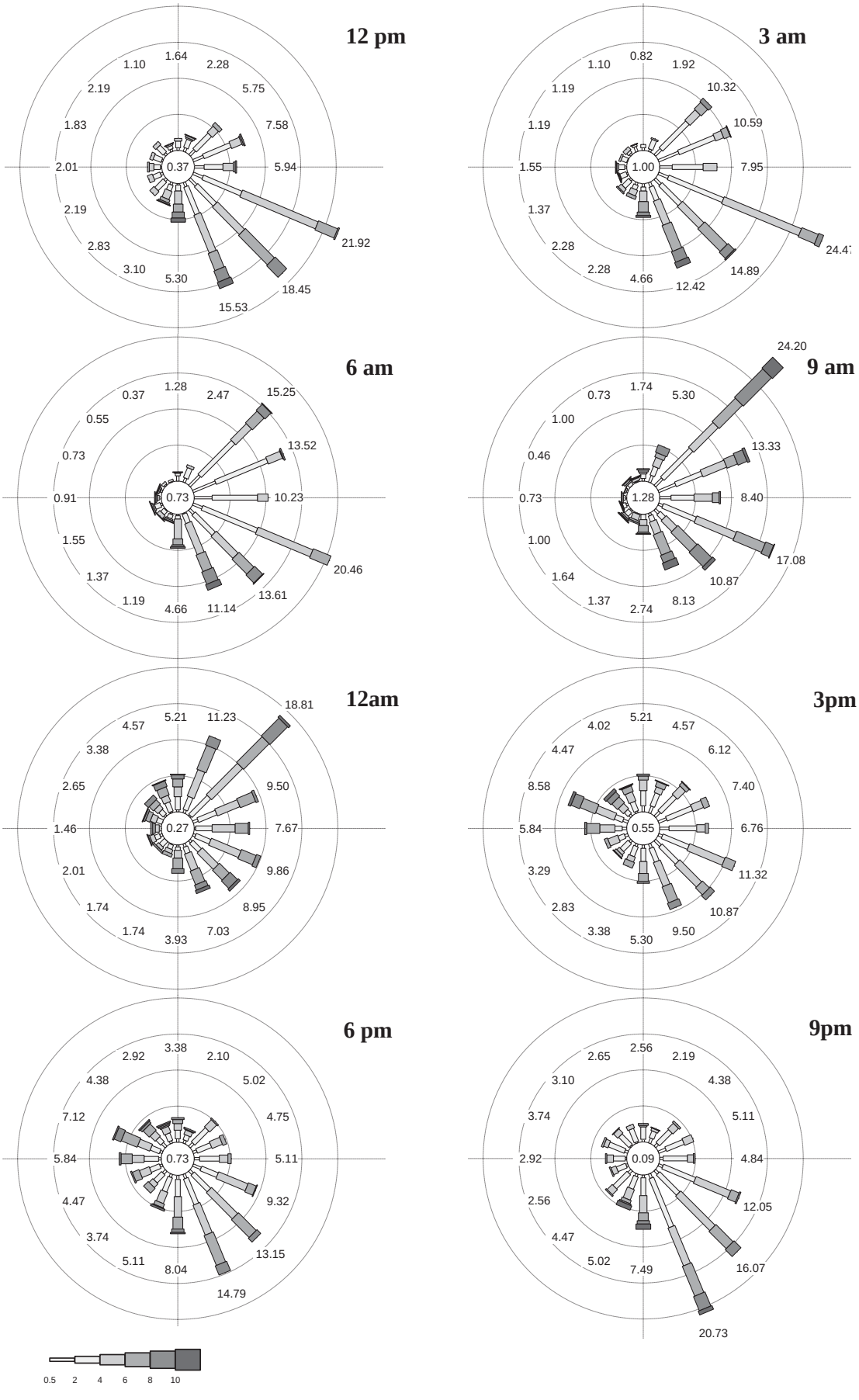

Figure 2-4 Wind roses by time of day for Wingellina for 2009

Figure 2-4 presents the hourly variation in wind speed and directions, and shows significant variation depending on the time of day. From 9 pm to 12 pm, SE winds predominate, whilst by 9 am the winds have shifted to predominant NE winds, whilst by 3 pm to 6 pm the wind direction distribution is more even.

2.2 Ambient Concentrations in the Wingellina Area

2.2.1 Particulate

Particulate concentrations in the area have been collected using:

- Depositional dust gauges from August 2008 to April 2011; and
- A TEOM continuous monitor to measure PM_{10} concentrations from the 20th October 2010 to 14th November 2011.

The dust depositional measurements are collected on a monthly basis with average insoluble, total insoluble and a metals analysis conducted. The locations of the sites and the average and monthly maximum insoluble deposition rates are presented in **Table 2-2**. Insoluble values are presented as these are comparable to the NSW dust depositional guidelines that are generally adopted for assessing depositional impacts (see **Section 3.2**).

Table 2-2 Monthly Insoluble Deposition (g/m^2/mth) at Wingellina

Site	Easting GDA94(m)	Northing GDA94 (m)	Average	Maximum
DMS1	495,885	7,118,252	0.7	3.3
DMS2	495,562	7,117,327	1.2	9.4
DMS4	493,178	7,117,002	0.8	2.9
DMS5	494,610	7,120,039	1.3	5.8
DMS6	494,400	7,114,864	0.7	2.1
DMS7	495,952	7,121,385	0.9	3.8
DMS8	492,130	7,121,690	0.9	4.2
Average All			**0.9**	**4.5**

Note: Period is August 2008 to April 2011.

Table 2-2 indicates that dust deposition levels are, on average, low, and less than the NSW maximum criteria of 4 g/m^2/mth criteria from all sources.

The TEOM data available at Wingellina from 20th October 2010 to 14h October 2011 are presented in **Figure 2-5**.

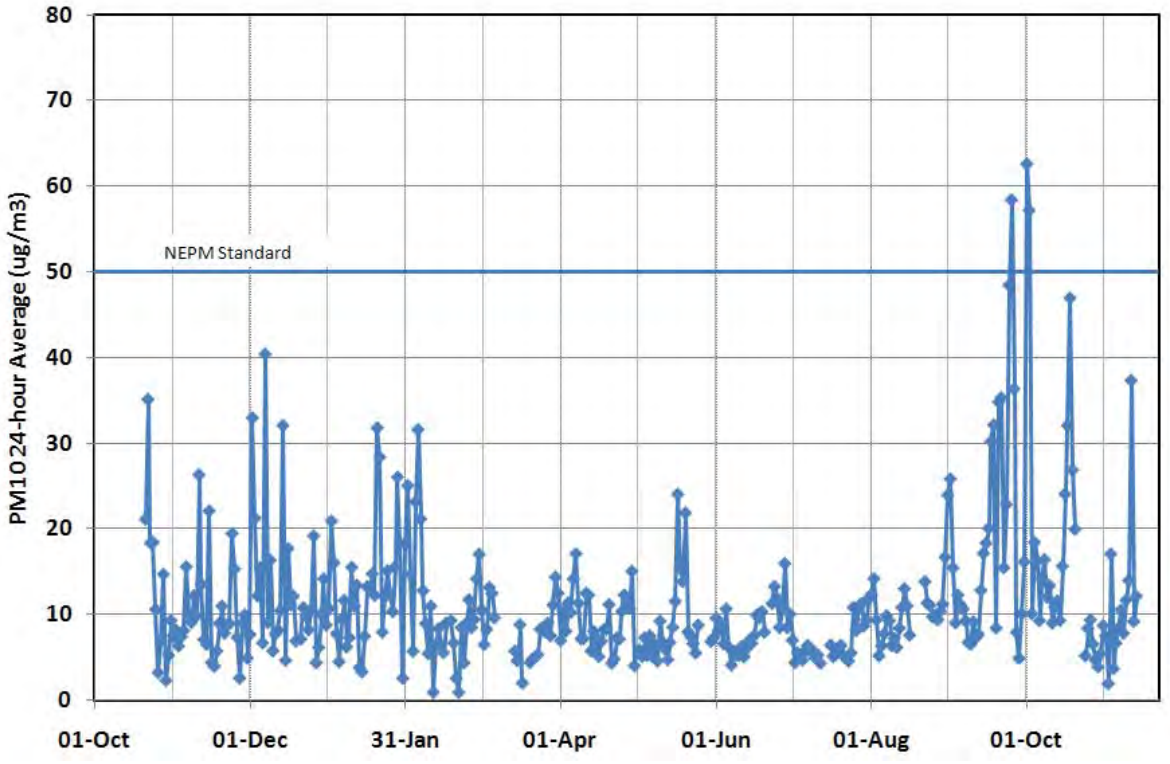

Figure 2-5 Twenty four hour average PM10 Data from Wingellina for October 2010 to November 2011

Figure 2-5 indicates that the PM_{10} levels have been generally low, except for late September and October 2011 due to what is thought to be smoke from large fires within central Australia, as determined by the satellite imagery for that time. The data is also summarised in **Table 2-3** along with results from other WA regional monitoring stations for comparison.

Table 2-3 Twenty Four hour PM_{10} Concentrations at Wingellina and other WA Sites

	Wingellina (Nov 2010 – Oct 2011)	**Duncraig (01 – 09)**	**South Lakes (01-09)**	**Collie (08-09)**	**Geraldton (06-09)**	**Kalgoorlie (06-07) BSY and HGC**	**Karratha (09/10)**
# of Exceedances of 50 µg/m^3	3	0 - 1	0 - 3	3 – 7	4 – 14	4 – 15 , 5 - 7	19
Maximum	63	40 - 67	45 - 99	80 – 86	78 – 151	-	118
99th Percentile	48	31 - 38	36 - 46	47 – 57	49 - 105	-	-
90th Percentile	19.7	22 - 26	25 - 29	31	35 - 40	23 – 37 , 26 - 34	-
75th Percentile	12.5	18.4 [2]	20.6 [2]	24.6 [2]	30.8 [2]	-	23
50th Percentile	9.0	15.0 [2]	16.2 [2]	18.4 [2]	21.0 [2]	16 - 19	-
Average	11.3						

Notes:

1) All data from DEC 2009 Air Quality monitoring report (DEC 2010), excepting Kalgoorlie data from DEC (2009) and Karratha data from RioTinto (2010). BSY is Boulder Shire Yard and HGC is Hannan's Golf Course.

2) 2009 data only.

Table 2-3 indicates that the PM_{10} concentrations at Wingellina are generally low compared to other sites within WA. For example, the average to 90th percentile concentrations are all below any of the

other sites. However, though typically low, there are occasional high particulate concentrations due to smoke and also occasional dust storms as have been recorded at Giles.

2.2.2 Background Particulate Concentrations used in Modelling

For determining cumulative concentrations from proposed sources including existing background concentrations, the Victorian EPA (Victoria Government Gazette, 2001) recommend the use of the 70th percentile measured concentration as the background value. The NSW EPA modelling guidelines (DEC NSW, 2005) have a two tiered approach and recommend the use of the maximum background concentration for level 1 (screening assessments), whilst for level 2 assessments, recommending the addition of hourly observations to hourly predicted concentrations. For this assessment, as there are no useable hourly data for the majority of the modelled period, the 75th percentile concentration has been adopted for short term predictions, whilst the average has been used for the annual average predictions.

Based on **Table 2-3**, a 75th percentile concentration of 13 μg/m^3 has been adopted that is slightly higher than the 75th percentile measured concentration to allow for some year to year variability, with a value of 11.5 μg/m^3 adopted as an annual average.

For TSP and $PM_{2.5}$ there are no data in the region. As such, TSP was conservatively estimated as twice the PM_{10} concentrations, as tends to occur for wind generated dust. This will be an overestimate of the TSP concentrations resulting in 75th percentile and average TSP concentrations of 26 and 23 μg/m^3 respectively. For $PM_{2.5}$, data from a semi-rural site in the southwest, collected using an US EPA approved Low Volume Air Sampler (Partisol) were used. This recorded an annual average of 5.5 μg/m^3 and 75th percentile value of 6.5 μg/m^3. Other data that was available are that from the DEC sampling. These however use TEOM samplers which have an as yet unverified correction factor with an offset of 3 μg/m^3. This offset was developed primarily from studies at urban sites in the US and may introduce a significant bias to sampling at WA sites. Sampling using TEOMs by the DEC have all recorded higher annual average $PM_{2.5}$ levels, with the nearest site Caversham, recording an annual average of 7.7 μg/m^3 (average of last three years) and 75th percentile concentrations of 8.7 μg/m^3 (DEC, 2010).

For other pollutants that may be of concern, background levels will be generally low apart from infrequent higher events from bush fires that may contribute to formation of NO_2, ozone and particulates. For example at Dampier which is impacted to some degree by industrial emissions, the 70th percentile 1-hour and annual average NO_2 concentrations are 4.2μg/m^3 and 2 μg/m^3 respectively. Other pollutants such as SO_2 and CO are expected to have negligible 70th percentile concentrations. Therefore for cumulative assessment of NO_2, CO and SO_2 background levels have been essentially assumed as zero.

2.2.3 Background Concentrations of Gaseous Pollutants

Background concentrations of gaseous pollutants are expected to be negligible or small. For SO_2 and sulphuric acid mist these are both expected to be negligible. For NO_2 low levels will generally occur, with only elevated levels occurring due to bushfires. As an estimate of the background levels, values from monitoring at Dampier (DoE, 2005) were used indicating background average and 75th percentile 1-hour levels of 2 μg/m^3 respectively.

3 Ambient Air Quality Criteria

3.1 Ambient Concentrations

For assessing ambient ground level concentrations, the WA EPA does not have state-wide standards, but are in the process of implementing a Statewide Environmental Policy (SEP) with a draft policy released for public comment in June 2009 (EPA, 2009). The policy objective is to meet environmental quality criteria with these being the:

- Approved National Environmental Protection Measure (NEPM) standards; and
- Standards or guidelines for Local Pollutants that are not part of an approved air related NEPM and are published as guidelines by the Chief Executive Officer of the Department. At present there are no Local Pollutants defined.

These criteria are to apply to the whole of Western Australia, excepting for the following:

- Where an Ambient Air SEP pollutant is covered by an Environmental Protection Policy (EPP). There are currently two existing EPPs; the Kwinana EPP which cover SO_2 and total suspended particulate and the Goldfields Residential Areas EPP which covers SO_2;
- Within the boundary of industrial premises;
- Within defined industrial buffer areas. These are to be recognised resident-free buffer areas which are secured by the planning system. Examples of residence free buffers are the Kemerton, Oakajee and Boodarie Resource Processing estates;
- Within the boundary of a road; and
- In an area where there are no sensitive receptors as determined by the Chief Executive Officer of the Department.

"If an industrial premises exists in a remote area where there is a reasonable likelihood that no sensitive receptors will be present, other than on a temporary basis, it may be determined that there is no need for the environmental quality criteria to be achieved at the premises boundary. There is an expectation however, that the environmental quality criteria will be achieved at the nearest sensitive receptor.

It is important to remember the term 'sensitive receptor' extends beyond a location where humans are likely to reside and includes areas of cultural or environmental significance, including environmentally sensitive areas declared under the act.

It is also expected that industry adopt and achieve best practice management of its operation and emissions control, which may require emission limits to be set and monitoring at the source." (EPA, 2009),

The NEPM standards applicable to this project are listed in **Table 3.1** , being for:

- Ambient Air Quality NEPM Standards (1998) covering six criteria pollutants;
- Ambient Air Quality NEPM Advisory Reporting standard (2005) for $PM_{2.5}$ with goal to gather sufficient data nationally to facilitate a review; and

There is also an Air Toxics NEPM (2004) with goal to gather sufficient data nationally to facilitate development of standards for air toxics which covers such species as benzene and formaldehyde.

Table 3.1 National Environmental Protection Measure - Air Quality Standards and Goals

Pollutant	Averaging Period	Maximum Concentration		Goal
		(ppm)	($\mu g/m^3$)	
				Maximum allowable exceedances
Carbon Monoxide	8-hour	9.0	*11,240*	1 day a year
Nitrogen Dioxide	1-hour	0.12	*246*	1 day a year
	1-year	0.03	*62*	None
Photochemical Oxidants (as ozone)	1-hour	0.10	*214*	1 day a year
	4-hours	0.08	*171*	1 day a year
Sulphur Dioxide	1-hour	0.20	*570*	1 day a year
	1-day	0.08	*228*	1 day a year
	1-year	0.02	*60*	None
Lead	1-year	-	0.5	None
Particles as PM_{10}	1-day	-	50	5 days a year
Advisory Reporting Standards and Goal				
Particles as $PM_{2.5}$	1-day	-	25 $\mu g/m^3$	Goal is to gather sufficient data nationally to facilitate a review of the advisory Reporting standard as part of the review of this Measure scheduled to commence in 2005
	1-year	-	8 $\mu g/m^3$	

Notes:

1) Concentrations of gaseous pollutants in italics have been converted from the NEPM standard quoted at 0 deg C and 101.3 kPa as per the NSW Guidelines (DEC NSW, 2005)

The NEPM standards for gaseous pollutants are given in parts per million (ppm) or parts per billion (ppb) as in this form, the concentrations are invariant with temperature and pressure. For ease of comparison with the results from this study, **Table 3.1** also provides these in terms of mass per volume of air. These have been converted as per the NSW guidelines for the NEPM criteria pollutants at standard conditions of 0 deg C and 101.3 kPa and for the air toxics at 25 deg C and 101.3 kPa.

The DEC requires that for modelling assessments, the predicted concentrations:

> *should be presented for both maximum concentrations and concentrations at the allowed exceedance level (e.g. for SO_2, 2nd highest 1-hour average on a day different to that on which the highest occurred)* (DoE, 2006).

Therefore in this assessment for SO_2 and NO_2, both the maximum and second highest 1-hour concentrations are presented, but only the second highest value compared to the NEPM 1-hour standards. The DEC modelling guidance (DoE, 2006) also requires that modelling be presented for existing concentrations, the proposed facility alone and cumulative (existing and proposed facility) to take into account existing background levels.

Apart from the NEPM pollutants, the WA DEC tend to adopt the Kwinana EPP standards for the assessment of the suitability of total suspended particulate (TSP) concentrations. For residential areas this is a 24-hour standard of 90 $\mu g/m^3$ (desirable not to be exceeded) and a limit (never to be exceeded) of 150 $\mu g/m^3$.

For assessing pollutants not covered (Local Pollutants under the draft SEP) the DEC look at applying other Australian guidelines and where these do not exist, World Health Organisation (WHO) guidelines. Besides the pollutants covered by the NEPM and Kwinana EPP, sulfuric acid mist is the other pollutant of concern from acid plants. Recognised guidelines for this are presented in **Table 3-2**.

Table 3-2 Sulphuric Acid Criteria

Regulator	Averaging Period	Statistic	Guideline ($\mu g/m^3$)
NSW Design Ground Level Concentration	1-hour	9th highest	18
Californian OEHHA (2006)	1-hour	Maximum	120
WA Department of Health (2007)	1-hour 24-hour	Maximum Maximum	500 100

Notes:

1) OEHHA Reference Exposure levels (RELs) are to be compared against the maximum predicted concentration, with preferably 5 years of meteorological data used (page 4-21 and page I-4, OEHHA, 2006); and
2) NSW to be applied outside lease boundary. I.e. irrespective of whether residences are there.

Of these:

- The NSW DGLCs (and also Victorian guidelines on which they are based) are considered to be overly conservative, as they were developed by applying large uncertainty factors to occupational health criteria;
- The WA Department of Health guideline for acid gases (the sum of hydrogen chloride, hydrogen fluoride and sulfuric acid mist) is considered to be perhaps not conservative enough. The derivation of this value is not clear; and
- The Californian Office of Environmental Health and Hazard Assessment (OEHHA) is considered to be the most rigorously derived criteria. This criteria has been used in most health risk assessments in Australia (see Toxikos, 2005 and 2008 for example) and is considered the most appropriate criteria for this study. These guidelines are primarily to protect against irritation of the eyes and airways, and to minimise changes to respiratory function.

3.2 Dust Deposition

No formal criterion for dust deposition exists within WA. As such, the New South Wales (NSW) criteria for the assessment of dust impacts is proposed, as this tends to be used in other deposition assessments in this State. The current NSW assessment criteria (DEC NSW, 2005) set a maximum annual dust deposition rate of 4 g/m^2/month and a maximum allowable increase in the deposition rate of 2 g/m^2/mth, whilst still remaining below the 4 g/m^2/month limit. Here deposited dust is determined as the insoluble solids as defined by AS 3580.10.1-1991.

4 Atmospheric Dispersion Modelling

4.1 Introduction

For the site, the pollutants of most concern are considered to be emissions from the acid plant stack (SO_2 and to a lesser extent sulphuric acid mist) and fugitive dust from the mining operations. For modelling, the following conditions are considered important:

- Acid Plant Emissions: Convective conditions that can lead to plume grounding within several hundred metres of the stack and possibly impacts on the Wingellina range approximately 5km to the south with peaks rising to nearly 300 m above the plant area; and
- Fugitive dust: Modelling the dispersion under light winds and also for wind erosion during strong winds.

4.1.1 Modelling Fugitive Particulate

To provide predictions from fugitive (uncontrolled) sources from the mine and plant area, the dispersion modelling system CALMET/CALPUFF was used. CALPUFF (the Californian Puff model) is the US regulatory model for assessing long range transport of pollutants and their impacts and on a case-by-case basis for certain near-field applications involving complex meteorological conditions. CALMET is the meteorological pre-processor to CALPUFF for generating the wind and turbulence fields.

CALPUFF is considered preferable to other models such as AUSPLUME in that it can:

1) Better model dispersion under light wind conditions where the winds may stagnate and meander. Under these conditions Gaussian puff models can better represent the dispersion of the plumes than Gaussian plume models such as AUSPLUME and AERMOD, which assume that the plume extends in a straight line to the end of the model domain for each hour;
2) Incorporate variable winds and land uses across the region. Variable land uses will result in different dispersion rates of the plumes as the plumes are blown across them. For example there can be large differences between the dispersion over a scrub land compared to a grassland or salt lake; and
3) Incorporates the effects of terrain more realistically.

4.1.2 Modelling Stack Emissions

To provide for model predictions from the point sources at the plant, importantly the taller acid plant stack at 60 m above ground level, the dispersion model TAPM was used. This was used as CALPUFF is not as recognised for these taller sources for modelling sources within 10 km of the stacks, whilst TAPM see Hurley has been validated for a range of tall sources and is generally used within Australia. TAPM though not always predicting well the winds near the surface has been shown to predict the winds well at higher elevation (see Hurley, 2008).

4.2 Development of Meteorological Files for CALMET and CALPUFF

The meteorological fields for the CALPUFF modelling were produced using the following:

- CALMET version 6.326 for the prediction of the meteorology,

- Data from January to December 2009;
- Surface parameters for the area were defined as per **Table 4-1** based on typical values in the scientific literature with the Bowen ratio taken typical of moderately dry conditions;

Table 4-1 Input Parameters for Land Use

Parameter	Comment and Units	Value
Bowen Ratio	Ratio of the Sensible to Latent Heat Flux (Dimensionless)	4.0
Albedo	Ratio of reflected to Incoming Short Wave Radiation (Dimensionless)	0..25
Roughness Length	The height at which the wind speed profile becomes zero (m)	0.10
Leaf Area Index	Ratio of the leaf area per unit area of land (Dimensionless)	0.4

- A 33 by 33 grid of 1 km grid spacing;
- Six vertical levels with upper heights at 20, 50, 100, 200, 500, 1500 m;
- Biases of -1 to determine the weighting of the wind profiles to use the surface winds only instead of winds generated from TAPM. This is relatively unimportant for modelling surface sources;
- Vertical extrapolation of winds using similarity theory;
- Use of diagnostic slope flow winds with a radius of influence of terrain features of 5 km;
- Temperature profiles predicted by TAPM at the Wingellina meteorological station site. This was required as the nearest observational data is Giles, 130 km to the NNW which is likely to be unrepresentative of the project area at times. Additionally, at Giles often only morning soundings are undertaken, with CALMET requiring two soundings per day.
- Hourly cloud observations from TAPM;
- Terrain was obtained from TAPM 9 second data bases. A map of the land use categories with a wind field developed using the single wind station run is shown in **Figure 4-1**; and

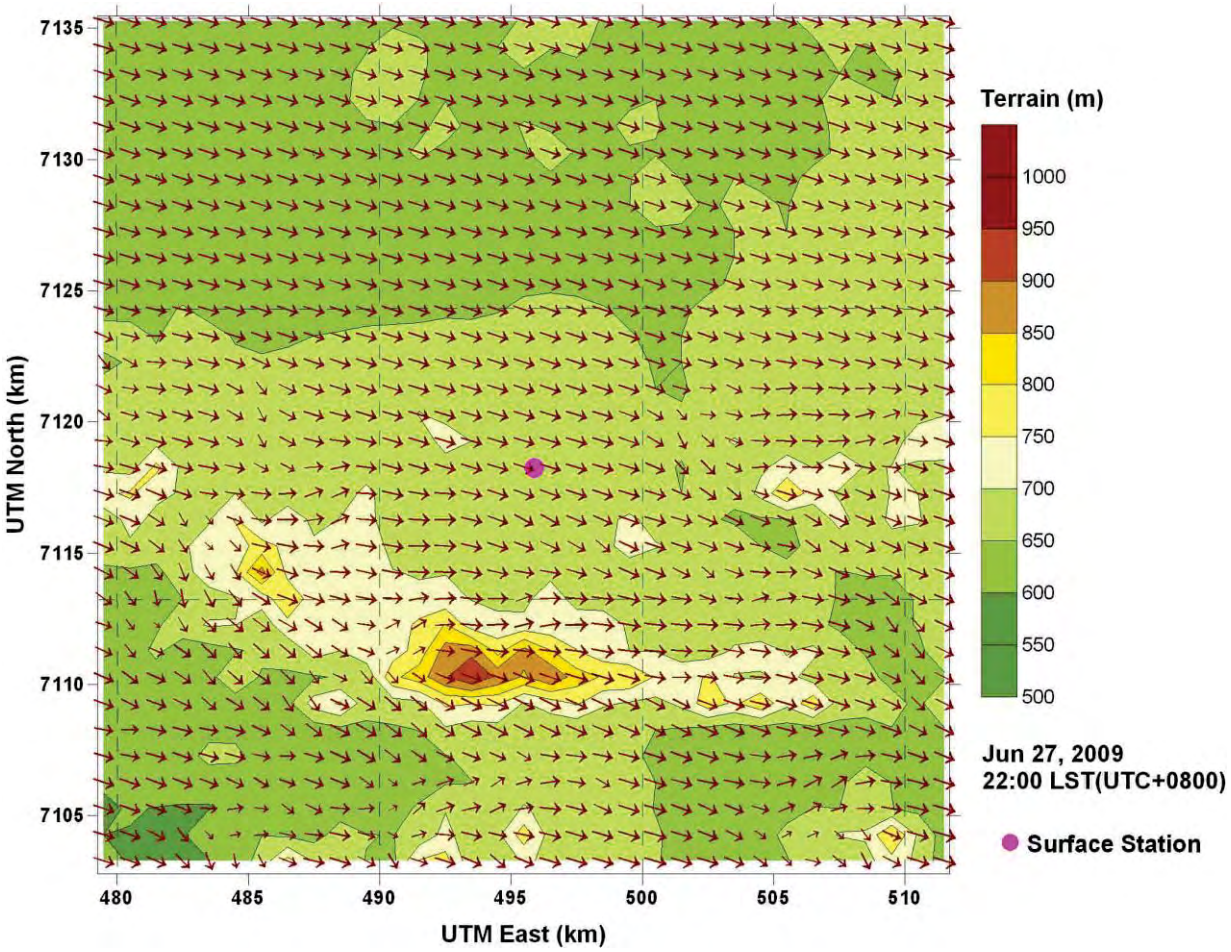

Figure 4-1 Meteorological grid showing, terrain contour, weather station and wind vectors for the 2200 WST 27th June 2009

- Step 1 wind fields from the diagnostic module were preserved by setting, Rmax1 and Rmax2 to very small values such that the observations were not re-entered. That is the adjusted wind fields were considered to be appropriate.

4.3 Stability Categories and Stability Wind Roses

The distribution of Pasquill Gifford stability classes as predicted by CALMET is presented in **Table 4-2** with stability wind roses for 2009 presented in **Figure 4-2**

Table 4-2 Distribution of Stability Classes for the Wingellina Weather Station Site

Stability Class	A	B	C	D	E	F
Percentage (%)	0.9	8.2	19.7	35.2	19.1	16.9

Note: Stability classes range from A, highly dispersive conditions that occur for low wind speeds with strong solar insolation, to neutral conditions (D class) which occur for overcast and/or cloudy conditions to F class which corresponds to very low dispersion rates (stable atmosphere). These conditions occur for nights with clear skies and low wind speeds.

The wind roses presented in **Figure 2-3** indicate that the stable conditions tend to occur for SE winds as SE winds occur predominantly at night. Therefore it would be expected that higher annual average concentrations from surface sources would occur to the W to NW.

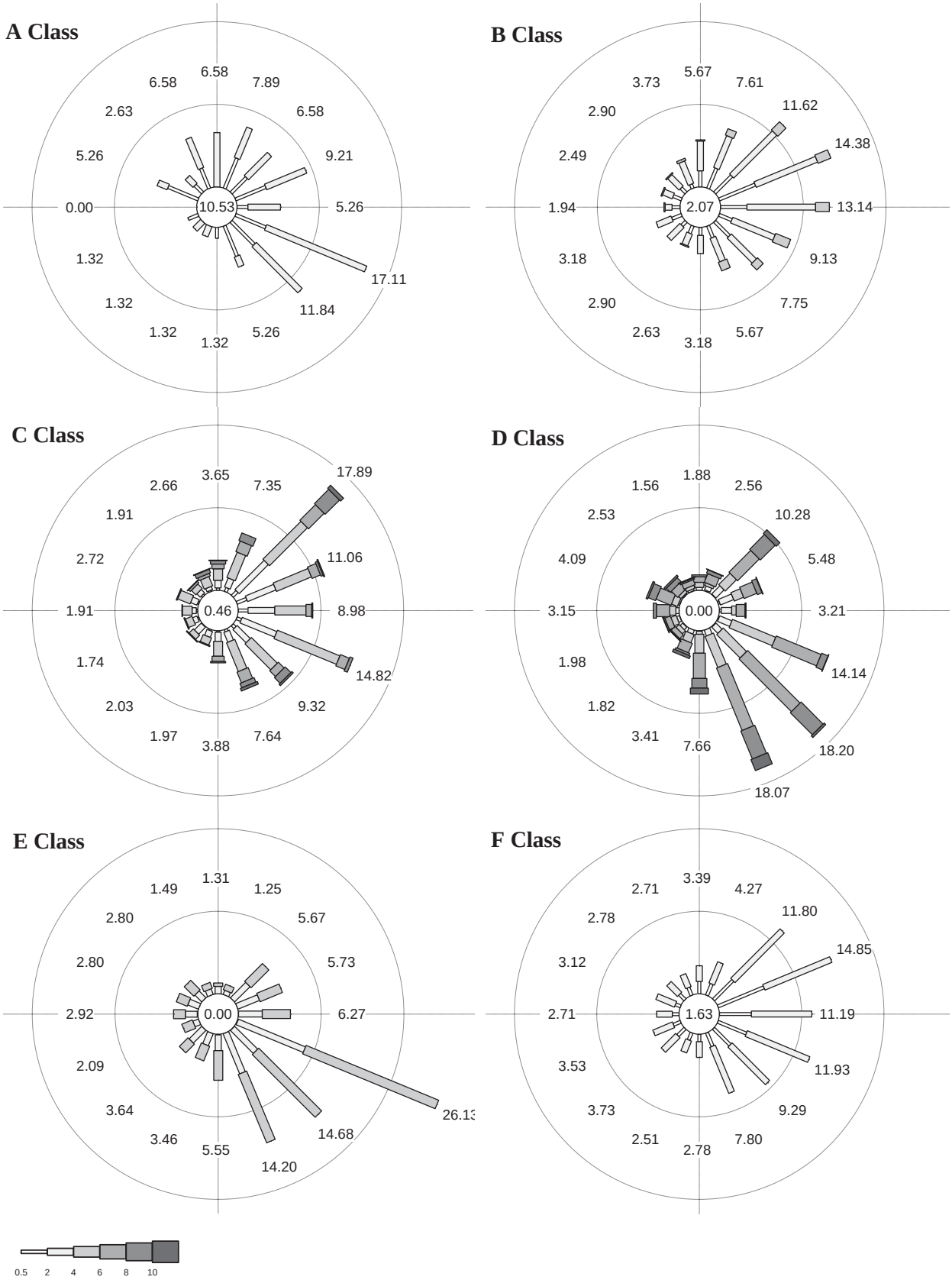

Figure 4-2 Stability Wind Roses for Wingellina 2009

4.4 CALPUFF Model Set Up

For dispersion modelling CALPUFF version 6.262 was used with the following model options:

- Meteorological file using the 3 dimensional wind and turbulence fields generated by CALMET;
- Pollution predicted over a 0.5 km grid which is a subset of the 33 by 33km meteorological grid;
- Dispersion estimates using the Pasquill Gifford dispersion curves with roughness length adjustment;
- Parameter tpg set to 10 minutes to account for the averaging time for the horizontal plume spread is about 10 minutes. This is roughly in line with standard practise in Australia where the Pasquill Gifford horizontal dispersion curves are considered to relate to 3 to 10 minute averages and therefore the horizontal dispersion should be increased when predicting 1-hour averages;
- Threshold for calms of 0.5 m/s;
- Minimum horizontal standard deviation of 0.5 m/s as per the CALPUFF defaults;
- Modelling of fugitive sources using the variable area source option within CALMET. This requires coordinates of the vertices of the area, an initial vertical dispersion, source height and allows for plume rise from a source of finite diameter and initial temperature and exit velocity. To ensure that the plume rise would be negligible and not influence dispersion, the temperature was set to the ambient temperature, with exit velocity and diameter set to 0.000001 m/s and 0.000001 m respectively;
- The initial vertical standard deviation of the plume from an area source was set to equal the dispersion that would occur for the plume travelling half the distance across the area using the Pasquill Gifford dispersion curves and the stability at the time; and
- CALPUFF terrain adjustment scheme. For surface releases it will have negligible effect on the predicted concentrations.

4.5 TAPM Modelling

TAPM results were generated using the following settings:

- TAPM v4.04;
- Land use defined from aerial photography to better reflect the area than the default TAPM land use data bases;
- Soil moisture of 0.08 kg/kg to minimise the latent heat flux;
- Modelling on a 33 by 33 meteorological grid with 30, 10, 3 and 1 km grid spacing;
- No incorporation of surface wind observations; and
- Exclusion of building wakes as detailed plans of buildings were not available. For the acid plant stack, it is anticipated that building wakes will not be an issue, with building wakes affects only potentially influencing the low level combustion sources.

4.6 Particulate Size Distributions

Particle size distributions used in PM_{10} and TSP modelling are generally derived from the USEPA emission factor work. These emission factors however, generally only provide the distribution below an aerodynamic diameter of 30 µm which is referred to as suspended particulate (SP). SP *"is often*

used as a surrogate for TSP, and is defined as particulate matter with an aerodynamic diameter no greater than 30 μm. SP may also be denoted as PM_{30}" (MRI, 1998). Total suspended particulate (TSP) on the other hand is the actual particulate that is measured by a TSP sampler and does not have a fixed upper particle size limit, as the upper cut "point" varies with the wind speed and the orientation of the sampler to the wind. Under strong winds and over rough surfaces, particles with aerodynamic diameters up to 100 μm can remain suspended, whilst under lighter wind conditions these particles will typically fall out within several minutes. Therefore, dependent on the wind speed and orientation, the 50% cut off of the sampler can vary between 30 and 80 μm. PM_{30} is used in the US emission factor work as it removes this problem.

For modelling TSP and deposition close to sources, the full particle size distribution is required other wise the modelled TSP and deposition will be less than actual as it neglects the greater than 30 μm fraction. In this study, the TSP size distribution has been determined from the USEPA 2006 size distribution and the NSW SPCC study (1988) as summarised in **Table 4.3**. In practice as the emission factors used were PM_{10} emission factors, the emissions in the various size categories have been multiplied by the PM_{10} emission factor by the multipliers (in percent) given in the last row of **Table 4.3**.

Table 4.3 Particle Size Distributions of Fugitive Dust

Source	<2.5 μm	2.5-5.0 μm	5.0-10.0 μm	10-15 μm	15-30 μm	30-50 μm	50-90 μm	90-150 μm
Percentage of PM30								
USEPA Wind erosion	7.5	42.5		10	40	NA	NA	NA
USEPA Unpaved Road	3.1	27.6		69.4		NA	NA	NA
Percentage of TSP								
USEPA Aggregate handling (Nov 2006)	5.3	14.7	15	13	26	26		
SPCC Operations Iso-kinetic Sampler	4	9	17	11	22	17	13	7
Adopted This Assessment	5	12	16	12	25	15	10	5

Notes

1) USEPA TSP percentages were estimated from the PM_{30} based on 74% of wind erosion material and 76% of batch drop dust is below PM_{30}.
2) Percentage may not tally to 100% due to rounding.

4.7 Conversion of NO to NO_2

At release from combustion sources, NO_X is predominantly in the form of NO with between 5 to 30% as NO_2 dependent on the combustion source. After release, the NO is converted to NO_2 by chemical reactions, primarily involving ozone in the presence of sunlight and to a lesser extent due to other reactive gases.

In the literature, there are a number of models and empirical relationships for estimating the conversion of NO to NO_2 for plumes from stacks. For example, the ozone limiting method (OLM) as developed by Cole and Summerhays (1979) and as specified by the USEPA and the NSW modelling regulations (DEC NSW, 2005) was used. This method requires an estimate of the NO_2/NO_X and background NO_2 and ozone concentrations. In this study however, as the NO_X emissions are low, to provide a conservative, but simple method for estimating the NO_2 a conversion of 30% was assumed as was used as per Katestone for the Newgen power station Perth (Katestone, 2007).

5 Atmospheric Emissions from the Project

5.1 Project Description and Sources of Atmospheric Emissions

The Project will involve open pit mining of nickeliferous limonite ore and on-site processing using a high pressure acid leach (HPAL) process to produce an intermediate mixed nickel-cobalt hydroxide product. The Project will produce approximately 4.3 million tonnes per annum (Mtpa), peaking within four years of operation. In terms of air quality, the main considerations of the project once in operation are the following:

Mining

- Mining of ore in up to 20 individual open pits, over a 10 km strike length. These pits are broadly grouped into three zones – North, Central, and South.
- Mining is to be by conventional drill and blast;
- As the bulk of the material to be mined is highly weathered lateritic rock, the mine planning assumption is that blasting will be required for only 10% of the material;
- Ore and waste ore will be loaded by excavator to haul trucks for haulage to the waste stockpile or to the Run of Mine (ROM) pad at the plant. Waste rock from the mine pits are to be located adjacent to the open pits and to hold up to 126 million m^3 of waste and cover up to 255 hectares (ha);
- Calcrete for the process will be sourced from a calcrete deposit in South Australia via a 22 km road using triple road trains and loaded into a calcrete stockpile at the plant;
- Soil stockpiles that are produced primarily from soil from the Tailings Storage Facility (TSF) and to a lesser degree the mine pits during the first 2 years will be reseeded as soon as practicable to minimise dust. The waste rock stockpiles will be progressively rehabilitated over the period of the mine. Prior to rehabilitation, dust will be managed by water spraying or potentially by application of chemical dust suppression; and
- Tailings from the process plant will be stored in a large Tailings Storage Facility (TSF). The land area to be cleared for this will be 1185 ha.

Processing Plant

- Processing of the ore will be via a High Pressure Acid Leach Process (HPAL);
- At the plant, the ore from ROM will be loaded by front end loader (FEL) to a hopper for crushing and grinding. Calcrete will likewise be loaded into the process using a FEL;
- Sulphuric acid required for the process will be generated using an acid plant producing up to 4,400 tpd of sulphuric acid;
- Electrical power for the operation will be generated in a cogeneration plant using steam produced from the sulphur burning acid plant, and from natural gas fired boilers from a natural gas pipeline from South Australia. The gas consumption rate will be 5.7 TJ/day under normal operation, and approximately 13TJ/day during acid plant outages when the HPAL processing

plant will operate at 50% capacity during acid plant outages. The average power consumption will be 38 MW with 64 MW at design capacity; and

- Raw material to the plant and the export of product will be via road trains via access roads through South Australia.

The major emissions to atmosphere of potential concern will therefore be:

- Fugitive particulates from mining, blasting, haulage operations and from wind erosion from the large open areas;
- Sulphur dioxide and sulphuric acid mist from the acid plant; and
- Oxides of nitrogen from burning of fossil fuels.

5.2 Plant Emissions

Emissions from the process plant are summarised in **Table 5-1**. These are given for three modes of operation:

- Normal operation with the acid plant in operation which is anticipated to occur for about 74% of the time;
- Normal operation with the acid plant offline which is expected to occur for 26% of the time. Under this mode, the boilers are operated at a higher capacity to generate the steam required which would have otherwise come from the acid plant; and
- Acid plant start up, which will occur for only 2 to 3 hours duration for about 5 times per year. In this mode, slightly higher SO_2 mass emissions will occur, but for a lower exit volume, higher concentration plume.

Table 5-1 Emission Parameters from Stacks and Vents at the Processing Plant

Source	Units	Gas Turbine	Boilers	Emergency Generators	Acid Plant Stack	Total
Number		1	2	2	1	-
Size (each)		25 MW	60 tph (steam)	2.5 MW	4400 tone acid/day	-
Stack Height	(m)	30	20	7	60	-
Stack Tip Diameter	(m)	2.4	0.9	0.8	2.2	-
Exit Temperature	(deg C)	150	200	500	79	-
Normal Operation with Acid Plant Operating (74% of operating time)						
Exit Velocity (m/s)	(m/s)	15.3	4.6	NA	27.2	-
Emissions NOx	(g/s)	2.27	0.07	0.0	Negl	2.4
Emissions SO_2	(g/s)	Negl	Negl	0.0	102	Negl
Emissions PM	(g/s)	Negl	0.01	0.0	Negl	0.02
Emissions H_2SO_4	(g/s)	0.0	0.0	0.0	3.8	
Normal Operation with Acid Plant Offline (26% of operating time)						
Exit Velocity (m/s)	(m/s)	20.6	36.9	NA	NA	-
Emissions NOx	(g/s)	3.06	0.56	0.0	0.0	4.2
Emissions SO_2	(g/s)	Negl	Negl	0.0	0.0	Negl
Emissions PM	(g/s)	Negl	0.08	0.0	0.0	0.17
Emissions H_2SO_4	(g/s)	0.0	0.0	0.0	0.0	0.0
Start Up of Acid Plant (2 to 3 hours duration)						
Exit Velocity (m/s)	(m/s)	15.3	4.6	20.1	10.9	-
Emissions NOx	(g/s)	2.27	0.07	2.7	0.0	7.83
Emissions SO_2	(g/s)	Negl	Negl	Negl	110	110
Emissions PM	(g/s)	Negl	0.01	0.03	0.0	0.086
Emissions H_2SO_4	(g/s)	0.0	0.0	0.0	0.0	0.0

The data in **Table 5-1** were sourced from:

- Acid plant emissions from the project engineers (via Outback Ecology, 2011);
- Boilers and gas turbines based on use of dry low NO_X burners as advised by the project engineers with emission factors sourced from the National Pollutant Inventory (NPI) manual for boilers with gas turbine NO_X emissions of 25 ppmvd;
- Exit volumes of exhaust air for boilers, generators and gas turbines scaled from similar projects;
- Stack temperatures for boilers, generators obtained from similar projects; and
- Stack exit diameters generally scaled to provide an exit velocity of about 20 m/s.

5.3 Fugitive Particulate Emissions

5.3.1 Overview

Particulate emissions for the above sources were based on the standard methodology in the NPI work books as detailed in **Table 5-3** with some revision for the wind speed dependency of wind erosion and some material handling operations. The NPI workbooks provide emission factors for the majority of activities that occur on mine sites on a per tonne of material handled basis for uncontrolled sources and also provide typical control efficiencies for pollution control equipment and management practices that

may be used to control such sources. Emissions were estimated for year 14, the year with the greatest haulage of ore and waste and assuming that mining occurred solely at the northern pit area resulting in the largest haulage distances.

5.3.2 Particulate from Wind Erosion

Annual wind erosion estimates were derived for the exposed areas, estimates of the unit erodibility per unit area and dust control factors.

The estimated bare areas and the degree of control on the areas and therefore total erodible areas are provided in **Table 5-2**.

Table 5-2 Factors Adopted for Wingellina Nickel Project Wind Erosion Estimates

Source	Bare Area (ha)	Control (%)	Uncontrolled Area (ha)	Comments
Mine Area	88.5	85	13.3	80% factor considered for generally rocky material. With water carts on roads and open areas in pits and also as pits will protect from wind erosion and dust release a higher factor is considered.
Soil Stockpiles	134	95	6.7	Soil stockpiles, covered by dust control material. Will be dusty if not controlled
Waste Stockpile	204	95	10.2	No control, though rocky material
ROM Pad areas Ore and Calcrete	25	50	12.5	Controlled by water sprays when required
TSF	1185	85	178	15% assumed beach areas and not under water, or damp and therefore uncontrolled.
Total	**1636.5**	-	**233**	

Note: The mine area is less than total cleared mine area as it is the representative area exposed for that year.

Table 5-2 indicates that the erodible areas are significant with the largest area being the TSF. This estimate is indicative only and may be much lower dependent on the area that dries and is erodible. For example with saline water the surface may tend to crust which will greatly reduce the emissions.

PM_{10} emissions on an annual basis for the above areas were estimated using the NPI equation where:

$$E_{PM10} = 0.5 \times 1.9 (S/1.5) (365-p)/235 (f/15) \text{ (kg/ha/day)} \qquad \textbf{Equation 5.1}$$

Where:

S = the silt content in percent.
p = the number of days with greater than or equal to 0.25mm precipitation.
f = the percentage of time the unobstructed wind at the mean pile height exceeds 5.4 m/s.

The NPI default of 0.2 kg/ha/hr that is often used in Australia is based on the above equation and Hunter Valley conditions with a silt content (s) taken equal to 7%, the value of f taken as 13.4% and the number of days of precipitation (p) as 80 days/year. For the Wingellina project as the default does not take into account the dryer climate, the equation was used with the local values of rainfall and wind to estimate a more appropriate climatic factor. Estimates were obtained from:

- A frequency of hourly wind speeds above 5.4 m/s of 33.6% as recorded from the Wingellina weather station; and

- The number of rain days per year (> 0.25mm) of 38 as obtained from the Wingellina weather station for 2009 and 2010.

For the silt content, no correction was applied as it is considered that the silt content variation in the equation is too simplistic and warrants further work to confirm this. Use of the above factors results in an average wind erosion of 0.53 kg/ha/hr. This indicates that due to climatic factors the area will be more dusty than the NPI default emission factor of 0.2 kg/ha/hr. This value is considered to be on the high side as the weather station may measure higher than normal winds as on a slight ridge and that crusting will lead to lower emissions than estimated.

To apportion the emissions throughout the year the emissions per hour were estimated using the general formulae for wind generated dust after Shao *et al* (1996) of:

$$PM_{10}\ (g/m^2/s) = C\ [WS^3 \times (1 - (WS_T^2)/WS^2)], \qquad WS > WS_T \qquad \textbf{Equation. 5.2}$$

$$PM_{10}\ (g/m^2/s) = 0, \qquad WS < WS_T$$

Where C is an empirical constant and WS_T is the wind speed threshold. For the project, the hourly wind speed threshold was set to 6.0 m/s which is reasonably typical, with the constant C estimated at 2.5×10^{-7} $g/m^2/s$ to match the annual emissions estimated by **Equation 5.1**.

5.3.3 Summary of Emission Factors Used

A summary of the emission factors for the various operations are presented in **Table 5-3**.

Table 5-3 PM_{10} Emission Factors from Material Handling and Ore Movement

Activity	Units	Factor	Control (%)	Resultant Factor	Source or Comment
Excavator Loading trucks (ore and overburden)	kg/tonne	0.012	0	0.012	(see text)
Dumping Trucks to ROM at mine or Waste Dump or by Calcrete trucks	kg/tonne	0.0042	0	0.0042	(see text)
FEL or Road trains dumping to Plant Hopper(Ore or Calcrete)	kg/tonne	0.0042	75	0.001	(see text)
Crushing and Screens	kg/tonne	0.10	98	0.002	Based on primary and tertiary crusher with good control with enclosure and capture by dust control equipment
Haul Trucks	kg/VKT	1.91	85	0.29	USEPA 2006 equation with 85% control assumed for use of water carts
Calcrete Trucks	kg/VKT	2.29	85	0.34	USEPA 2006 equation with 80% control assumed for use water carts
Light Vehicles	kg/VKT	0.44	85	0.067	USEPA 2006 equation with 85% control assumed for use of propriety binders and water carts
Heavy Vehicles in and out of Site	kg/VKT	2.29	75	0.57	USEPA 2006 equation with 75% control assumed by use of water carts. Lower control assumed for offsite road
Dozing	kg/hr	4.0	0	4.0	Default NPI. No controls possible
Grading	kg/hr	1.17	0	1.17	NPI Equation. No controls possible

Notes:

1. Control percentages or factors are the degree of dust suppression achieved and range from 0% (no control) to 100% (full control or no dust emissions).
2. Emissions from the plant itself such as from conveyor or ball mill are considered minor in comparison to other sources here and have been omitted.
3. Emissions from blasting have been neglected as blasting is considered will only be required infrequently and management timing controls can be easily applied if required.

Further details on the emission and control factors in **Table 5-3** are provided below:

- Bulldozing emissions were estimated using the NPI (Environment Australia, 2001) default PM_{10} emission factor of 4 kg/hr (1.1 g/s). These have been derived from typical default surface moisture content of 2% and silt content of 10% using the equation

$$E_{10} = 0.34 \times s^{1.5} / M^{1.4} \quad \text{(kg/hr)} \qquad \textbf{Equation 5.3}$$

  Here silt is defined as material less than 75 μm;

- Grading emissions were based on the default equation:

$$E_{10} = 0.0034 \times S^{2.0} \quad \text{(kg/VKT)} \qquad \textbf{Equation 5.4}$$

  Assuming a speed of 7 km/hr gives emissions of 1.17 kg/hr.

- Emissions of wheel generated dust were estimated for five major road areas. These were the:
  - Haulage road from the mine to the ROM stockpile;
  - Haulage road to the waste stockpile;

- Road from accommodation village to plant with predominant light vehicle usage;
- The portion of the haulage road from the calcrete mine that was in the model domain; and
- The portion of the road to offsite that large general haulage used and some light vehicles that was in the model domain.

Emissions for these roads were estimated using the new USEPA (2006) equation for vehicles travelling on unpaved surfaces at industrial sites:

$$E_{10} = 0.282 \times 1.5 (s/12)^{0.9} (W/2.7)^{0.45} \text{ (kg/VKT)} \qquad \textbf{Equation 5.5}$$

Where:

s is the silt content (%); and
W is the weight of the loaded vehicle in tonnes.

It is noted that the present NPI uncontrolled default emission factor of 0.96 kg/VKT is considered incorrect (see the NPI review, SKM, 2005) and in practice represents a somewhat controlled road. Dust emission from an large trucks on an uncontrolled road are at least a factor of two higher as supported by the measurements in Environmental Alliances 2007 (see table 5) and Pitts (2000). The controlled emissions provided in the NPI of 0.22 and 0.48 kg/VKT for controlled roads are however typical of moderately to well controlled road (see also Environmental Alliances. That the end result (controlled emissions) are considered approximately correct is a result of the uncontrolled factor being too low and the control percentages recommended of 50% and 75% being also too low. According to the new USEPA equation (USEPA, 2006) control efficiencies can be much larger.

"By increasing the surface moisture content of the road by two, AP42 estimates that a 70% control is achieved with in excess of 90% control achieved by increasing the moisture 5 times. For chemical dust suppressants the same control factors as supplied in the 1998 AP42 are recommended with up to 80% controls achieved for PM_{10}. (SKM, 2005)"

Similarly Environmental Alliances (2007) found control efficiencies from about 78 to 96% control from road watering, which are well above the defaults given in the NPI manual.

Therefore for estimating the uncontrolled particulate emissions from trucks, **Equation 5.5** has been used with an average weight of 77 tonne (average loaded and unloaded) for the ore haul trucks , default road silt content of 12% giving an uncontrolled PM_{10} emission of 1.91 kg/VKT. Taking a control efficiency of 85%, PM_{10} emission of 0.29 kg/VKT are derived. This is between the NPI default controlled emissions of 0.48 and 0.24 kg/VKT for watering at the level 1 and 2 watering rates. Emissions likewise were estimated for the triple road trains used for the calcrete haulage and movement into and out of the site with average weight of 115 tonne.

For light vehicles **Equation 5.3** was used with an average vehicular weight of 3 tonne and the same control factors. This results in PM_{10} emissions of 0.066 kg/VKT.

Usage of trucks has been based on the tonnage of ore moved and the capacity of trucks (taken as 55 tonne for the haul trucks and 105 tonne for the triple road trains) and typical distances to the various operations. For mining at year 14, the average haul distance from the mine pits to the ROM was taken as 5.4 km with a distance of 1.5 km to the waste stockpiles;

- Light vehicle movements were based on the estimated fuel usage of 235 kL per year (10% of total onsite fuel) and a vehicle fuel consumption of 12L/100km. This resulted in an average vehicle kilometres travelled of 282 VKT/hr. The usage of light vehicles were assigned to 20% to the ore haulage road (or adjacent to it), 10% to the haulage road to the calcrete mine, 20% to the roads leading offsite which were in the model domain, 20% to road to the accommodation village and 30% in the plant area itself.
- For estimating emissions from drop operations (excavators and FELs loading trucks and trucks dumping material), generally Australian studies use the NPI equation (NPI, 2001) obtained from the USEPA. This equation is:

$$E_{10} = k\ 0.0016\ (U/2.2)^{1.3}\ (M/2)^{-1.4}\ (kg/tonne) \qquad \textbf{Equation 5.6}$$

Where:
k equals 0.35 for PM_{10};
U is the mean wind speed in (m/s); and
M is the material moisture content (%).

This equation has been shown in all known Australian source testing studies to significantly under-predict emissions. This is noted in the NPI itself (NPI, 2001), in the NPI review (SKM, 2005) who recommended against using the equation, in the extensive measurements at Port Hedland (SKM, 2002 and 2006) and measurements at Alcoa refineries (Pitts, 2000).

Within the NPI (2001), default generic emission factors are also supplied of 0.03 kg/tonne and 0.02 kg/tonne for ore with moisture below 4 % and above 4% respectively. **Figure 5-1** compares these defaults to **Equation 5.6** showing that these default emissions are much greater than that derived from the equation. For example, at just below 4% moisture the equation predicts values which are 0.0002 to 0.0011 kg/tonne (for wind speeds of 2 and 8 m/s) which is 27 to 150 times less then the default factor.

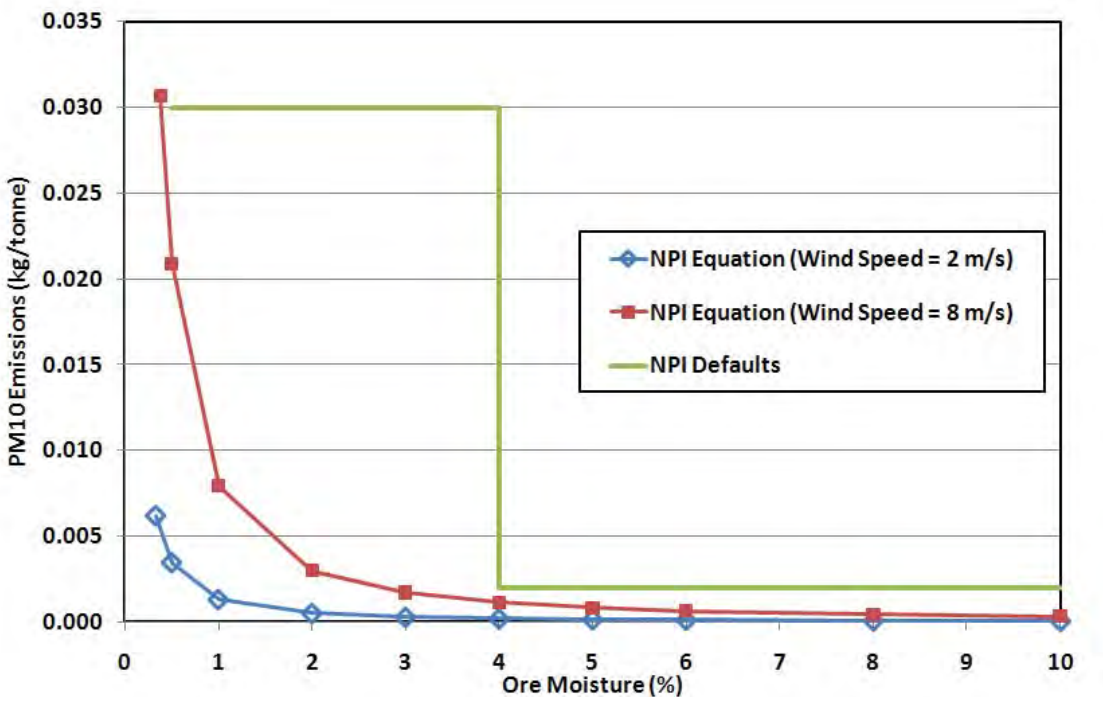

Figure 5-1 Estimated PM_{10} emissions from Batch Drop Operations using the equation and the defaults

The derivation of the generic defaults in the NPI were stated adopted from the report by Holmes Air Sciences (1998) as also re-presented by NSW Minerals Council (2000). However, the value of 0.03 kg/tonne adopted in the NPI manual appears to be derived incorrectly from the TSP value in Holmes Air Sciences (1998) for unloading coal from stockpiles of 0.03 kg/tonne. The correct PM_{10} value for unloading coal should be 0.013 kg/tonne.

Therefore in summary the use of the NPI equation is considered to understate the emissions, whilst the dry ore default of 0.03 kg/tonne is considered an error in the current manual. This issue with the NPI has been raised by the CASANZ modelling special interest group (see Pitts and Hibberd 2009) and is being considered by Environment Australia.

As such, for this study it is considered that for dry sections of ore and waste rock above the operations may be around 0.012 kg/tonne and for the truck dumping operations around 0.0042 kg/tonne.

Table 5-4 Operating Conditions and Control Factors Adopted for Wingellina Year 14

Source	Tonnage (Mtpa)	Rate (tph)	VKT/hr	Hours per year	Resultant Emission Factor
Excavator Loading Trucks	8.4	1345	-	6246	0.012 kg/tonne
Haulage to ROM	4.3	688	133	6246	0.287 kg/VKT
Haulage of Waste to old pits	4.1	656	30	6246	0.285 kg/VKT
Haul Truck Dumping to plant hopper	4.3	688	-	6246	0.0042 kg/tonne
Haul Truck Dumping waste to old pits	4.1	656	-	6246	0.0042 kg/tonne
FELs at ROM to hopper	4.3	688	-	6246	0.0030 kg/tonne
Graders	NA	NA	-	3470	1.17 kg/hr
Dozers	NA	NA	-	6940	4 kg/hr each
Haulage of Calcrete	0.86	248	76	3470	0.343 kg/VKT
Calcrete Dumping	0.86	248	-	3470	0.0042 kg/tonne
Calcrete Loading by FEL	0.86	138	-	6940	0.0030 kg/tonne
Haulage in and Out of Plant to offsite	NA	NA	24	8328	0.57 kg/VKT
Light Vehicles	NA	NA	235	8328	0.066 kg/VKT

Note: Hours per year 8328 based on 347 days of operation

5.3.4 Daily and Wind Speed Variation

Emissions from mining and haulage, and associated activities were taken as 18 hours per day, 365 days per year. These were estimated uniformly throughout a 24 hour period with a total of 6 hours of breaks, whilst for calcrete haulage, dozing, grading were taken as 10 hours a day from 7am to 7pm with 2 hours of breaks.

For drop operations the emissions were varied by the wind speed to the power of 1.3 after the USEPA batch drop equation (USEPA, 2006). Here the default values in **Table 5-4** were assumed equal to the emission at the wind speed of 2.2 m/s and varied by:

$$PM_{10}\ (g/s) = \text{Default factor} \times (WS/2.2)^{1.3} \qquad \textbf{Equation 5.7}$$

This reduces the emissions for the low wind speeds and for high wind speeds, increase the emissions due to the increased winnowing effect of the wind.

5.3.5 Resultant Dust Emission Estimates

Emissions of particulate are estimated on an hourly basis based on the operations at the time and the winds. This results in variable emissions that are input into the dispersion model for that hour. A summary of the estimated PM_{10} emissions for year 14 (the anticipated maximum) are presented in **Table 5-5** for both the average and maximum emissions to show the variation that occurs.

Table 5-5 PM_{10} Emission Estimates for the Wingellina Nickel Project

Activity	Average (g/s)	Maximum (g/s)
Operations		
Excavator loading trucks	9.6	74
Haul Truck Dumping to ROM at mine	1.7	13
Haul Truck Dumping waste to old pits	1.6	13
FEL loading at Plant ROM	1.8	14
Crushing	0.7	4.8
Calcrete Dumping at plant	0.4	2.8
FELs at Plant Calcrete ROM	0.2	1.9
Graders at Mine	0.1	0.3
Dozers at Mine (total of two)	0.9	2.2
Total	**17.0**	**122**
Vehicle Movement		
Haulage to ROM	7.9	10.6
Haulage of Waste to old pits	1.8	2.4
Calcrete Haulage	3.0	7.2
Light Vehicles	4.3	7.5
General Offsite Haulage	3.8	3.8
Total	**20.8**	**31.4**
Wind Erosion		
TSF Beach areas	26.8	2769
Soil stockpiles	1.0	105
Waste Stockpile	1.5	160
Mine Area	3.4	347
ROM Pad areas	1.9	196
Total	**34.6**	**3578**
Total All Sources	***72.4***	***3718***

Notes:

1) Values may not tally due to rounding and maximums may not tally as maximums may not occur at the same hour.
2) Values will be conservative in that no suppression due to rainfall is assumed (except in the wind erosion sources).

Table 5-5 indicates that the total average PM_{10} emissions will be about 72.4 g/s though maximum emissions under very strong winds can be significantly higher. Based on a conservative estimate of operation for 365 days per year (in reality should be 347 days), the total annual PM_{10} emissions are estimated at 2,285 tpa.

5.3.6 Comparison to other Mining PM_{10} emissions

A comparison of the PM_{10} emissions associated with the mine is presented in **Table 5-6** along with that reported from iron ore and nickel projects and that considered reasonable for various mining operations by Holmes Air Sciences (NSW Minerals Council, 1998) These are presented on a per tonne of iron ore basis to normalise the emissions.

Table 5-6 Estimated PM_{10} Emissions from Mines

Project and Source	Ore Mined (Mtpa)	Annual PM_{10} Emissions (tpa)	Dust Emission Index (kg PM_{10}/Tonne Ore)
BHP Billiton Iron Ore Mines (2006/2007 NPI)			
Yandi, Whaleback, Jimblebar, Area C	35.548	12,000	0.33 – 0.65
Rio Tinto Iron Ore Mines (2003/2004 NPI)			
Yandicogina, West Angelas, Marandoo, Brockman, Mesa J [(2)]	21.4	2,300	0.10 – 0.34
Truck and shovel mine with dust controls (NSW MC, 1998)			
Average	-	-	0.42 - 0.51
Minimal Control	-	-	0.87
Dragline coal mine with dust controls (NSW MC, 1998)			
Good,	-	-	0.28
Average	-	-	0.34
Minimal Control	-	-	0.47
Open Cut metalliferous Mine (NSW MC, 1998)			
Good	-	-	0.16
Average	-	-	1.97
Minimal Control	-	-	17.7
Murrin Murrin Nickel Project	3.0	3,700	1.23
Mt Keith Nickel Project	11.5	3200 - 9500	0.28 – 0.83
Wingellina Nickel Project (Year 14)	**4.3**	**2,285**	**0.53**

Notes:

1) The Dust Emission Index is the dust emissions per tonne of iron ore mined.
2) Throughput from BHP Billiton (2007).
3) The Mesa J estimate is for 2004/2005 as the 2003/2004 value appears incorrect and not consistent.

Table 5-6 indicates that the dust index estimated for year 14 operations of 0.53 kg PM_{10}/tonne ore is similar to other projects indicating that the dust emission estimates here are reasonable.

6 Predicted Concentrations

This section presents the predicted concentrations of atmospheric emissions from the plant and fugitive particulate emissions from the mining operations. Predicted concentrations from the plant stack and vent sources include all the significant emissions of local air quality concern; SO_2, sulfuric acid mist, NO_2 and PM_{10} and are presented in **Section 6.1**. Particulate concentrations from fugitive activities (the mining and stockpiling etc) are presented in **Section 6.2**. The fugitive particulate predictions have been presented without the stack PM_{10} emissions as the stack contribution are minor. For NO_2 predictions, vehicle NO_X has been omitted as the contribution from this source is generally small for distances greater than 100 m from roads.

6.1 Plant Sources

6.1.1 Overview

Predicted concentrations from the plant operations are presented in **Table 6-1** without background concentrations (i.e. the plant alone) and with background concentrations in **Table 6-2**. These have been predicted for three cases:

- Normal operation with the acid plant operating, which is estimated to occur for 74% of the time when the plant operates;
- Normal operation with the acid plant offline (anticipated to occur for 26% of the plant operating time); and
- Non routine operation with an acid plant start up, anticipated to occur for 2 to 3 hours for up to 5 times per year.

A description of the concentrations and where appropriate contour plots of pollutants closest to the criteria presented in **Sections 6.1.2** to **6.1.4.**

Table 6-1 Predicted Concentrations from the Plant Operation (excluding background)

Source	Averaging Period	Criteria	Concentration (µg/m^3)			Percentage of Criteria (%)		
			Any Location	Wingellina	Accom. Village	Any Location	Wingellina	Accom. Village
Normal Operation with Acid Plant Operating (74% of operating time)								
NO_2	1-hr (max)	- [2]	5	2.4	2.4	-	-	-
	1-hr (2nd)	246	3	2	2	1.2	0.8	0.8
	Annual Ave	62	0.2	0.03	0.02	0.3	0.05	0.03
SO_2	1-hr (max)	-	403	240	230	-	-	-
	1-hr (2nd)	570	305	190	180	54	33	32
	24-hr (max)	-	118	35	50	-	-	-
	24-hr (2nd)	228	111	25	45	49	11	20
	Annual Ave	57	9.5	1.9	2.5	17	3.3	4.3
PM_{10}	24-hr (max)	50	0.16	0.02	0.03	0.3	0.04	0.06
Sulfuric Acid Mist	1-hr (max)	120	15	9	7	13	7.5	6
Normal Operation with Acid Plant Offline (26% of operating time)								
NO_2	1-hr (max)	-	8	4	7	-	-	-
	1-hr (2nd)	246	5	3	4	2.0	1.2	1.6
	Annual Ave	62	0.3	0.05	0.04	0.5	0.08	0.06
SO_2	1-hr (max)	-	Negl	Negl	Negl	-	-	-
	1-hr (2nd)	570	Negl	Negl	Negl	0	0	0
	24-hr (max)	-	Negl	Negl	Negl	-	-	-
	24-hr (2nd)	228	Negl	Negl	Negl	0	0	0
	Annual Ave	57	Negl	Negl	Negl	0	0	0
PM_{10}	24-hr (max)	50	0.7	0.15	0.17	1.4	0.3	0.3
Sulfuric Acid Mist	1-hr (max)	120	0	0	0	0	0	0
Non Normal - Start Up of Acid Plant (2 to 3 hours duration)								
NO_2	1-hr (max)	-	57	14	13	-	-	-
	1-hr (2nd)	246	34	12	12	14	4.9	4.9
	Annual Ave	62	NA	NA	NA	-	-	-
SO_2	1-hr (max)	-	660	240	400	-	-	-
	1-hr (2nd)	570	417	230	300	73	40	53
	24-hr (max)	-	NA [1]	NA	NA	NA	NA	NA
	24-hr (2nd)	228	NA	NA	NA	NA	NA	NA
	Annual Ave	57	NA	NA	NA	NA	NA	NA
PM_{10}	24-hr (max)	50	0.7	0.08	0.15	0.14	0.16	0.3
Sulfuric Acid Mist	1-hr (max)	120	0	0	0	0	0	0

Notes:

1) NA is not applicable. The 24-hour and annual average concentrations are not predicted for the acid plant start up, as start up only occurs for 2 to 3 hours duration and 5 times per year.
2) The NEPM 1-hour NO_2 and SO_2 and 24-hour SO_2 standards allow for no more than one exceedance and therefore should be compared to the second highest prediction. This is in line with the DEC's modelling guidance "For NEPM pollutants, results should be presented for both maximum concentrations and concentrations at the allowed exceedance level (e.g. for SO_2, 2nd highest 1-hour average on a day different to that on which the highest occurred)." (DEC, 2006). For 24-hour PM_{10}, the DEC require the predicted maximums to be presented.

Table 6-2 Predicted Concentrations from the Plant Operation (including background)

Source	Averaging Period	Criteria	Concentration (µg/m^3)			Percentage of Criteria (%)		
			Any Location	Wingellina	Accom. Village	Any Location	Wingellina	Accom. Village
Normal Operation with Acid Plant Operating (74% of operating time)								
NO_2	1-hr (max)	- [2]	7	4.4	4.4	-	-	-
	1-hr (2nd)	246	5	4	4	2.0	1.6	1.6
	Annual Ave	62	2.2	2.03	2.02	3.5	3.3	3.3
SO_2	1-hr (max)	-	403	240	230	-	-	-
	1-hr (2nd)	570	305	190	180	54	33	32
	24-hr (max)	-	118	35	50	-	-	-
	24-hr (2nd)	228	111	25	45	49	11	20
	Annual Ave	57	9.5	1.9	2.5	17	3.3	4.3
PM_{10}	24-hr (max)	50	13.16	13.02	13.03	26	26	26
Sulfuric Acid Mist	1-hr (max)	120	15	9	7	13	7.5	6
Normal Operation with Acid Plant Offline (26% of operating time)								
NO_2	1-hr (max)	-	8	4	7	-	-	-
	1-hr (2nd)	246	5	3	4	2.0	1.2	1.6
	Annual Ave	62	0.3	0.05	0.04	0.5	0.08	0.06
SO_2	1-hr (max)	-	Negl	Negl	Negl	-	-	-
	1-hr (2nd)	570	Negl	Negl	Negl	0	0	0
	24-hr (max)	-	Negl	Negl	Negl	-	-	-
	24-hr (2nd)	228	Negl	Negl	Negl	0	0	0
	Annual Ave	57	Negl	Negl	Negl	0	0	0
PM_{10}	24-hr (max)	50	13.7	13.15	13.17	27	26	26
Sulfuric Acid Mist	1-hr (max)	120	0	0	0	0	0	0
Non Normal - Start Up of Acid Plant (2 to 3 hours duration)								
NO_2	1-hr (max)	-	59	16	15	-	-	-
	1-hr (2nd)	246	36	14	14	15	5.7	5.7
	Annual Ave	62	NA	NA	NA	-	-	-
SO_2	1-hr (max)	-	660	240	400	-	-	-
	1-hr (2nd)	570	417	230	300	73	40	53
	24-hr (max)	-	NA [1]	NA	NA	NA	NA	NA
	24-hr (2nd)	228	NA	NA	NA	NA	NA	NA
	Annual Ave	57	NA	NA	NA	NA	NA	NA
PM_{10}	24-hr (max)	50	13.7	13.08	13.15	27	26	26
Sulfuric Acid Mist	1-hr (max)	120	0	0	0	0	0	0

Notes:

1) NA is not applicable. The 24-hour and annual average concentrations are not predicted for the acid plant start up, as start up only occurs for 2 to 3 hours duration and 5 times per year.
2) The NEPM 1-hour NO_2 and SO_2 and 24-hour SO_2 standards allow for no more than one exceedance and therefore should be compared to the second highest prediction. This is in line with the DEC's modelling guidance "For NEPM pollutants, results should be presented for both maximum concentrations and concentrations at the allowed exceedance level (e.g. for SO_2, 2nd highest 1-hour average on a day different to that on which the highest occurred)." (DEC, 2006). For 24-hour PM_{10}, the DEC require the predicted maximums to be presented.
3) Background levels of SO_2 and sulphuric acid are taken as zero, whilst for NO_2 the background levels are taken as 2 µg/m^3 as per **Section 2.2.3** with 24-hour PM_{10} as 13 µg/m^3 as given in **Section 2.2.2.**

6.1.2 Normal Operations – Acid Plant Operating

Predicted concentrations with and without background levels are presented in **Table 6-1** and **Table 6-2** with contour plots of the concentrations closest to the criteria also presented in **Figure 6-1** to **Figure 6-6**.

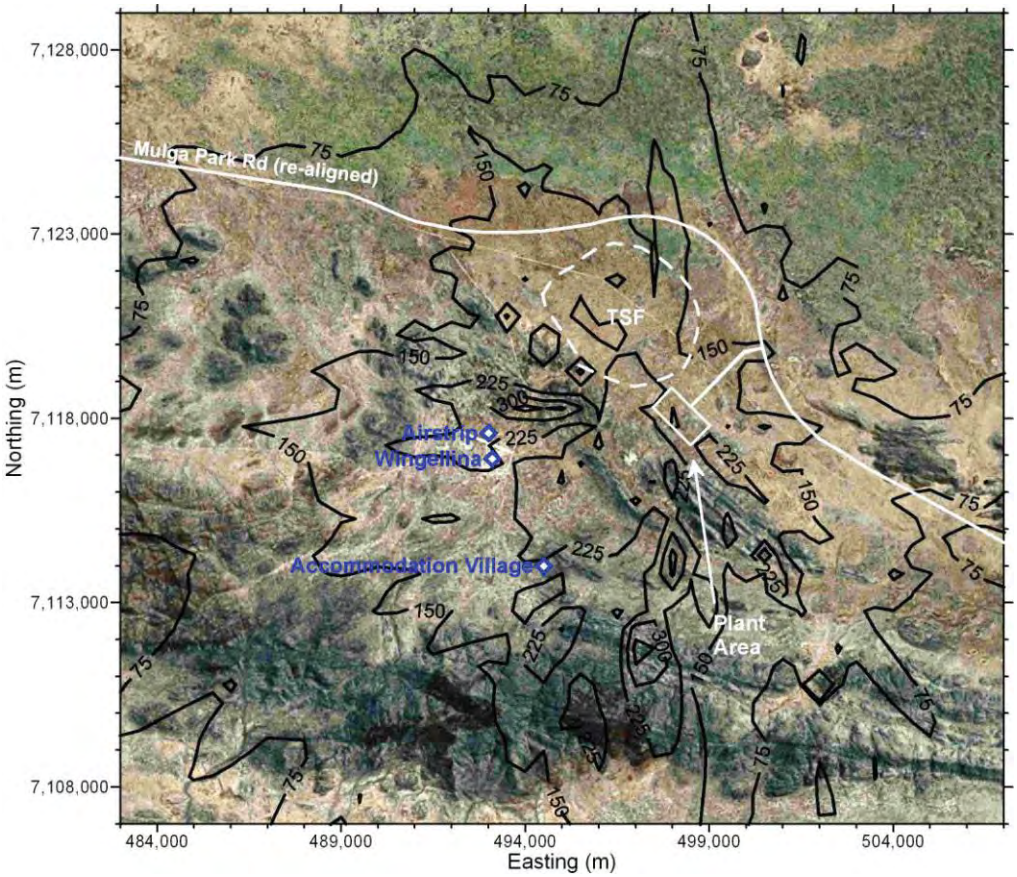

Figure 6-1 Predicted maximum 1-hour SO_2 concentration (µg/m^3) with the acid plant under normal operation - Excluding background concentrations

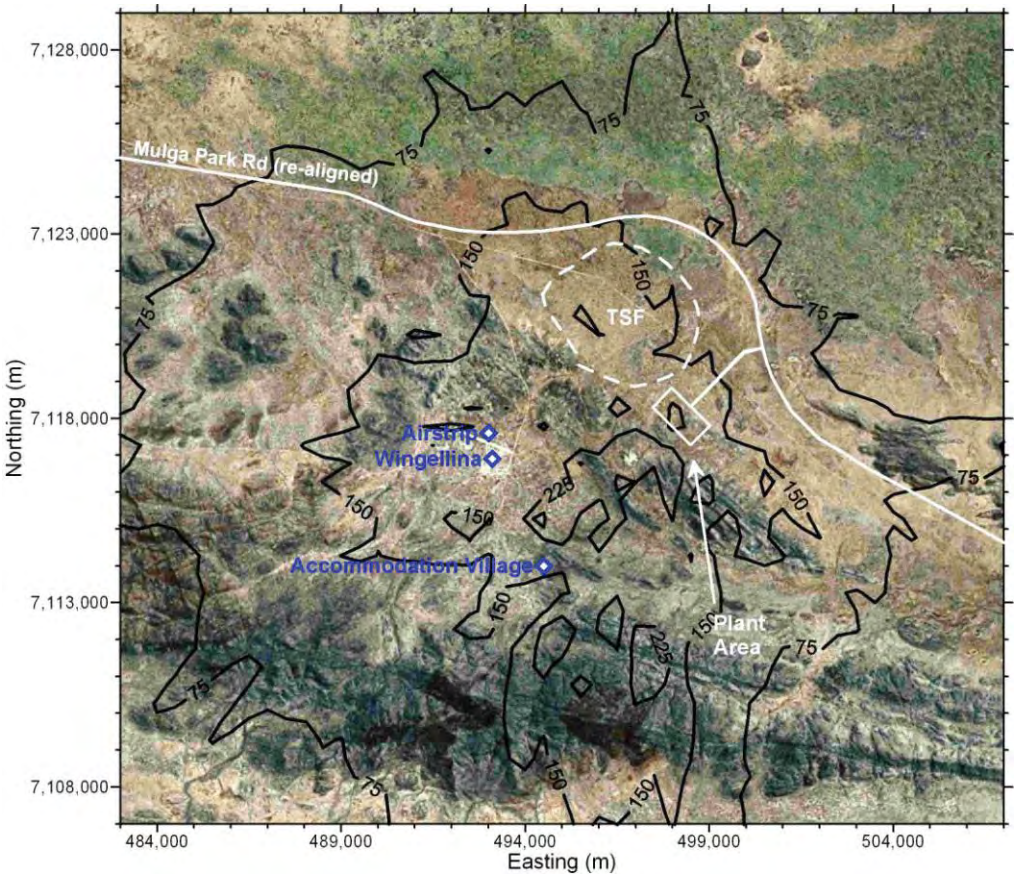

Figure 6-2 Predicted 2nd Highest 1-hour SO_2 concentration (µg/m^3) with the acid plant under normal operation - Excluding background concentrations

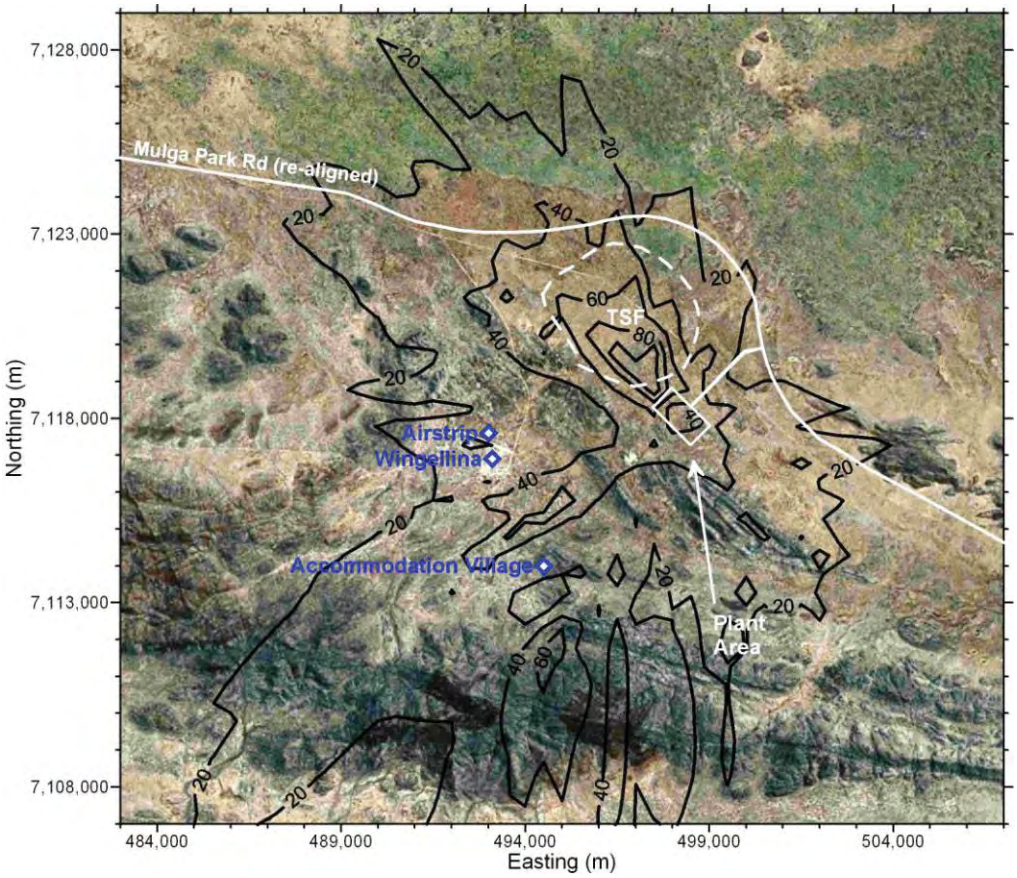

Figure 6-3 Predicted maximum 24-hour SO_2 concentration (µg/m^3) with the acid plant under normal operation - Excluding background concentrations

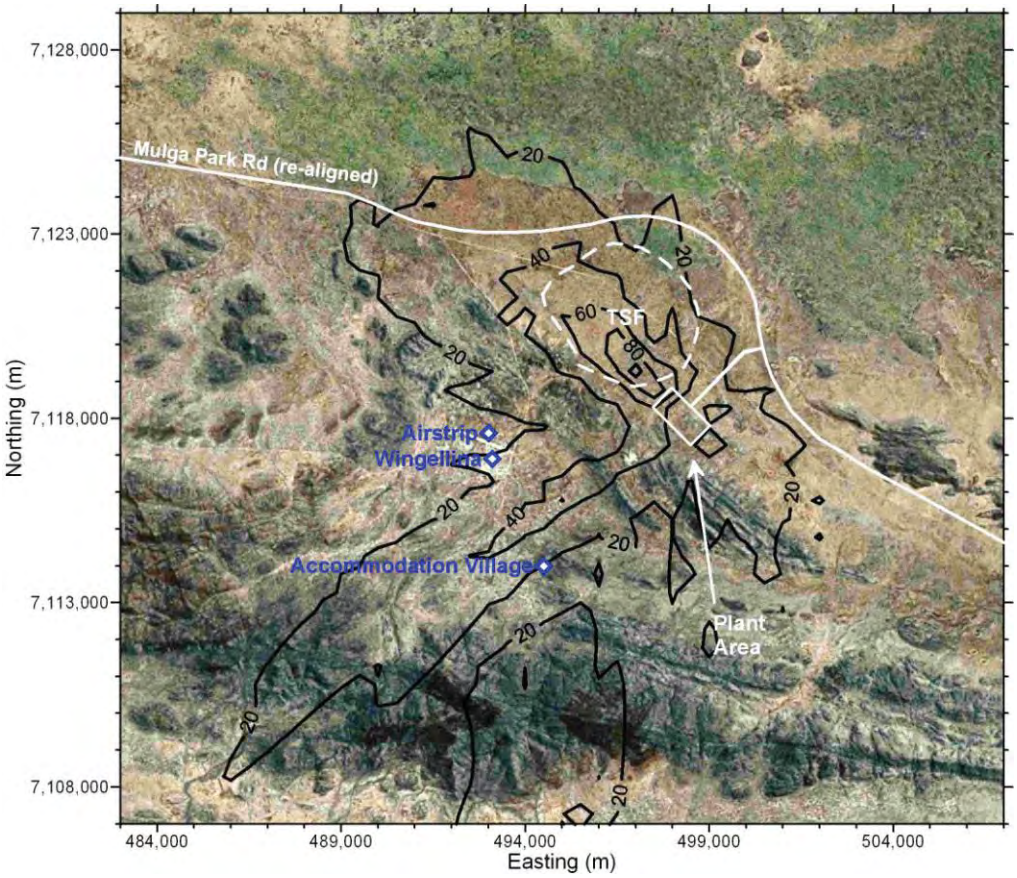

Figure 6-4 Predicted 2nd Highest 24-hour SO_2 concentration (µg/m^3) concentration (µg/m^3) with the acid plant under normal operation - Excluding background concentrations

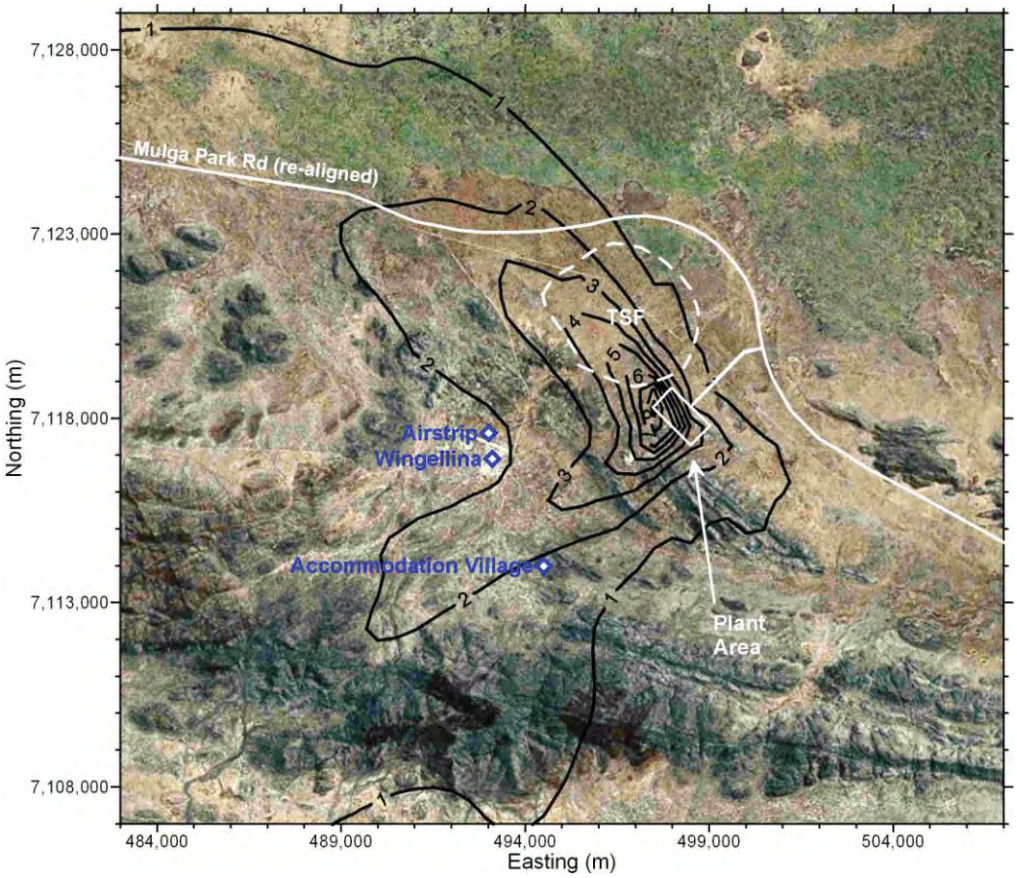

Figure 6-5 Predicted annual average SO_2 concentration (µg/m^3) with the acid plant under normal operation - Excluding background concentrations

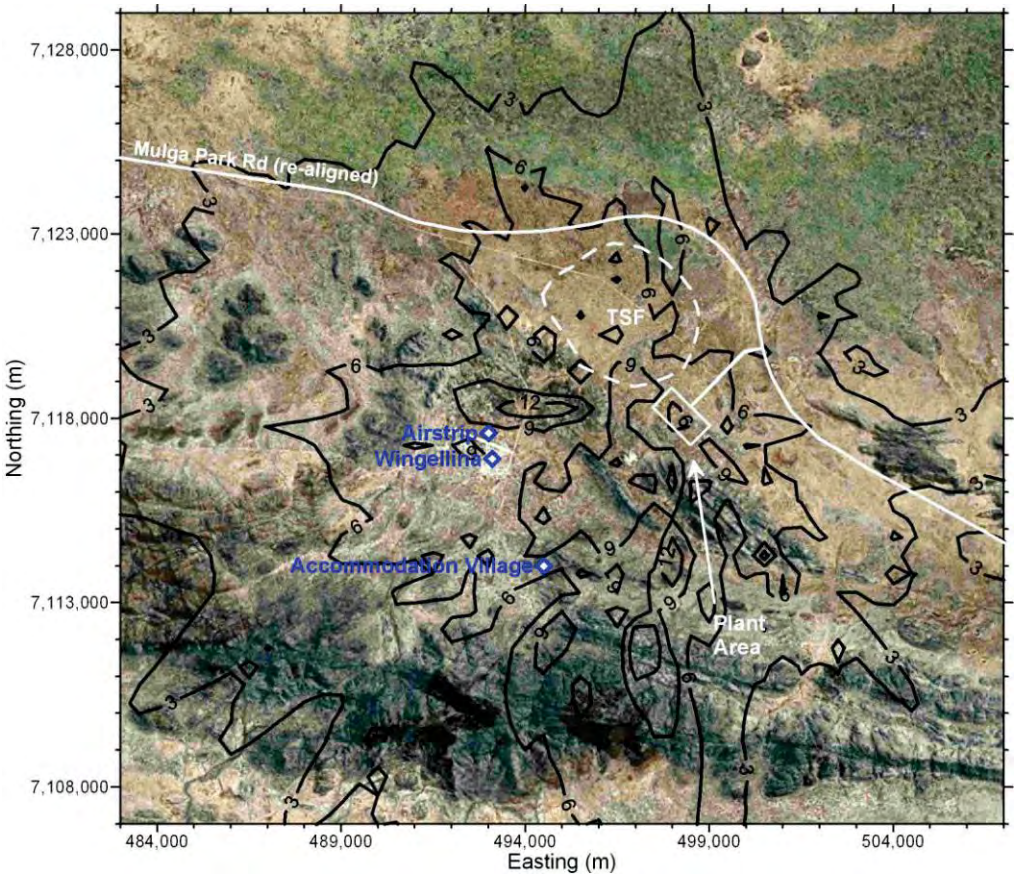

Figure 6-6 Predicted maximum 1-hour sulfuric acid mist concentration (µg/m^3) with the acid plant under normal operation - Excluding background concentrations

Table 6-1and **Table 6-2** and **Figure 6-1** to **Figure 6-6** indicate that for normal operations with the acid plant operating that the concentrations will be:

- Below the criteria at all locations, with concentrations at either the accommodation village or Wingellina predicted to be at most 33% of the 1-hour SO_2 NEPM standard. Note this is using the second highest 1-hour prediction as per the DEC modelling guidance;
- The highest concentration relative to the criteria anywhere is predicted at 54% of the NEPM 1-hour SO_2 standard, occurring 3 km to the south of the plant away from the residential areas. Analysis of the data indicates that this maximum occurs under light winds in the mid morning, with a low inversion where the acid plant plume is either trapped or undergoes fumigation; and
- Concentrations of other pollutants from the plant are predicted to be low.

6.1.3 Normal Operations with the Acid Plant Off-line

Predicted concentrations with the acid plant off-line are presented in **Table 6-1** and **Table 6-2**. When the acid plant is off-line, the operations utilise steam from the boilers. Under this mode of operation the predicted concentrations are very low, contributing at most 1.6% and 1.2% of the NO_2 1-hour NEPM standard at the accommodation village and Wingellina respectively. Including background concentrations, the maximum concentrations are at most 26% of the NEPM PM_{10} standard, though with the plant contributing only 0.3% of the NEPM standard.

6.1.4 Start Up Conditions

Predicted concentrations from the plant operations when an acid plant start-up occurs are presented in **Table 6-1** and **Table 6-2** with contour plots of the concentrations closest to the criteria presented in **Figure 6-7** and **Figure 6-8**. These predictions are made conservatively assuming that the start up occurs for the whole year continuously.

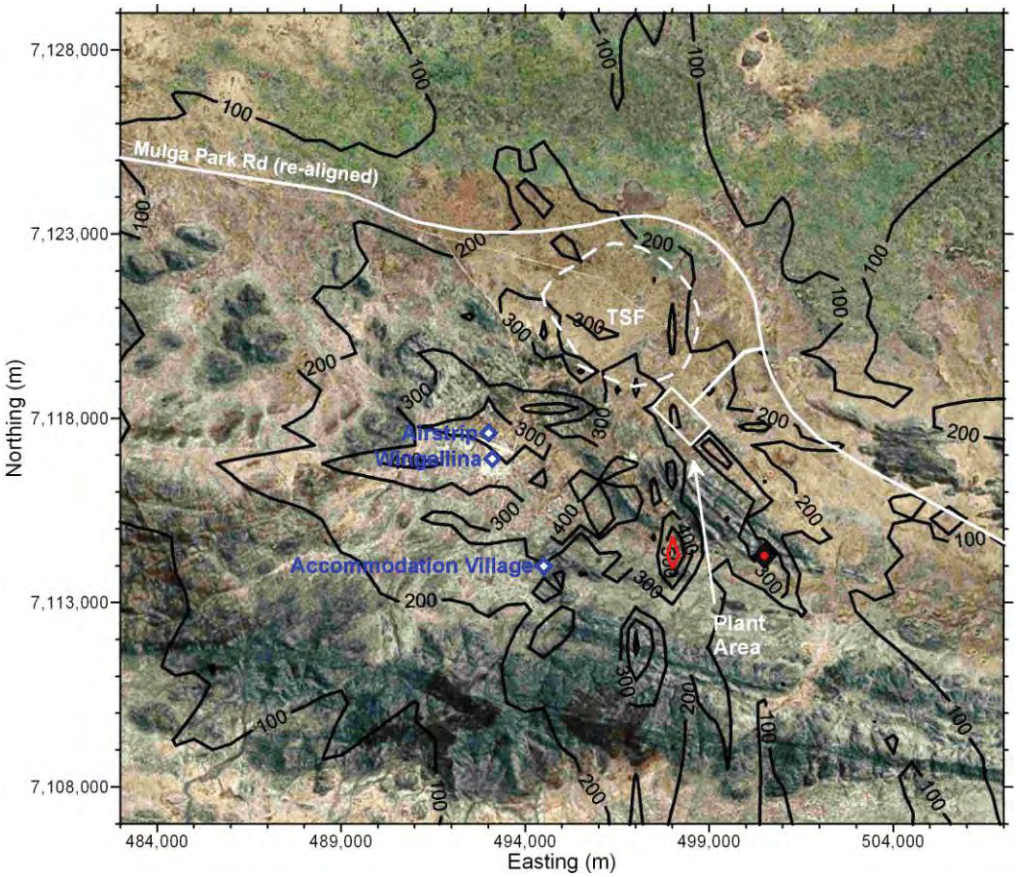

Figure 6-7 Predicted maximum 1-hour SO_2 concentration (µg/m^3) with the acid plant under start up. The red line is the NEPM standard of 570 µg/m^3. Excludes background concentrations

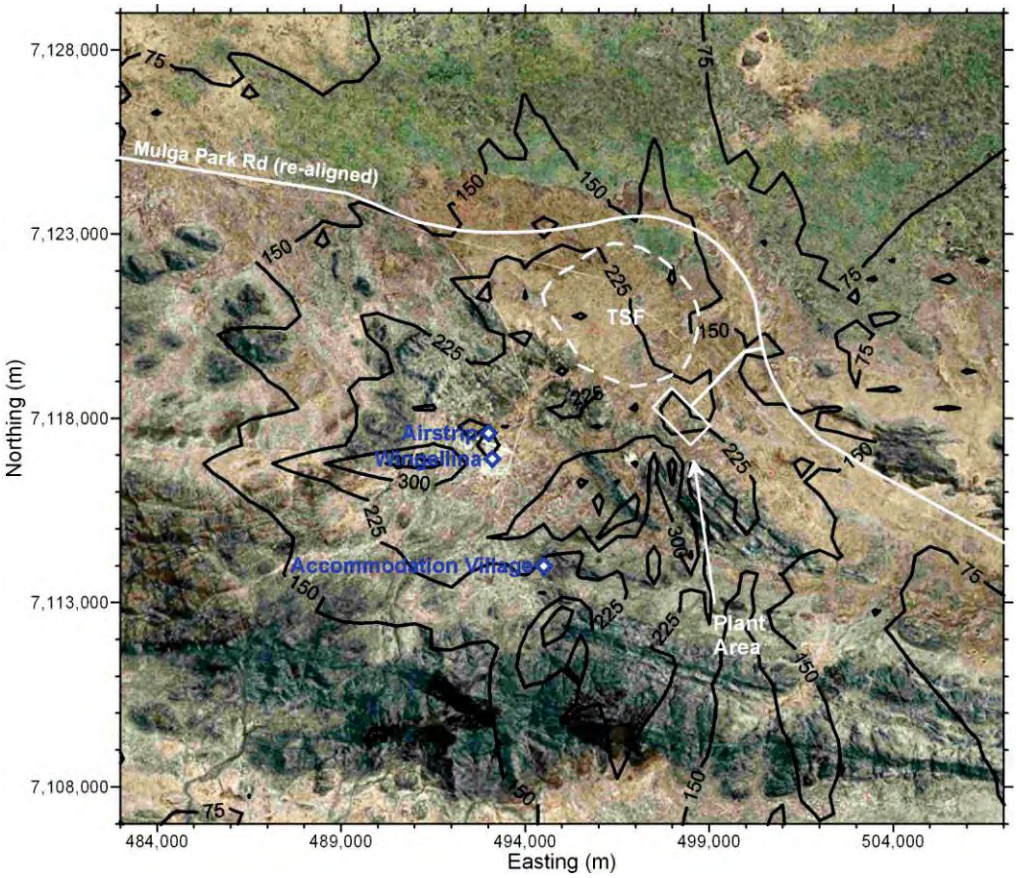

Figure 6-8 Predicted 2nd highest 1-hour SO_2 concentration (µg/m^3) with the acid plant under start up - Excluding background concentrations

Table 6-1 and **Table 6-2** and **Figure 6-7** and **Figure 6-8** indicate that under start up of the acid plant that:

- The pollutant predicted closest to its respective criteria is SO_2. The predicted 2nd highest 1-hour SO_2 concentration anywhere is 417 µg/m^3, which is 73% of the NEPM standard. At or near the accommodation village, the 2nd highest 1-hour concentration is about 300 µg/m^3 or about 53% of the NEPM standard. At Wingellina, the predicted concentrations are slightly lower at 230 µg/m^3 or about 40% of the NEPM standard;
- The maximum 1-hour SO_2 concentration predicted is 660 µg/m^3 occurring approximately 3 kilometres south of the plant. This is predicted to occur under mid morning, light wind, low mixing height conditions as per that for normal operations. Such a high concentration is very unlikely to occur as the acid plant start up is estimated to occur for only 5 times per year for 2 to 3 hours each. As such, the probability of a start-up hour occurring (less than 15 hours per year) at the hour of worst case dispersion is extremely unlikely; and
- All other concentrations are predicted to be low, at most 5% of their respective criteria at either the accommodation village or Wingellina.

6.2 Fugitive Particulate Emissions

Predicted particulate concentrations and depositions from the operations at the year of maximum operations/impacts are presented in **Table 6-3** with contour plots of the concentrations in **Figure 6-9** to

Figure 6-15. These are presented without background levels to enable the operations contribution to be more easily seen. The total cumulative concentrations including background levels are presented in **Table 6-4** as also required for comparison to the criteria. Contour plots are not presented with cumulative concentrations as they are merely the repetition of **Figure 6-9** to **Figure 6-15** with a constant background value added.

Table 6-3 Predicted Particulate Levels from Fugitive Dust – Excluding Background Levels

Pollutant	Averaging Period	Criteria Value	Units	Predicted Value			Percentage of Criteria (%)		
				Air Strip	Wingellina	Accom. Village	Air Strip	Wingellina	Accom. Village
TSP	24-hr (max)	90	$\mu g/m^3$	37	34	19	41	38	21
	Annual Ave	90	$\mu g/m^3$	11	9	4	12	10	4
PM_{10}	24-hr (max)	50	$\mu g/m^3$	20	19	10	40	38	20
	24-hr (5^{th})	-	$\mu g/m^3$	19	16	9	-	-	-
$PM_{2.5}$	24-hr (max)	25	$\mu g/m^3$	3.8	3.2	1.9	15	13	8
	Annual Ave	8	$\mu g/m^3$	0.9	0.8	0.4	11	10	5
Dust Deposition	Monthly	2	$g/m^2/mth$	0.9	0.7	0.4	45	35	20

Table 6-4 Predicted Particulate Levels from Fugitive Dust – Including Background Levels

Pollutant	Averaging Period	Criteria Value	Units	Back-ground Value	Predicted - Including Background			Percentage of Criteria (%)		
					Air Strip	Wingellina	Accom. Village	Air Strip	Wingellina	Accom. Village
TSP	24-hr (max)	90	$\mu g/m^3$	26	63	60	45	70	67	50
	Annual Ave	90	$\mu g/m^3$	23	34	32	27	38	36	30
PM_{10}	24-hr (max)	50	$\mu g/m^3$	13	33	32	23	66	64	46
	24-hr (5^{th})	None	$\mu g/m^3$	12	31	28	21	-	-	-
$PM_{2.5}$	24-hr (max)	25	$\mu g/m^3$	6.5	11.3	9.7	8.4	45	39	39
	Annual Ave	8	$\mu g/m^3$	5.5	6.4	6.3	5.9	80	79	74
Dust Deposition	Monthly	4	g/m^2//mth	0.9	1.8	1.6	1.3	45	40	33

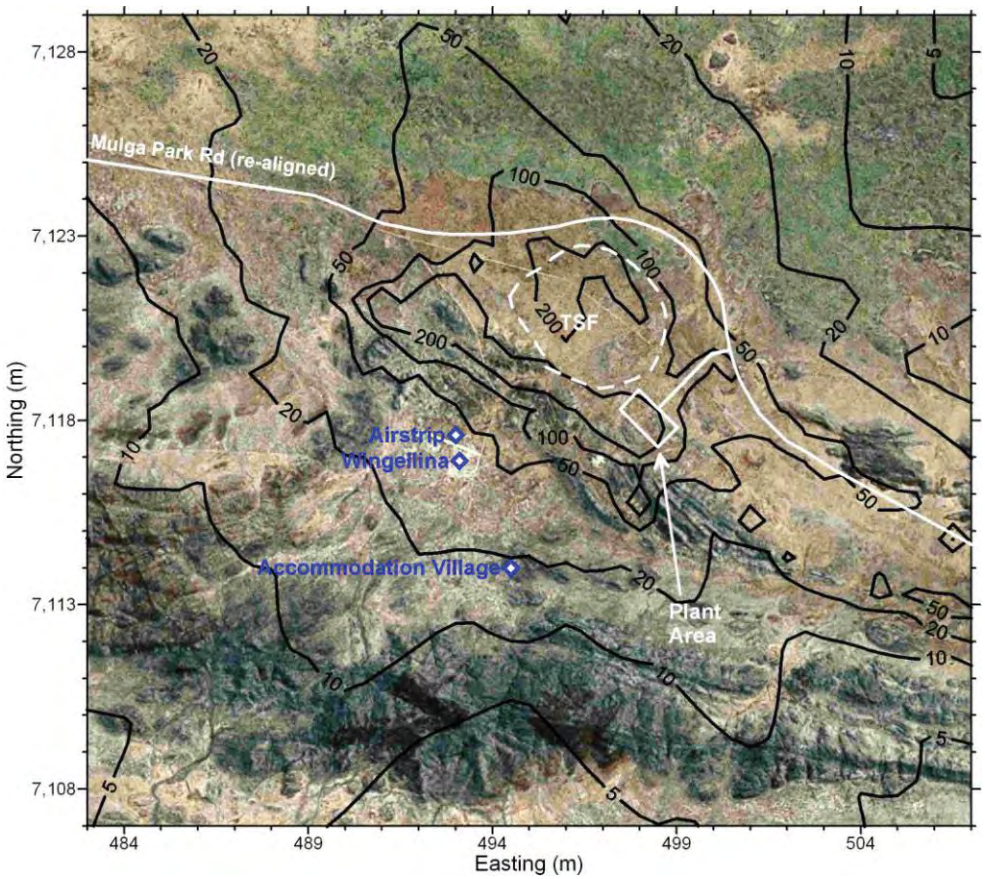

Figure 6-9 Predicted maximum 24-hour average TSP concentrations ($\mu g/m^3$) - Excluding background concentrations

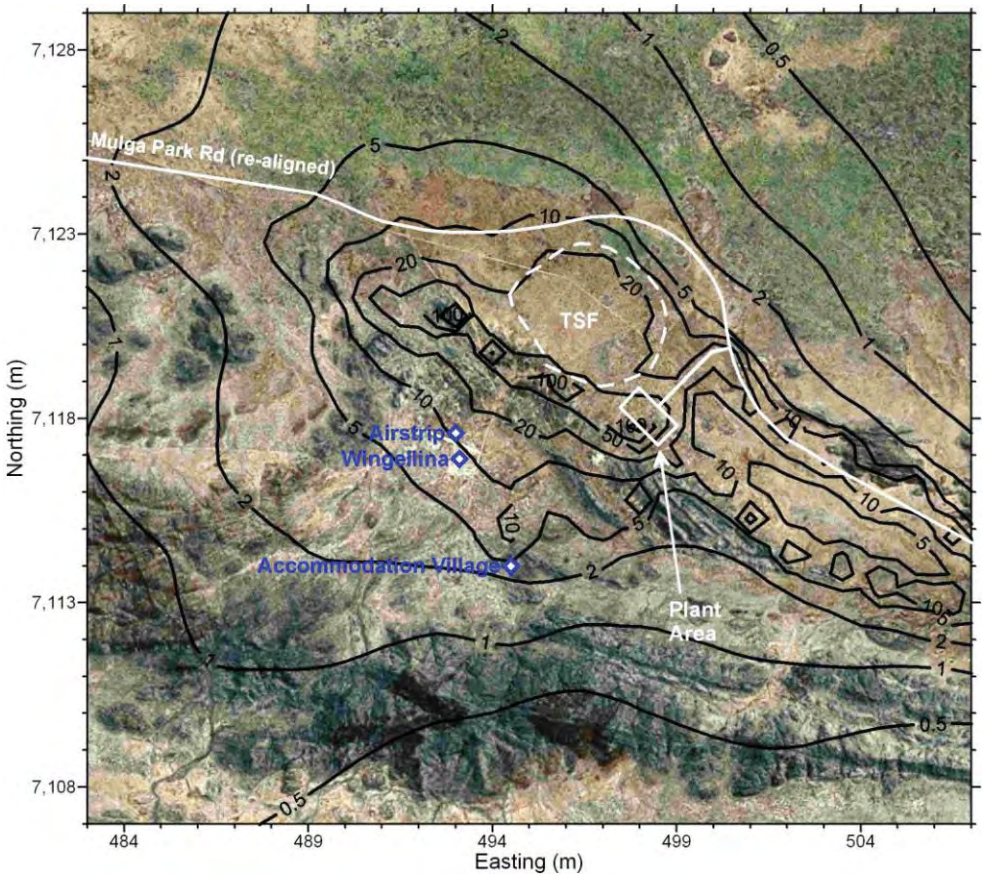

Figure 6-10 Predicted annual average TSP concentrations (µg/m^3) -- Excluding background concentrations

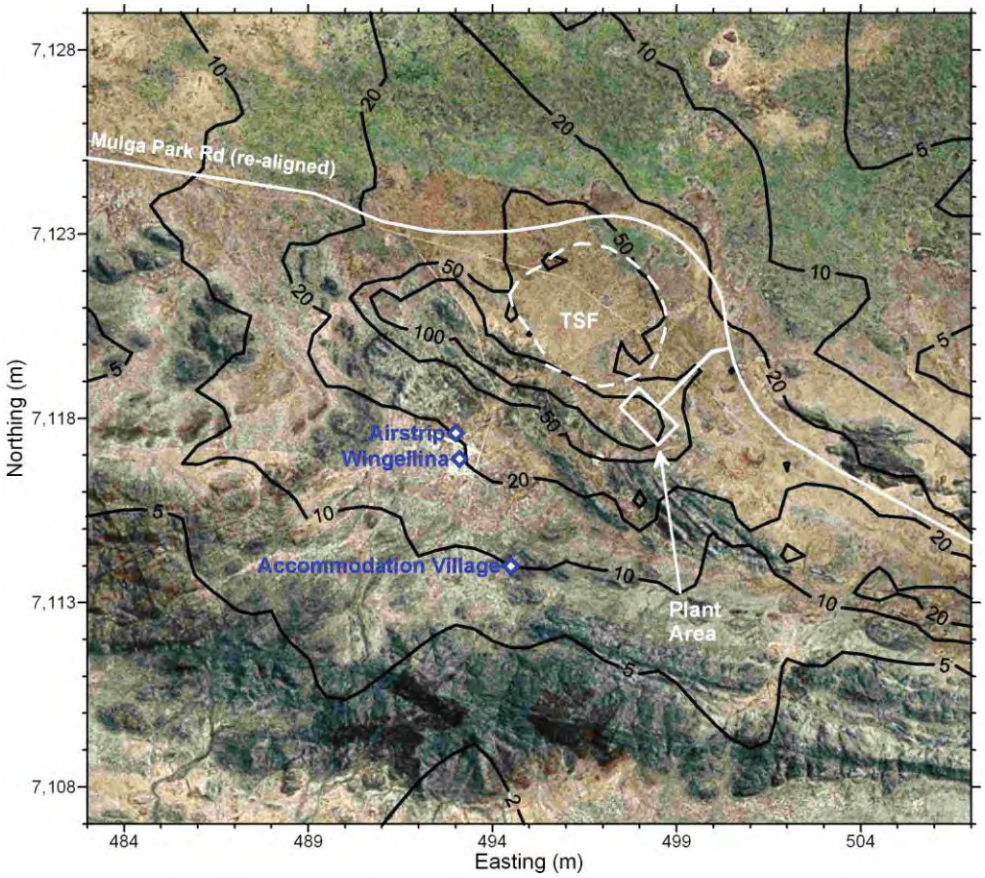

Figure 6-11 Predicted maximum 24-hour average PM_{10} concentrations (µg/m^3) - Excluding background concentrations

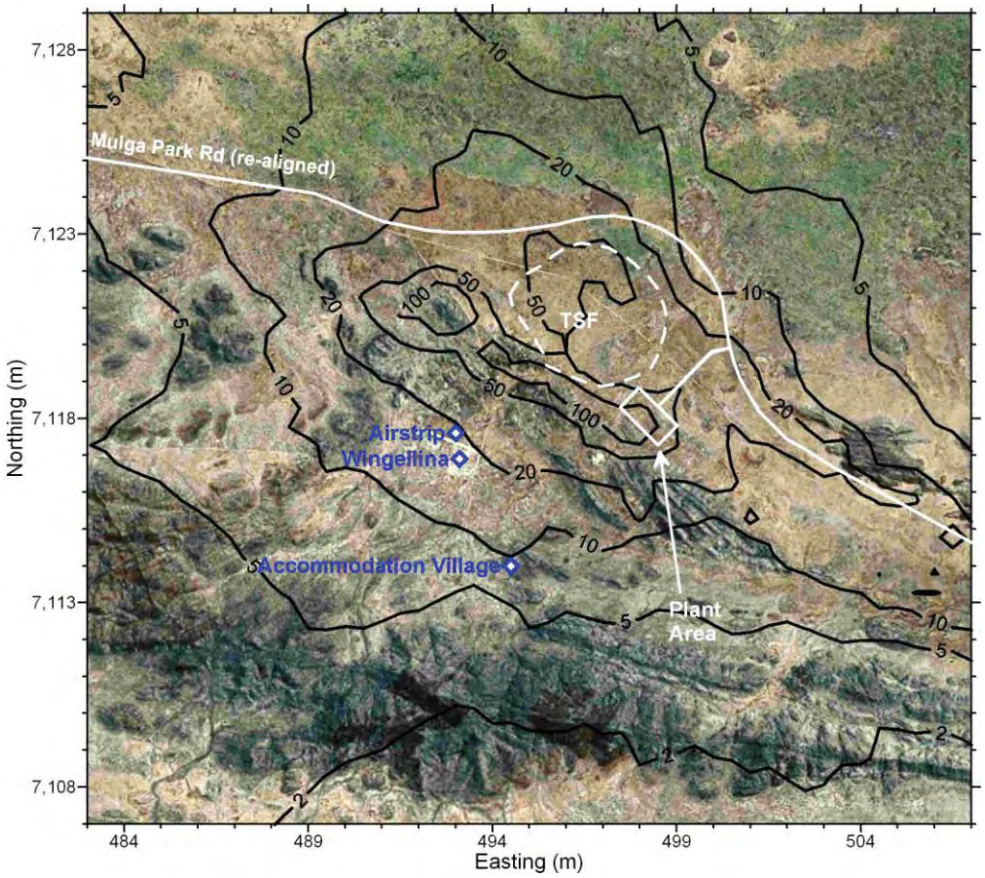

Figure 6-12 Predicted 5th highest 24-hour average PM_{10} concentrations (µg/m^3) - Excluding background concentrations

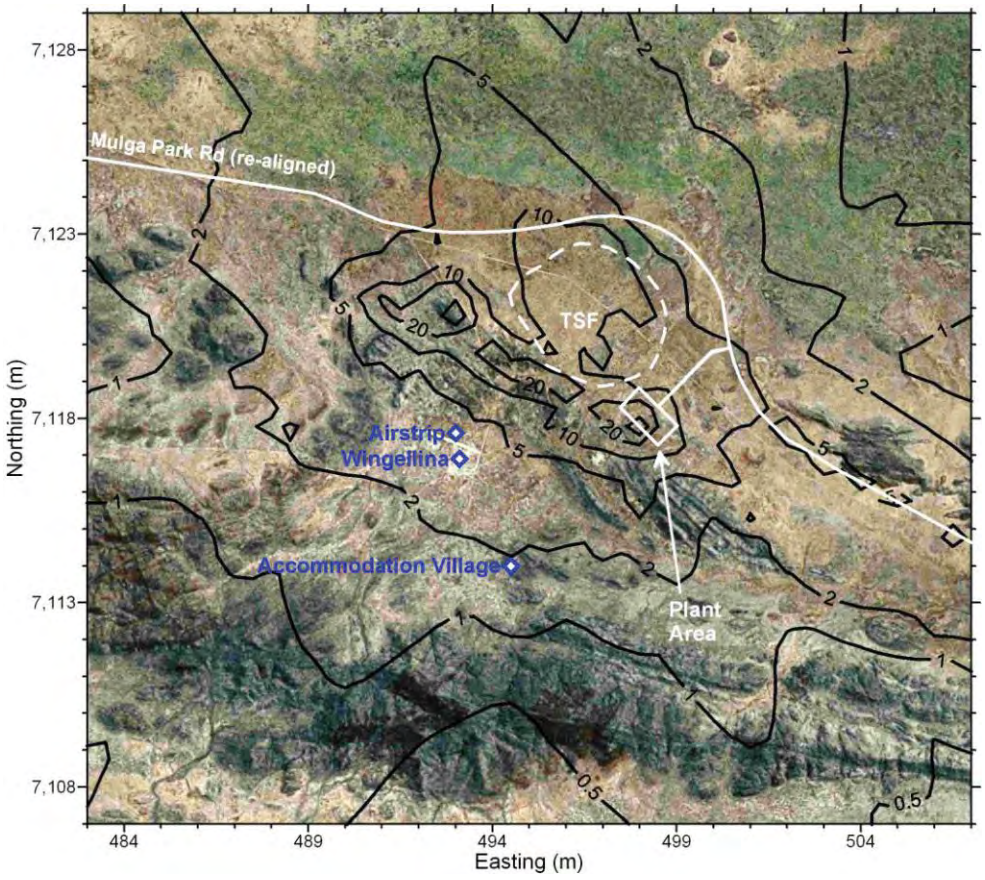

Figure 6-13 Predicted maximum 24-hour average $PM_{2.5}$ concentrations (µg/m^3) - Excluding background concentrations

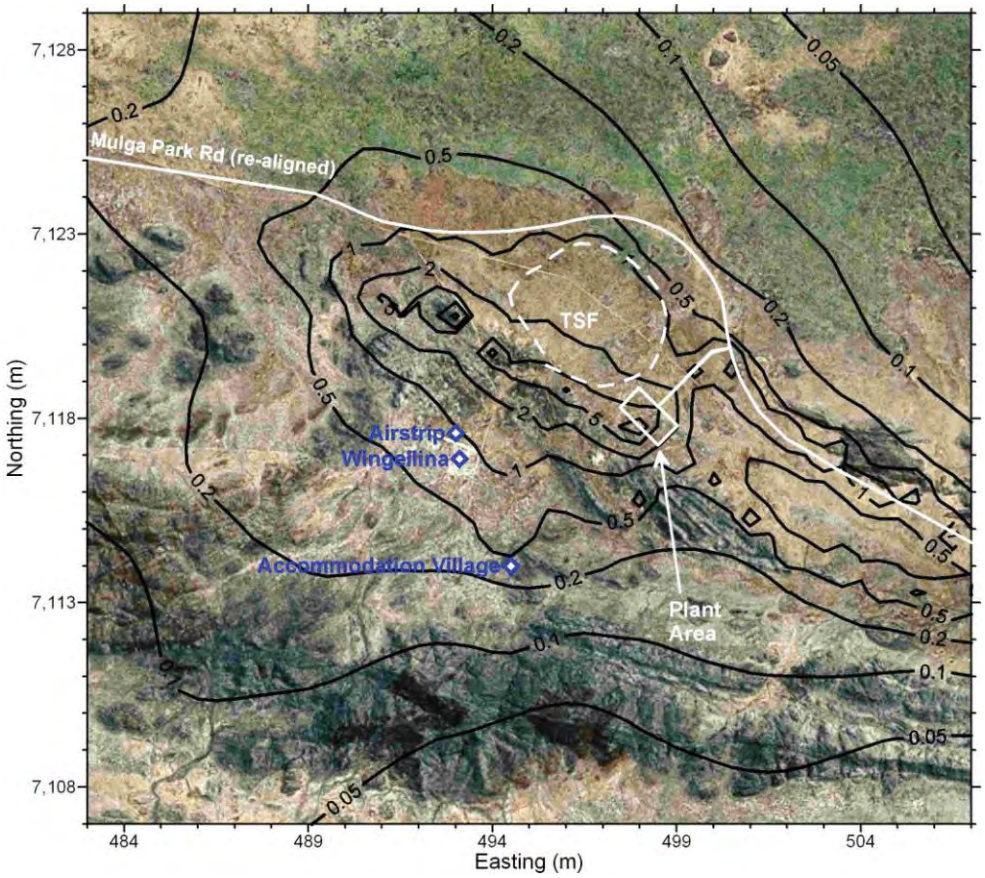

Figure 6-14 Predicted annual average $PM_{2.5}$ concentrations (µg/m^3) - Excluding background concentrations

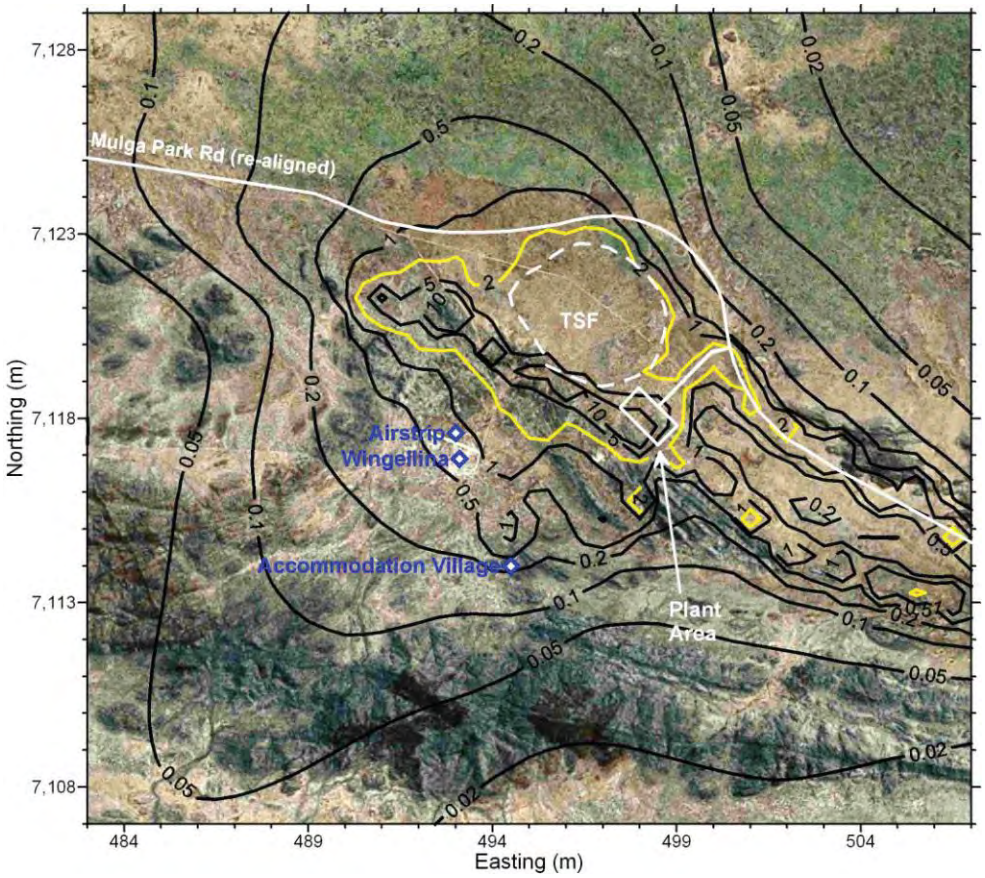

Figure 6-15 Predicted annual average particulate deposition (g/m^2/mth) expressed on a monthly basis. The yellow line is 2 g/m^2/mth criteria

Table 6-3 and **Table 6-4** and **Figure 6-9** to **Figure 6-15** indicate that:

- Particulate concentrations from the mining and tailings when including background levels are predicted to below the criteria at the nearest residential sites (Wingellina and the accommodation village);
- PM_{10} concentrations are predicted to be up to 64% of the 24-hour NEPM standard at Wingellina, with $PM_{2.5}$ concentrations at 39 and 79% of the 24-hour and annual average reporting standard respectively. Note the $PM_{2.5}$ standards are reporting standards are to facilitate the collection of data and are not health standards as per the other NEPM standards. The majority of the annual $PM_{2.5}$ concentrations are from background particulate with a relatively small contributions from the operations; and
- Particulate levels at the proposed accommodation village will be lower than at Wingellina due to the greater distance from the operations and siting to the south resulting in the particulate concentrations decreasing relatively rapidly in this direction due to the infrequent northerly winds. Maximum 24-hour PM_{10} levels are 46% of the NEPM standard with 24-hour and annual $PM_{2.5}$ concentrations at 39 and 74% of their respective reporting standards.

Note that in interpreting the results the predictions are to a degree indicative, due primarily to the uncertainty in estimating fugitive dust emissions. Therefore the model results should not be seen in terms of strict acceptance/ non acceptance, but indicative of areas of concern. In cases where the predicted levels of airborne contaminants are well below conventional air quality standards, it can be assumed that no extraordinary management controls are likely to be required. Where modelled results show worst case contaminant levels near or above conventional air quality standards, specific management controls should be defined and/or monitoring programs implemented to confirm the model predictions.

7 Conclusions

This report presents an assessment of the air quality from the proposed Wingellina Nickel Project. Major sources of atmospheric emissions will be the 4,400 tpd acid plant, fugitive dust from the mining operations and waste and tailings storage facilities and to a lesser extent, emissions from power generation. The assessment has been conducted using:

- Emission estimates from the plant as provided and where not available from best estimates from similar plants
- Fugitive particulate emissions estimated from emission factors, plans of the site and proposed operational data. For the fugitive dust estimates, generally conservative assumptions, such as size of the exposed areas and the moisture content of the material have been used;
- Use of onsite meteorological data from air quality grade weather station at Wingellina; and
- The model TAPM for modelling plant emissions, including importantly the 60 m acid plant stack and CALPUFF for modelling fugitive particulate dispersion.

Model predictions from the plant emissions indicate that:

Normal Operations

- With the acid plant operating, the predicted concentrations will be below the criteria at all locations with the 2nd highest 1-hour SO_2 concentration being closest to its criterion at the residential areas (33% of the criteria at Wingellina and 32% at the accommodation village). At any location, 3 km south of the plant away from residential areas, the maximum is 54% of the NEPM, though the NEPM does not strictly apply; and
- When the acid plant is off-line and the operations utilise steam from the boilers, the contribution from plant is very low, at most 1.6% and 1.2% of the NO_2 1-hour NEPM standard at the accommodation village and Wingellina respectively. Including background concentrations, the maximum concentrations are at most 26% of the NEPM PM_{10} standard, though with the plant contributing only 0.3% of the NEPM standard.

Start Up of Acid Plant

- During start up of the acid plant, the pollutant predicted to be closest to its respective criterion is SO_2. The 2nd highest 1-hour concentration predicted anywhere is 417 $\mu g/m^3$ which is 73% of the NEPM standard. At residential areas where the NEPM standard would apply, the 2nd highest 1-hour concentration is about 300 $\mu g/m^3$ or about 53% of the NEPM standard at the accommodation village and 230 $\mu g/m^3$ or about 40% of the NEPM standard at Wingellina;
- The maximum 1-hour SO_2 concentration predicted is 660 $\mu g/m^3$ occurring 3 kilometres south of the plant. This is predicted to occur under mid morning light wind, low mixing height conditions as per that for normal operations. Such a high concentration is very unlikely to occur as the acid plant start up is estimated to occur for only 5 times per year for 2 to 3 hours each. As such, the probability of a start-up hour (under 15 hours per year) occurring for this worst case hour (one in 8760 hours) is extremely unlikely; and

- All other concentrations are predicted to be low during start up, with the plant contributing at most 5% of their respective criterion at either the accommodation village or Wingellina.

Fugitive Particulate

- Particulate levels from the mining and tailings are predicted to below the criteria at Wingellina and the proposed accommodation village;
- PM_{10} concentrations are predicted to be up to 64% of the 24-hour NEPM standard at Wingellina, with $PM_{2.5}$ concentrations at 39 and 79% of the 24-hour and annual average reporting standard. Note the $PM_{2.5}$ standards are reporting standards to facilitate the collection of data and are not health standards as per the other NEPM standards. Additionally, the majority of the annual $PM_{2.5}$ concentrations are from background particulate with a relatively small contribution from the operations; and
- Particulate levels at the proposed accommodation village will be lower than at Wingellina due to the greater distance from the operations and siting to the south resulting in the particulate concentrations being less in this direction due to the infrequent northerly winds. Maximum 24-hour PM_{10} levels are 46% of the NEPM standard with 24-hour and annual $PM_{2.5}$ concentrations at 39 and 74% of their respective reporting standards.

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GREENHOUSE EMISSION ESTIMATION AND REPORTING ADVICE FOR WINGELLINA NICKEL PROJECT

JANUARY 2011

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EXECUTIVE SUMMARY

Greenbase Ltd was engaged by Outback Ecology who have been contracted to prepare a Public Environmental Review (PER) on behalf of Hinckley Range Pty Ltd for the Wingellina Nickel Project. Hinckley Range is a wholly owned subsidiary of Metals X Limited.

The scope of this report includes estimates of:

- Greenhouse gas emissions for the whole of the operations from mine to port involved in the Wingellina Nickel Project over a 20 year mine life;
- an assessment of expected types of NPI emissions under NPI guidelines; and
- an assessment of whether the Wingellina Nickel Project will be required to report under the NPI, NGER, CPRS and EEO programmes.

The CO_2-e emission during normal operation for Wingellina is estimated to be 499.3 kt/yr.

Activities taken into account included:

- ore processing,
- electricity production,
- sulphur transport,
- mixed hydroxide precipitate (MHP) transport,
- calcrete mining and transport operations,
- other materials transport and
- miscellaneous (clearing, diesel generator and pumping for water supply).

An uncertainty assessment was also undertaken to determine a maximum and minimum range of CO_2-e emissions. The graph below represents the bounds of uncertainty on the estimation.

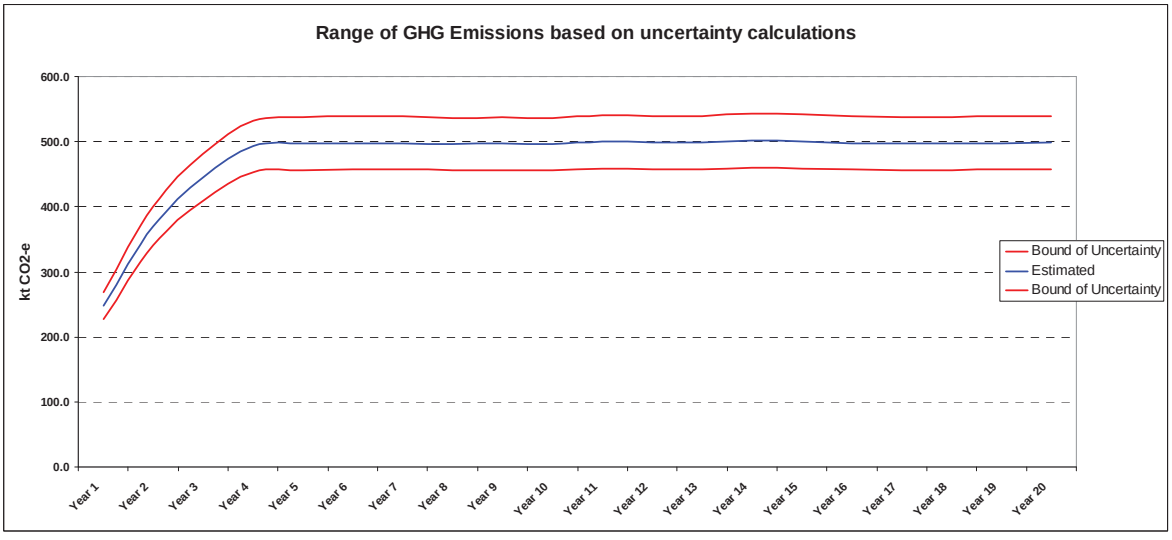

Figure 1: Contribution of activities on CO_2-e emissions

The assessment of the NPI substances that will need to be reported on can be found in Section 3.2. The Wingellina Nickel Project is expected to have to participate and report in NPI, NGER, CPRS and EEO programmes, more detail can be found in Section 3.3

1.0 INTRODUCTION

This Report has been produced by Greenbase Ltd on behalf of Outback Ecology who have been contracted to prepare a Public Environment Review (PER) for Hinckley Range Pty Ltd (Hinckley Range) which is a wholly owned subsidiary of Metals X Limited (Metals X).

1.1 BACKGROUND

The Wingellina Nickel Project is designed around a high quality nickel laterite deposit located near Wingellina on the West Australian border where it meets with the South Australian border and the Northern Territory border, also known as Surveyor's Corner. The Nickel plant plans to process 4.3 Mtpa of ore using a High Pressure Acid Leach (HPAL) process to extract the metal from the ore. The Wingellina Nickel project will utilise large quantities of calcrete for acid neutralisation. This is expected to be sourced from a calcrete mine 22km from Wingellina inside the South Australian border.

1.2 SCOPE OF WORK

The work completed for this report is as follows;

i) An estimate of greenhouse gas emissions (GHG) for the Wingellina Nickel Project as outlined by the Wingellina Nickel Project Environmental Scoping Document for a mine life of 20 years;

ii) An assessment of the potential NPI emission types that may be emitted from Wingellina Nickel Project during operation; and

iii) An assessment of whether the Wingellina Nickel Project will be required to report under the NPI, NGER, CPRS and EEO programmes.

2.0 METHODOLOGY

2.1 DATA ACQUISITION

Greenbase acquired most of the required data upon request from Outback Ecology. The data came in the form of: spreadsheets describing inputs and outputs; an *Environmental Scoping Document* (ESD); parts of the draft PER; and a mining feasibility study undertaken by Coffey mining on behalf of Hinckley.

2.2 GREENHOUSE GAS EMISSIONS

Greenbase has estimated the greenhouse gas emissions using the methods and emission factors provided by the NGER (Measurement) Determination 2008, with the exception of clearing and rehabilitation emissions where the National Carbon Accounting Toolbox has been used. The definition of the activities for which the estimations were undertaken was determined from the ESD provided by Outback Ecology.

Greenbase has estimated the fuel usage of the transport and mining activities from operating data provided in the ESD and Coffey mining study.

3.0 RESULTS

3.1 GREENHOUSE GAS EMISSIONS ESTIMATES

The GHG emissions estimations were broken down into eight different activities listed in order of magnitude: ore processing; electricity produced; sulphur transport; Ni-Co ore mining; MHP transport; calcrete operations; other transport; and miscellaneous representing clearing, an auxiliary diesel generator and pumping.

Table 1 below shows a summary of the average emission of each activity over the fully operational period of the mine life, while Figure 2 shows a percentage breakdown of each activity based on average emissions once the mine is fully operational.

Activities	Average kt CO2-e
Ore Processing	303.3
Electricity Produced	135.3
Sulphur Transport	21.5
Ni-Co Ore Mining	13.2
MHP Transport	11.8
Calcrete Operations	4.9
Miscellaneous	5.0
Other Transport	4.3
Total	499.3

Table 1: Average emissions of defined activities

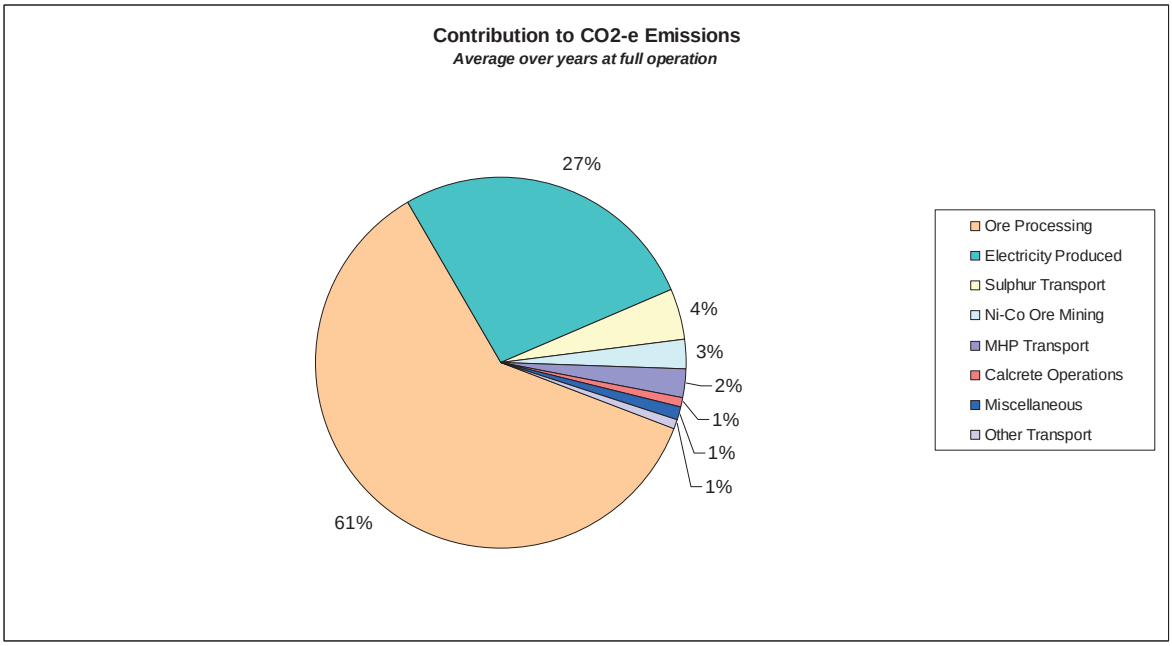

Figure 2: Breakdown of emissions by activity

The year by year breakdown of all activities estimated can be seen below in Figure 3.

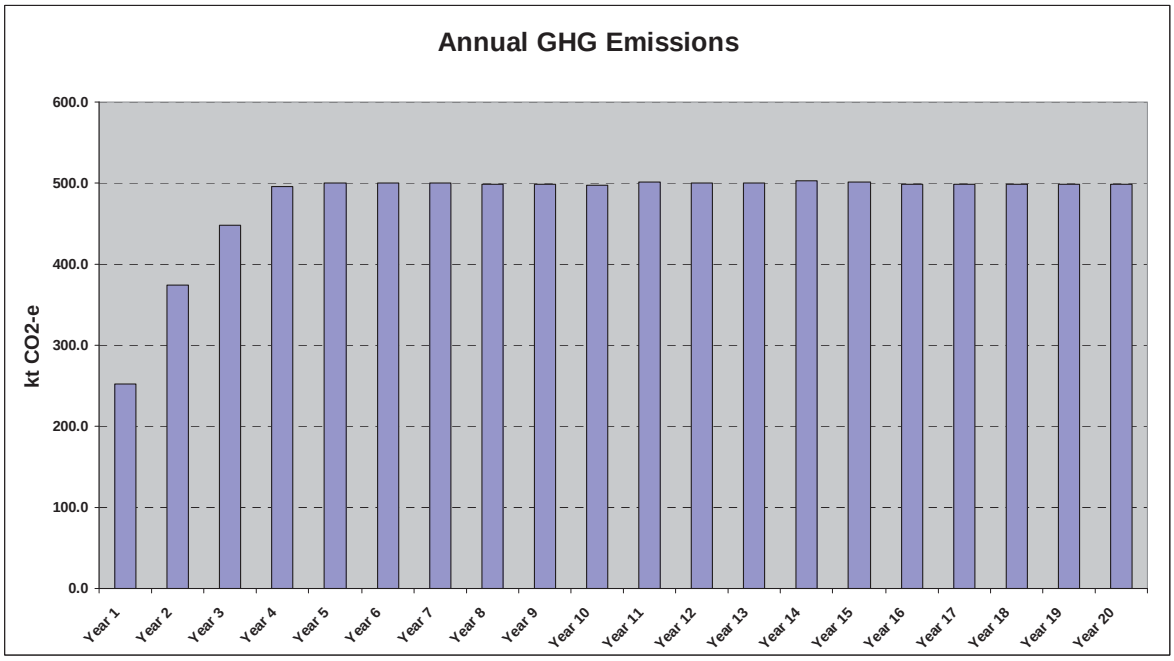

Figure 3: Annual CO_2-e emissions

After these initial estimations were completed an uncertainty study was undertaken to create a range for the amount of emissions Wingellina Nickel Project would emit. The uncertainties were calculated in accordance with NGER (measurement) Determination 2008. Figure 4 below shows the bounds of uncertainty on our initial estimation.

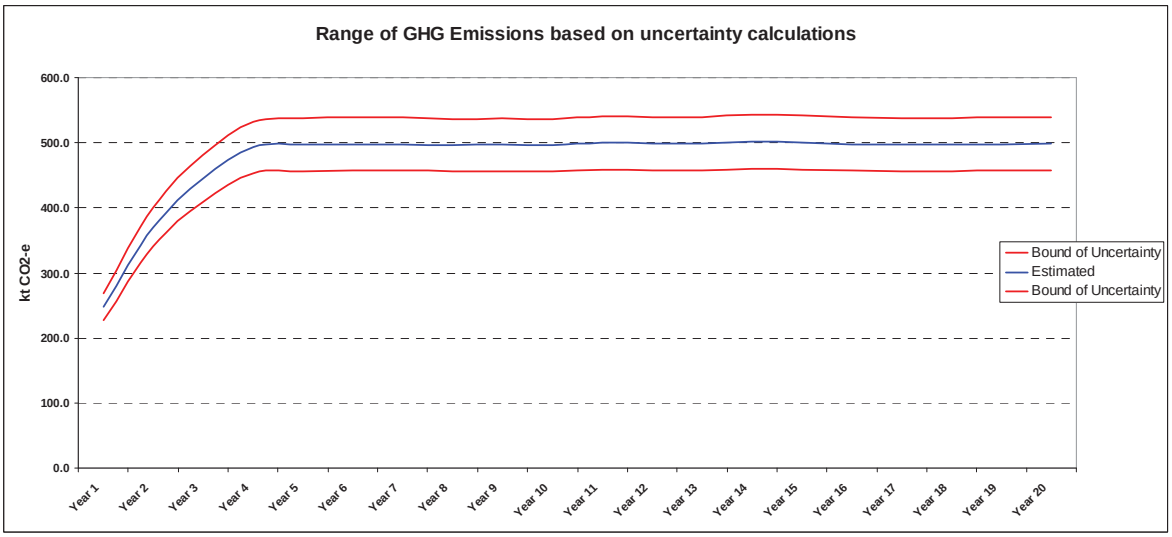

Figure 4: Bounds of uncertainty on initial estimation

3.2 POTENTIAL EXPECTED NPI EMISSION TYPES

The Wingellina Nickel Project should be expected to emit the following NPI substances during operation. The first section of Table 2 lists the substances that will require reporting while the second section has substances which may possibly require reporting.

Table 2: Expected Reportable NPI Emissions

Substances Will be required to report	Categories	Category and Probable Thresholds Tripped
Arsenic & compounds	1&2b	2b, 60000 MWh or rated at 20 MW
Beryllium & compounds	1&2b	2b, 60000 MWh or rated at 20 MW
Cadmium & compounds	1&2b	2b, 60000 MWh or rated at 20 MW
Carbon monoxide	1,2a,2b	1, 10 tonnes/yr 2a, 1 tonne/hr 2b, 60000 MWh or rated at 20 MW
Chlorine & compounds	1	1, 10 tonnes/yr
Chromium (III) compounds	1&2b	1, 10 tonnes/yr 2b, 60000 MWh or rated at 20 MW
Chromium (VI) compounds	1&2b	1, 10 tonnes/yr 2b, 60000 MWh or rated at 20 MW
Cobalt & compounds	1	1, 10 tonnes/yr
Copper & compounds	1&2b	1, 10 tonnes/yr 2b, 60000 MWh or rated at 20 MW
Fluoride compounds	1,2a,2b	1, 10 tonnes/yr 2a, 1 tonne/hr 2b, 60000 MWh or rated at 20 MW
n-Hexane	1	1, 10 tonnes/yr
Hydrochloric Acid	1,2a,2b	2b, 60000 MWh or rated at 20 MW
Hydrogen sulphide	1	1, 10 tonnes/yr
Lead & compounds	1&2b	1, 10 tonnes/yr 2b, 60000 MWh or rated at 20 MW
Manganese & compounds	1	1, 10 tonnes/yr
Mercury & compounds	1b&2b	1b, 5 kilograms/yr 2b, 60000 MWh or rated at 20MW
Nickel & compounds	1&2b	1, 10 tonnes/yr 2b, 60000 MWh or rated at 20 MW
Oxides of Nitrogen	2a,2b	2a, 400 tonnes/yr or 1 tonne/hr 2b, 60000 MWh or rated at 20 MW
Particulate matter (PM_{10})	2a,2b	2a, 400 tonnes/yr or 1 tonne/hr 2b, 60000 MWh or rated at 20 MW
Particulate matter ($PM_{2.5}$)	2a,2b	2b, 60000 MWh or rated at 20 MW
Polychlorinated dioxins and furans	2b	2b, 2000 tonnes/yr or 60000 MWh or rated at 20MW
Polycyclic aromatic hydrocarbons	2a,2b	2a, 400 tonnes/yr or 1 tonne/hr 2b, 60000 MWh or rated at 20 MW
Sulphur dioxide	1,2a,2b	1, 10 tonnes/yr 2a, 1 tonne/hr 2b, 60000 MWh or rated at 20 MW
Sulphuric acid	1	1, 10 tonnes/yr
Total Volatile Organic Compounds	1a,2a,2b	1a, 25 tonnes per year 2a, a design capacity of 25 kilotonnes for bulk storage facilities 2b, 60000 MWh or rated at 20 MW

Zinc & compounds	1	1, 10 tonnes/yr
Will possibly be required to report		
Antimony & compounds	1	1, 10 tonnes/yr
Boron & compounds	1	1, 10 tonnes/yr
Chlorine dioxide	1	1, 10 tonnes/yr
Cumene	1	1, 10 tonnes/yr
Ethylbenzene	1	1, 10 tonnes/yr
Selenium & compounds	1	1, 10 tonnes/yr
Toluene	1	1, 10 tonnes/yr
Xylenes	1	1, 10 tonnes/yr

NPI has a total of 93 listed substances. In Table 2 there are 26 substances that Wingellina should expect to report and 8 substances that possibly may require reporting.

3.3 FUTURE RESPONSIBILITIES FOR CORPORATE AND FACILITY REPORTING

3.3.1 NATIONAL POLLUTANT INVENTORY (NPI)

The National Pollutant Inventory requires facilities to report on their usages and emissions of 93 substances. Full detail of the thresholds required can be found in the NPI Guide.

Based on the data available and our understanding of the processes and activities involved we expect Hinckley Range will be required to report Wingellina Nickel Project's emissions to the NPI program every year during the mine sites operation. The substances that will be expected to be reported are shown in section 3.2, Table 2.

It's expected that Wingellina will be required to report the calcrete operations as a separate facility for the purposes of the NPI due to the distance from the nickel mine and it's location in another state.

3.3.2 NATIONAL GREENHOUSE AND ENERGY REPORTING (NGER)

The National Greenhouse and Energy Reporting (NGER) scheme is a currently legislated program that requires corporations emitting more than 25 kt of greenhouse gasses or consuming more than 100TJ of energy to register and report their energy consumption, production and greenhouse gas emissions.

Based on the emissions estimations in this document it is anticipated that Metal X will need to register for the NGER program and be involved at a corporate level. This could also require other activities under Metal X's operational control to be reported.

3.3.3 CARBON POLLUTION REDUCTION SCHEME (CPRS)

The Carbon Pollution Reduction Scheme (CPRS) would attach a cost to the emission of all carbon dioxide or equivalents in Australia. Large corporations would be required to participate directly in the program with smaller emitters being involved indirectly.

As of writing this report in Jan 2010 the CPRS in its current form is not being considered by the current Labor Government and has not attained royal assent. There is political uncertainty as to when and how any future Carbon Tax or Emission Trading Scheme (ETS) will operate.

Under the draft CPRS legislation released by the Labor Government in 2008 Hinkley Range Pty Ltd would have been required to register under the CPRS and be liable for some form of carbon tax.

3.3.4 ENERGY EFFICIENCY OPPORTUNITIES (EEO)

The Energy Efficiency Opportunities program requires corporations to report on their current energy use and assess their opportunities to improve the efficiency of their energy use. Corporations that use more than 500TJ are required to register and report.

It's expected that Wingellina Nickel Project will exceed the 500TJ energy consumption threshold and will require Metal X to report under the program.

4.0 CONCLUSIONS

The Wingellina Nickel Project's total emissions for the 20 year lifetime of the project, including all activities are estimated to be 5.9 million tonnes CO2-e. The CO2-e emissions during normal operation for Wingellina are estimated to be 499.3 kt per year with the maximum and minimum bounds of uncertainty estimated at 540.3 kt and 458.6 kt.

Under the NPI programme, emission of substances detailed in Table 2 of Section 3.2 are anticipated to trip the various NPI thresholds, with substances that are possibilities but not certainties shown in the bottom section of Table 2.

APPENDIX A – ACTIVITY BREAKDOWN PER YEAR*

EMISSIONS	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Ore Processing	151.6	227.5	273.0	303.3	303.3	303.3	303.3
Electricity Produced	67.7	101.5	121.8	135.3	135.3	135.3	135.3
Sulphur Transport	10.8	16.1	19.4	21.5	21.5	21.5	21.5
Ni-Co Ore Mining	4.9	7.2	9.0	9.9	14.2	13.1	12.9
MHP Transport	5.9	8.8	10.6	11.8	11.8	11.8	11.8
Calcrete Operations	1.7	2.6	3.2	3.4	3.4	5.1	5.1
Miscellaneous	7.1	7.1	7.1	6.3	5.9	5.6	5.4
Other Transport	2.1	3.2	3.8	4.3	4.3	4.3	4.3
TOTAL ktonnes CO_2-e	251.8	374.0	448.0	495.8	499.7	500.0	499.6

Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
303.3	303.3	303.3	303.3	303.3	303.3	303.3	303.3	303.3	303.3	303.3	303.3	303.3
135.3	135.3	135.3	135.3	135.3	135.3	135.3	135.3	135.3	135.3	135.3	135.3	135.3
21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5
11.6	12.7	11.2	14.8	13.6	13.5	16.7	15.4	13.1	12.4	12.2	13.2	13.4
11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8
5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1
5.2	5.1	5.0	4.9	4.8	4.7	4.7	4.6	4.6	4.5	4.5	4.5	4.4
4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3
498.1	499.1	497.5	501.0	499.8	499.6	502.6	501.3	499.0	498.3	498.1	499.0	499.2

***Numbers shown are rounded for convenience, for more exact numbers please request the spreadsheet.**

APPENDIX B – METHODS REFERENCE TABLE

GIMS CODE	GIMS TITLE	PAGE REFERENCE
66-5-2-1	Emissions of carbon dioxide from the combustion of natural gas (Method 2)	NGER Determination 2008 p.49-56
66-7-4-1	Emissions of GHGs from combustion of diesel oil for non-transport uses (Method 1)	NGER Determination 2008 Schedule 1 part 3, item 40
66-15-4-1	Emissions of GHGs from combustion of diesel oil for transport uses (Method 1)	NGER Determination 2008 p.206-207
66-153-4-1	Greenhouse gas emissions from industrial processes involving the calcination of carbonates (Method 3)	NGER Determination 2008 p.128-129
60-1-5-1	Estimating greenhouse gas emissions from land use clearing using FullCam model using modelling	National Carbon Accounting Toolbox p.117

SNC·LAVALIN

HEALTH IMPACT ASSESSMENT

WINGELLINA NICKEL PROJECT

METALS X LIMITED

ENVIRONMENT & WATER

03 | 09 | 2015

REPORT
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HEALTH IMPACT ASSESSMENT

WINGELLINA NICKEL PROJECT

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EXECUTIVE SUMMARY

The Wingellina Nickel Project (the Project) proposes the construction and operation of an open pit mine extracting nickeliferous limonite ore. The Project site is located in Western Australia, approximately 1,450km east northeast of Perth.

The existing Wingellina Township (or Irrunytju Community) is typical of a remote, desert Aboriginal settlement and is the closest existing resident population to the Project site. The nearest planned mining pit is located approximately two to three kilometres (km) from the Wingellina Township. The Project site is located on land within the Determined Ngaanyatjarra Lands under Native Title Claim (WC04/03).

The Township was initially erected as an exploration camp in the mid-1950s by Southwestern Mining Co and was then occupied after the company vacated the Ngaanyatjarra Lands. The Irrunytju Community established a permanent community using the existing infrastructure left from the pre-existing mine-camp. The town was incorporated in 1976, receiving significant funding from the Commonwealth Government to fund necessary repairs and expansion to facilitate permanent settlement.

In 2012, URS were engaged to prepare a Social Impact Management Plan (SIMP), documenting the current social environment and existing socio-economic landscape for this Aboriginal Community. The SIMP profiled the existing community, documented existing health issues, identified social indicators and recorded community and stakeholder consultation undertaken during preparation of the SIMP. The report concluded that the quality of housing and infrastructure was poor and neglect over time has attributed to a number of key health hazards and outcomes.

The community's socio-economic situation can be attributed to a number of existing issues such as the remote location, poor living conditions, limited access to essential social services and lack of infrastructure. Low levels of income, limited employment opportunities and inadequate access to health and education services demonstrate a population that is very disadvantaged and vulnerable.

The aim of this Health Impact Assessment (HIA) is to apply a general risk assessment framework that recognises the existing health profile for Wingellina and to identify the likely risks and benefits for the residents of this community resulting from the construction and operation of the Project over the mine's projected lifespan of 40 years.

The HIA uses a health determinants assessment approach to compare existing conditions with that of predicted Project impacts across seven identified categories, each conducive to health. A health risk assessment (HRA) on the Wingellina town was undertaken for this project on specific environmental health hazards. The HRA identified, air quality (specifically exposure to Nickel in dust) and noise as presenting the highest potential risks associated with the development and rated these as medium to low. The HRA concluded these potential risks can be adequately managed through project design, construction and operational environmental management plans, best practice operational procedures

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protective of environmental and health factors with ongoing monitoring and reporting during the operational phase.

The Project has the potential to implement a number of positive outcomes, or at least influence positive impacts on the socio-economic landscape for the community through compensation payments and other investment initiatives aimed at improving infrastructure as documented in the 'Wingellina Project Agreement'. Opportunities for local employment and business ventures, as well as wider participation in training and development programs will aim to improve skills, job-readiness and potentially increase income levels and thus provide positive outcomes for members of the community. The flow-on effects of these positive outcomes may in turn generate further improvements to current living conditions through highlighting the current gaps faced by this community in anticipation of better coordination of services (such as infrastructure maintenance programs and better access to currently lacking health services).

Table S1 provides the key mitigation measures and management strategies to be employed by the proponent, some measures requiring support from all levels of Government to improve the socio-economic and health outlook for this vulnerable community. It is noted that these mitigation measures are considered key measures and actions, but do not represent an exhaustive list. These key measures are consistent with the various technical studies completed for the Project, namely the Social Impact Management Plan, Air Quality Impact Assessment and Noise and Vibration Impact Assessment.

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Health Aspect/ Impact	Risk/ benefit rating (--ve or +ve impact)	Key Management Measures *(not this is not an exhaustive list, but aims to address key management strategies and actions)*	Pre-construction	Construction	Operation	Residual risk/ benefit rating
Air Quality	Medium (-ve)	• Air Quality Management Plan which includes and an air quality monitoring schedule in line with routine and non-routine maintenance events such as start-up and shut down of HPAL plant and at-boundary monitoring of dust from ROM and TSF areas. Included in the Air Quality Management Plan will be an appropriate dust management plan (DMP) to include monitoring for PM10 and Nickel dust using hi-volume air samplers (HVAS). The location of HVAS to include representative sensitive receiver locations. • Dust sampling regime and analysis would be carried out in accordance with the relevant Australian Standards and EPA approved methodology so that results are compared against the existing WA health guidelines. • Dust suppression measures on unsealed roads, stockpiles, TSF and ROM areas. • A continuous emissions monitoring system (CEMS) will be operated to monitor stack emissions. • Soil stockpiles to be covered and exposed soils reseeded/revegetation where possible. • Complaints register and response process for managing emission as described in the Air Quality Management Plan (Appendix 1).	✓	✓	✓	Low
Noise and Vibration	Low (-ve)	• Construction Noise and Vibration Management Plan. • Operational Noise and Vibration Management Plan (no air-blasting or noisy activities during Aboriginal cultural events such as funerals).	✓	✓	✓	Low to Very Low

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Health Aspect/ Impact	Risk/ benefit rating (--ve or +ve impact)	Key Management Measures *(not this is not an exhaustive list, but aims to address key management strategies and actions)*	Pre-construction	Construction	Operation	Residual risk/ benefit rating
Contaminated land and water (surface and groundwater) quality	Very Low (±ve)	• Construction Soil and Water Management Plan with Spill Management procedures and management of chemical storage areas and refueling locations according to relevant safety and environmental protection legislation. • Mine design to include levees at pits, contained drainage to avoid contamination of existing surface water and groundwater and stockpiles away from streamlines. • Waste disposal areas constructed outside of known drainage lines with contained drainage discharging into sediment sump. • Groundwater monitoring bores and routine groundwater monitoring program.	✓	✓	✓	Very Low
Visual Amenity (light)	Low (-ve)	• Design measures to reduce lightspill and appropriate location of infrastructure to minimise light emissions on sensitive receivers. • Constructions measure such as light shields to minimise illumination levels.		✓	✓	Very Low
Biodiversity and natural resources	Low (±ve)	• Minimising clearing footprint and complete clearing in progressive manner to reduce bare soils (subject to wind erosion and dust generation). • Vehicle access to be within cleared footprint to reduce impacts on flora, reduce spread of weeds and control any potential fire sources. • Construction Environmental Management Plan to include Flora and Fauna Management Plan.	✓	✓	✓	Low

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Health Aspect/ Impact	Risk/ benefit rating (--ve or +ve impact)	Key Management Measures *(not this is not an exhaustive list, but aims to address key management strategies and actions)*	Pre-construction	Construction	Operation	Residual risk/ benefit rating
Waste Management	Low (±ve)	• Construction and Operational Waste Management Plan which include heirarchy of waste (avoid, reduce, reuse and recycle). • Waste to be handled and disposed of appropriately during construction and operational phases.		✓	✓	Very Low
Access to transport	Medium (±ve)	• Traffic Management Plan. • Traffic Control measures to avoid conflict with pedestrian, motorists and other road users. • Road safety campaign to educate primary and secondary student. • Project transport routes to avoid existing township.	✓	✓	✓	Low
Feelings of trust	Medium (+ve)	• Early and ongoing consultation with Aboriginal stakeholders to actively engage with the community to protect cultural values, sites and places through cultural awareness training delivered by senior Ngaanyatjarra Lands people. • Emphasis should be placed on all employees to be 'good neighbours', employees (construction and operations) to be aware of and not enter heritage exclusion zones. • Formation of the Implementation and Review Committee acting as a forum to consult with Ngaanyatjarra Lands People and maintain good relationship with the Irrunytju Community from the outset ensure success during all stages of the Project. • Undertake all of the relevant SIMP recommendations.	✓	✓	✓	Low

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Health Aspect/ Impact	Risk/ benefit rating (--ve or +ve impact)	Key Management Measures *(not this is not an exhaustive list, but aims to address key management strategies and actions)*	Pre-construction	Construction	Operation	Residual risk/ benefit rating
Recreational facilities	High (+ve)	• Wingellina Project Agreement to include investment in improved community facilities. This would also include mechanisms for coordination and communication with State and Federal departments and local councils to fund infrasturcture improvements beyond the Project investments.	✓			Low
Support for local businesses	High (+ve)	Implement all relevant SIMP recommendations including: • Preparing a Contracting and Procuring Strategy aimed at the Ngaanyatjarra Lands people. • Work with Ngaanyatjarra Lands businesses and develop a Communications Strategy that inform the Ngaanyatjarra Lands people about business development opportunities. • Prepare and Implement Aboriginal Employment Strategy.	✓		✓	Low
Employment, Income, Training and Education,	High (+ve)	• Prepare and Implement Aboriginal Employment Strategy that enables the employment of suitably qualitfied Ngaanyatjarra Lands people and includes flexible work proactices that encourage Aboriginal participation. • Traineeships for youth and identification of all levels of skills required, including low-level skills such as seed collection and fencing. • Mentor and support school students and improve work-readiness.	✓		✓	High

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Health Aspect/ Impact	Risk/ benefit rating (--ve or +ve impact)	Key Management Measures *(not this is not an exhaustive list, but aims to address key management strategies and actions)*	Pre-construction	Construction	Operation	Residual risk/ benefit rating
Infrastructure and housing and better access to health services	High (+ve)	• If relocation of existing township does not occur, then investment by MetalsX or proponent in improving housing and community infrastructure. • Proponent to sponsoring training in building repairs and maintenance to help local community maintain their own houses where relevant. • Encouraging the community/MetalsX to fund through compensation payments and Wingellina Project Agreement new facilities or improvement to existing structures. • Coordination and communication with state and federal government department and local councils (as noted in the SIMP) to facilitate combined efforts to improve current infrastructure.	✓	✓	✓	Low
	Low (+ve)	• If relocation of existing township does not occur, then investment by MetalsX in improving housing and community infrastructure, including health facilities.	✓	✓		Low

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The results of the risk assessment across the determinants of health for the Irrunytju community at Wingellina are shown in Figure S1. These determinants of health were initiated by the Western Australian Department of Health with sub categories selected according to relevance for the existing Wingellina Township and the Project. The residual risk ranking takes into consideration mitigation measures applied and the Project outcomes are compared to the existing Wingellina conditions (baseline), as well as in comparison to the National Health indicators for the wider Australian non-Indigenous and Indigenous populations.

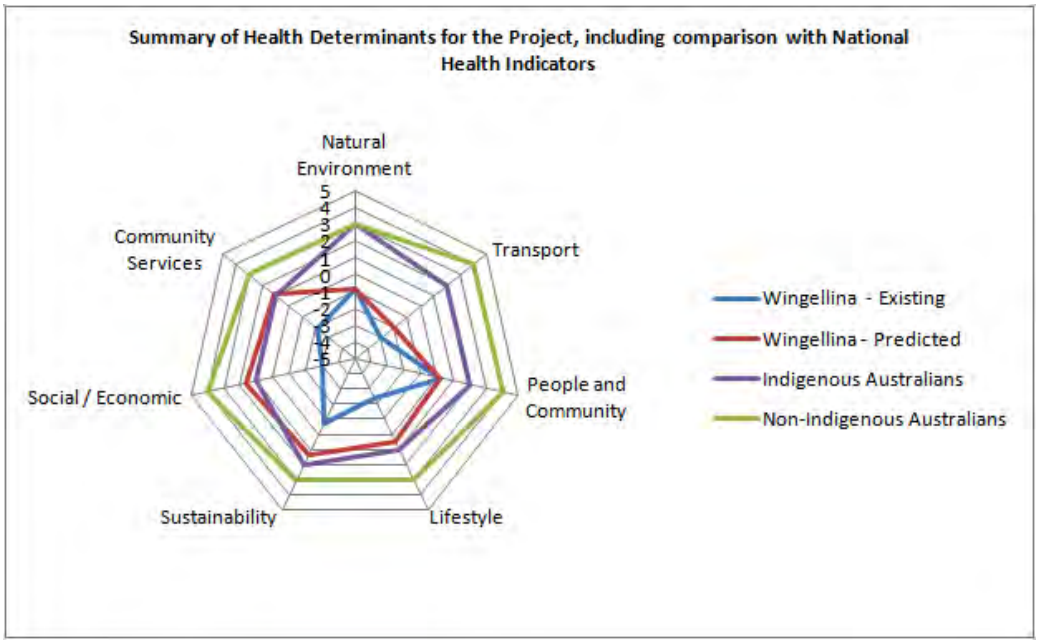

Figure S1 Overall Health Determinants

Figure S1 shows that with adequate mitigation measures in place, the Project will have a positive impact overall for the Wingellina Township, with significant benefits shown across five of the seven health determinant categories. There are some negative impacts on the Natural Environment as a result of the Project however these impacts can be managed through environmental management plans to reduce the impact to a lower level, neutral.

The greatest areas of improvement will be achieved through the Social Environment, with expected increases in income, better housing/infrastructure conditions, improved employment status and accessible training/education programs compared to existing conditions. Despite this, comparison against National Health indicators demonstrates that the Irrunytju Community at Wingellina are still likely to experience health status levels below that of the national health standards for both Non-Indigenous and Indigenous Australian populations, due largely to the remote location.

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In summary, the proposed mine development is likely to improve the overall health of the existing Irrunytju Community compared to existing health and socio-economic conditions, and as such the Project on-balance presents more benefits than risks for this population.

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Appendix 1 Air Quality Impact Assessment Findings

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GLOSSARY

Acronym / Term	Definition
AEF	**Australian exposure factors**
AQGs	**WHO Air Quality Guidelines**
Cd	**Cadmium**
CEO	**Chief Executive Officer**
Cr	**Chromium**
Cr IV	**Hexavalent chromium**
CR1	**Central Ranges Subregion**
Cu	**Copper**
dB	**Decibel**
dB(A)	**A weighted Decibel**
DEC	**Department of Environment and Conservation (DEC)**
DO	**Dissolved oxygen**
ED	**Exposure Duration**
GL	**Gigalitres**
ha	**hectare**
HPAL	**High Pressure Acid Leachate**
HRA	**Health Risk Assessment**
IRIS	**US EPA Integrated Risk Information System**
Km	**Kilometre**
m	**metre**
mAHD	**elevation in metres with respect to the Australian Height Datum**
Mg/l	**Milligram per litre**
Mtpa	**Million Tonnes per Annum**
NEPM	**National Environmental Protection Measure**
NHMRC	**National Health and Medical Research Committee**
Ni	**Nickel**
NO	**Nitrous Oxide**
NO2	**Nitrogen Dioxide**
NOHSC	**National Occupation Health and Safety Committee**
NOx	**Oxides of Nitrogen**
Pb	**Lead**

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Acronym / Term	Definition
PM	**Particulate matter**
PM10	**Particulate Matter (10µm)**
PM2.5	**Particulate Matter (2.5µm)**
PPE	**Personal Protection Equipment**
ppm	**Parts per million**
RfD	**Oral reference dose**
ROM	**Run of Mine**
SMBS	**Sodium metabisulphite**
SO2	**Sulphur Dioxide**
SOx	**Oxides of Sulphur**
STEL	**Short term exposure limit**
TSF	**Tailings Storage Facility**
TSP	**Total suspended particulate**
TWA	**Time-weighted average**
US EPA	**United States Environment Protection Agency**
WHO	**World Health Organisation**
Zn	**Zinc**
µg/m3	**Micrograms per cubic metre**

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1.0 INTRODUCTION

The proposed Wingellina Nickel Project (the Project) located in Western Australia involves the development of a nickel mine through open pit mining of nickeliferous limonite ore. The mine would include on-site processing to produce an immediate mixed nickel-cobalt hydroxide product. Mine infrastructure would be developed to include tailings storage facility, mine accommodation, roads and various other components as part of the Project.

The nearest planned excavation pit is located two to three kilometres south west of the existing Wingellina Township. The potential risks to the existing Wingellina population resulting from the construction and operation of the Project were assessed and a draft Human Health Risk Assessment (HRA) document developed. A HRA (SNC, 2015) was completed for the Project which documented the potential health risks from reduced air quality and noise and vibration impacts associated with the Project, taking into consideration the background environmental conditions and existing socio-economic and poor health indicators. The HRA included a quantitative assessment on nickel exposure in windblown dust given air quality impacts presented the main negative health risk as a result of the Project.

1.1 Assessing Health and the Community

Koh (2011) notes that many sectors of society are unable to reach optimal health-levels because of ' *unnatural causes linked to economic, social, or environmental disadvantage. Such situations limit opportunities for good health choices*'. Koh notes that in addressing these health disparities, a better understanding of measures representing social, economic, educational, environmental, policy-oriented, cultural, and even spiritual dimensions of health is required. Health is therefore influenced by a variable range of factors, with these factors known as health determinants. Broad categories of health determinants include those related to the social and economic environment, physical environment and the person's individual characteristics and behaviours (WHO, 2014). The context of people's lives also determines their health. Vulnerable populations are generally unable to anticipate, cope with or resist issues such as poverty and remote-living conditions. Common elements may include poor nutrition, limited access to health services and poor housing. This HIA considers seven main determinants of health, as detailed in Section 4.

According to the enHealth Health Impact Assessment Guidelines (2001), a '*HIA is a process that systematically identifies and examines, in a balanced way, both the potential positive and negative health impacts of an activity.'*

The aim of this HIA is to apply a general risk assessment framework which considers the current health impacts affecting the existing Wingellina community resulting from their unique environmental, social and economic factors and related health determinants. The risk assessment identifies the likely risks and benefits resulting from the construction and operation of the Project and documents risk

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management recommendations and outcomes. This HIA therefore provides decision makers with options to strengthen and extend the features of a proposal to improve health outcomes.

This HIA draws upon the quantitative modelling and findings included in the various technical studies that have already been completed for the Project and provided in the Referral and Scoping document.

In-depth consultation was previously undertaken with members of the Wingellina Community and addressed health-related and socio-economic issues (refer to Sections 5.6 and 6.5). This consultation was recorded in the Social Impact Management Plan (SIMP) and was undertaken during 2011 and 2012. The HIA relies upon the outcomes and findings from the SIMP consultation noting additional consultation was not considered necessary for the purpose of this HIA. MetalsX has an ongoing and positive relationship with the existing Wingellina Community with much of the feedback received from the community during the SIMP believed to be consistent with the community's expectations and response to the Project currently.

1.2 The Wingellina Nickel Project

Hinckley Range Pty Ltd (Hinckley Range), a wholly owned subsidiary of Metals X Limited (MetalsX) is proposing to develop the Wingellina Nickel Mine (the Project) at a site located approximately 1450 km east-northeast of Perth. The Project will involve open pit mining of nickeliferous limonite ore and on-site processing using a high pressure acid leach (HPAL) process to produce an immediate mixed nickel-cobalt hydroxide product. The Project will involve the main operational elements of ore processing, tailings disposal, dewatering and groundwater abstraction.

The Project includes the development of mine infrastructure including internal service roads, buildings, processing plant, tailings facility, hardstand areas and other components supporting the mine's operation. The mine development also includes new road infrastructure, linking the mine to a rail siding for the transport of the nickel-cobalt hydroxide product to either the Port of Darwin or the Port of Adelaide.

The Project will involve the mining of approximately 4.3 million tonnes of nickeliferous ore per annum (Mtpa) within four years of commencement of operation and would operate 24 hours a day, seven days a week for 365 days per year. It is estimated the Project life would extend to 40 years based on the estimated size of the current reserves estimates for the ore body at Wingellina.

The proposed layout of the Project is provided in Figure 1. It is noted that the proposed layout is indicative, and may change upon further concept and detailed design phases. The layout gives an indication of the existing Wingellina Township's location in relation to the locality of various planned mine pits and infrastructure.

The Wingellina Township (also referred to as the Wingellina Community or Irrunytju Aboriginal Community) is located between two and three kilometres west-southwest from the nearest planned pit and five kilometres from the proposed HPAL

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processing plant. The Mine Accommodation (also referred to as the Mine Workers Camp) is planned to be located five kilometres south-west of the HPAL processing plant.

The existing Giles to Mulga Park Road is located to the north of the planned mine and will be re-routed during mine construction to be outside the boundary of the mine's operations.

As Figure 1 shows, there are heritage exclusion zones located to the south and west of the planned mine footprint and boundary. These exclusion zones will not be impacted upon during the mine's construction or operation.

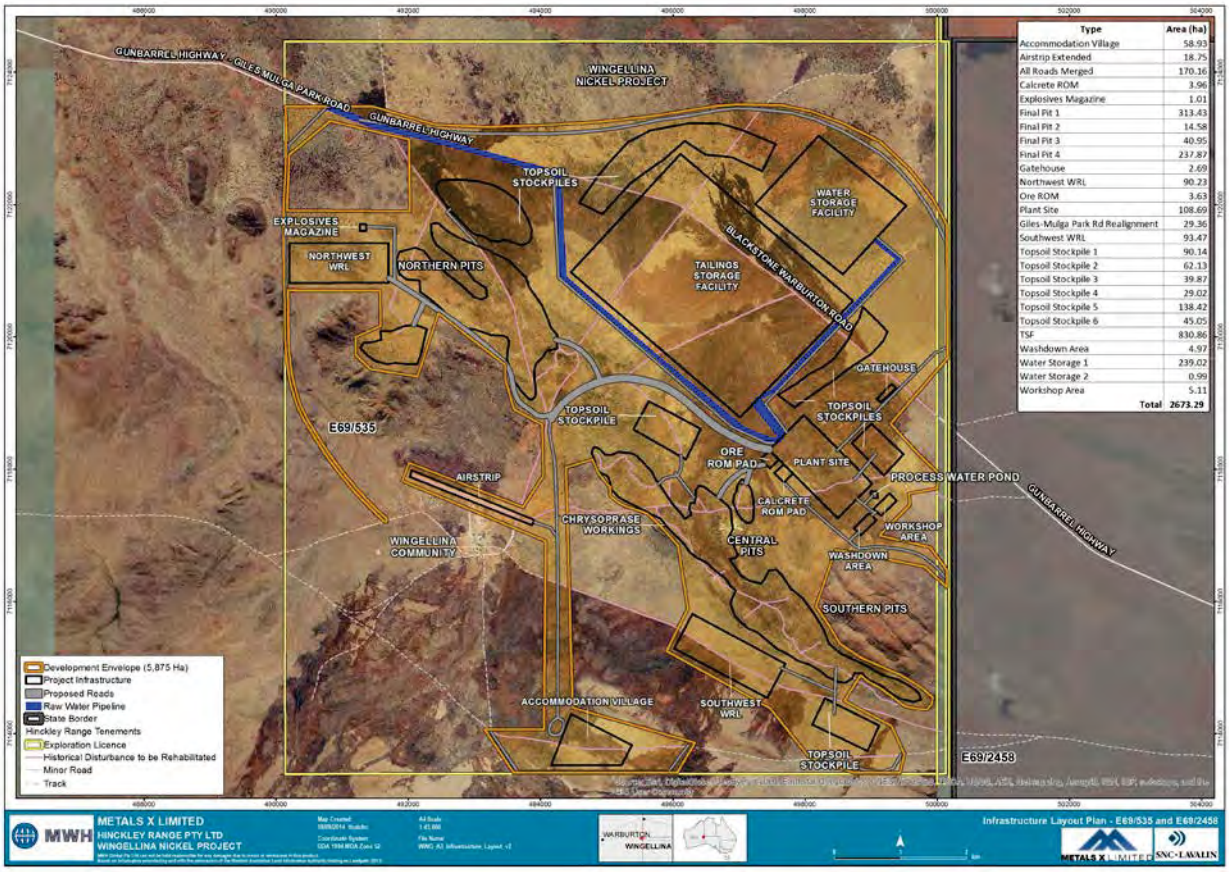

Figure 1 Footprint of the proposed mine and related infrastructure

1.3 Limitations

This HIA has a number of or gaps in data, particularly accurate data on health, education and the status of health services currently provided to the community. A number of assumptions are made in order to assess the current level of risks in comparison with predicted Project-induced risks. Publically available information regarding other similar mining projects in comparable locations (such as the Pilbara) and resulting health and socio-economic outcomes are used where

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possible to learn from and adopt similar management recommendations. There is also an element of subjective risk rating completed where information currently available on the existing community does not provide a clear level of health risk.

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2.0 PROJECT DESCRIPTION

2.1 The Project Site

The Project site is located approximately 1,450 km east-northeast of Perth within the Shire of Ngaanyatjarraku in Western Australia (refer to Figure 2). The Project is 8 km south west of Surveyor Generals' Corner which is located at the junction of the Western Australian, South Australian and Northern Territory borders. The Project is located entirely on Exploration Licence E69/535, Aboriginal Reserve 17614 and is within the Ngaanyatjarraku Indigenous Protected Area.

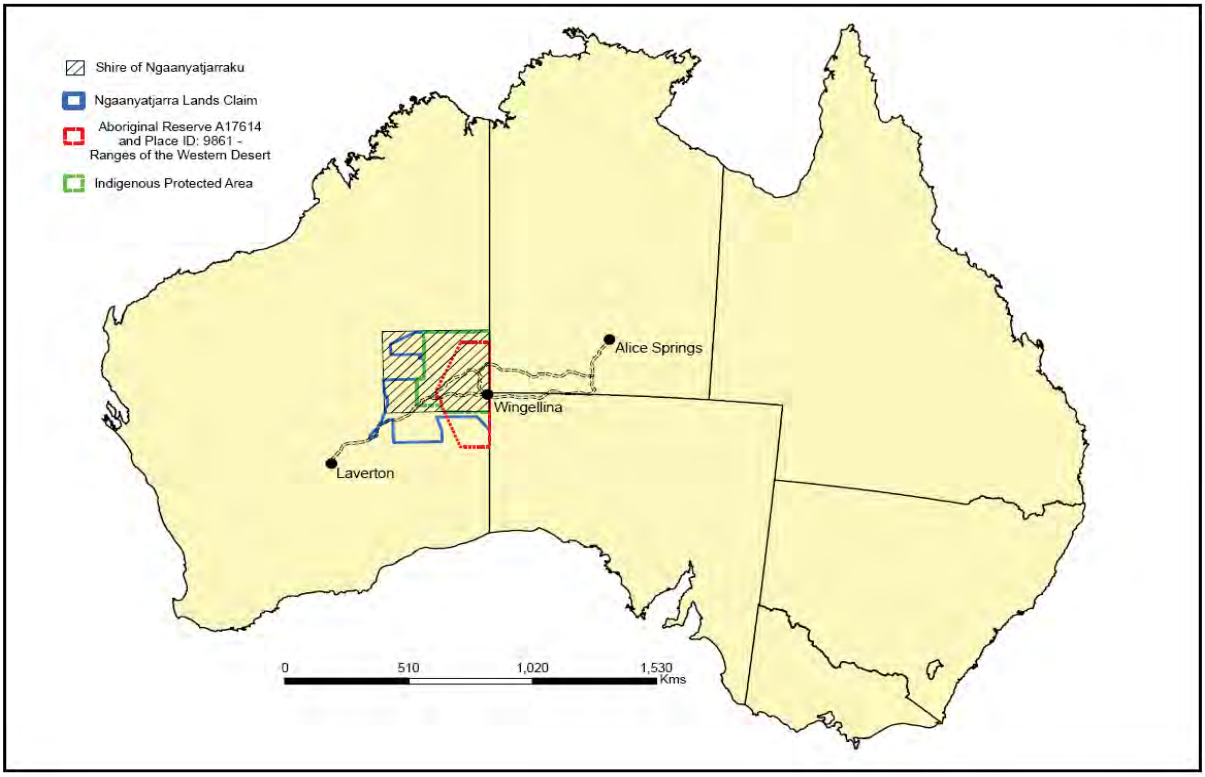

Figure 2 Location and Regional Context of the Project

The Project is located within the Central Ranges Bioregion, dominated by rugged ranges and red sand plains with predominately mulga open woodland over spinifex grasslands. The Central Ranges Bioregion is made up of three subregions with the Wingellina Project located within the Mann-Musgrave (CR1) subregion.

2.2 Site History and Current Land Use

The Project is located entirely within Aboriginal Reserve 17614. The physical local land use around Wingellina is generally limited to the hunting of animals, gathering bush tucker and cultural ceremonies.

The past land use in the Ngaanyatjarra Lands is varied with traditional practices dominating current and past land use. Whilst there hasn't been significant pastoral

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history in the region, the United Aboriginal Mission which was established in 1934 at Warburton managed livestock until the mid 1980s. Other activities such as sandalwood harvesting and some prospecting have occurred in the past, however no economic land use of worth other than that undertaken to support the community has been conducted in the vicinity of the Project site (URS, 2012).

Hinckley Range secured the exploration tenement (E69/535) in 2000. A number of abandoned small-scale chrysoprase pits are found throughout the Project area as exploration and mining activity was carried out prior to Hinckley Range's ownership. However, no current mining activity or other industrial activities are currently undertaken in the Project area. Should the Project proceed, it will be the first major mineral resource operation in the Ngaanyatjarra Lands.

The existing Wingellina Township or the Irrunytju Community is the closest existing resident community to the Project site, located on land within the Determined Ngaanyatjarra Lands (Part A) Native Title Claim (WC04/03). The Irrunytju Aboriginal Community (Wingellina Township) is located at the former Wingellina exploration camp. The townsite was initially erected as the exploration camp in the late 1950s by Southwestern Mining Co (a subsidiary of International Nickel Company of Canada) and was then occupied by the Irrunytju Community after the company vacated the lands (URS, 2012). The township consists of housing, unsealed roads, a community power station, unsealed airstrip and associated community infrastructure, supporting a resident population of approximately 60 full-time residents and up to 100 people including occasional residents. Nearby communities of Kalka and Pipalyatjara in South Australia are visited regularly by members of the Irrunytju Community.

Figure 3 provides the layout and land ownership for the Wingellina Township. The layout of the township demonstrates the proximity of the airstrip to the north of the township and the various community, recreation, residential, commercial and industrial land use within the settlement zone. Other than the land occupied by the air strip to the north west of the town, the majority of land use is open space, residential and recreational.

2.3 Site Climate

The general meteorology of Wingellina is summarised as a dry climate, exhibiting hot summers and mild winters. Average rainfall is low (less than 300mm), with the climate of the region strongly influenced by a band of high pressure known as the subtropical ridge. The wettest months occur between December and March. For the majority of the year, the ridge is located to the south, allowing east to south east winds to prevail (Air Assessments, 2013). The wind rose data collected for Wingellina show summer months have predominately easterly winds with winter months showing a more even distribution of winds.

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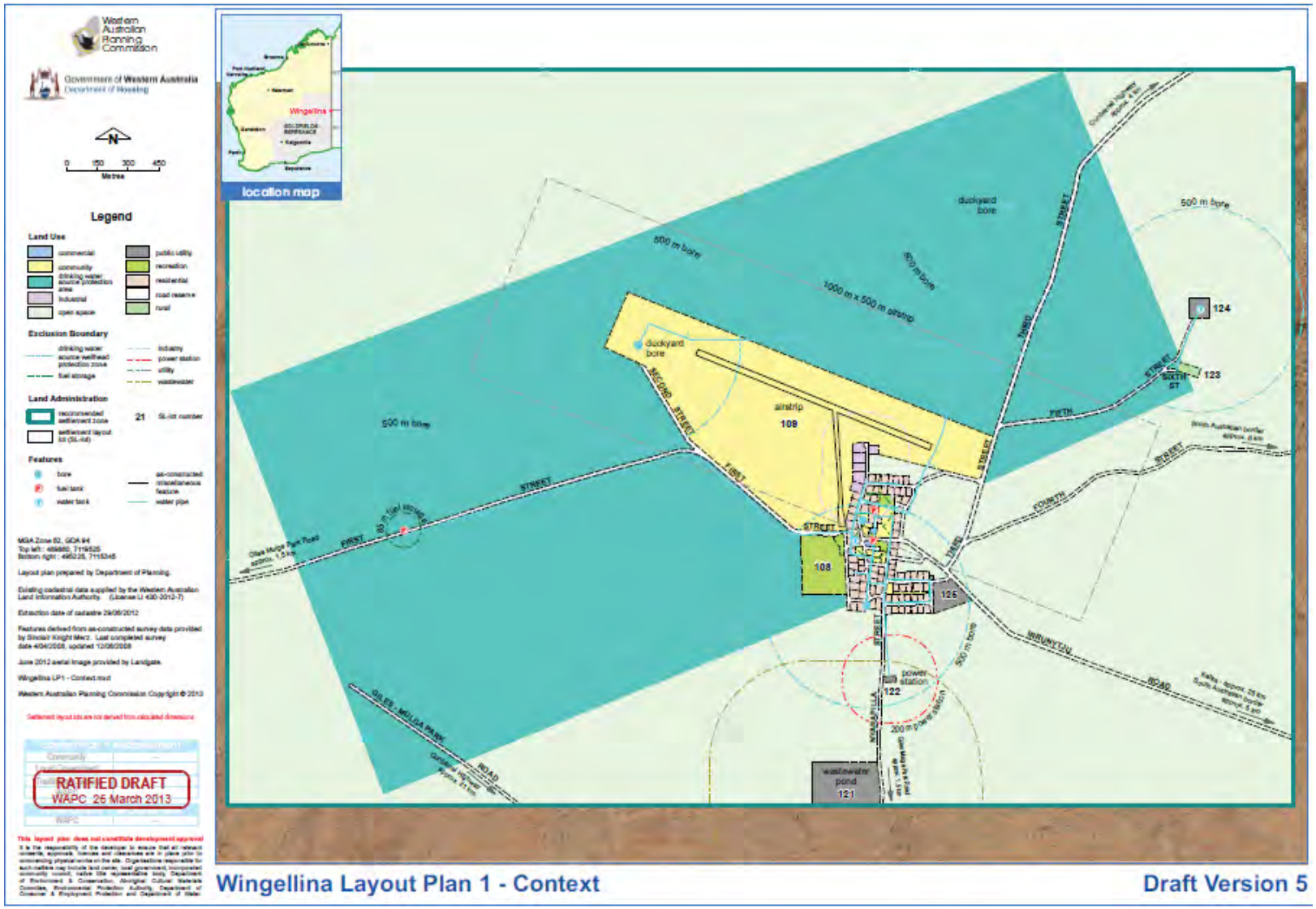

Figure 3 **Wingellina Township layout** (***Source: Western Australian Planning Commission***)

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3.0 PROFILING THE COMMUNITY

3.1 Wingellina (Irrunytji) Community

The Wingellina Community may be subject to a number of positive and negative impacts as a result of the proposed Nickel Project.

Physically, Wingellina is located close to the Western Australian and South Australian borders, characterised by rocky hills that form part of the Central Ranges region that stretches from Warburton in the west to the Mann Ranges in South Australia.

The people of the Wingellina Community, also known as the Irrunytju Aboriginal Community, identify with their location due to the nearby Irrunytju rockhole in the foothills of the Tomkinson Range, south of the community (URS 2012). The rockhole was an important site for the Aboriginal people because of the presence of permanent water.

Figure 4 Location of the Irrunytju Aboriginal Community within the Ngaanyatjarra Lands

The Ngaanyatjarra Council (Aboriginal Corporation) represents the interests of around 2000 Ngaanyatjarra, Pintupi and Pitjantjatjara Traditional Owners (Yarnangu) who reside in the twelve member communities of the Ngaanyatjarra Council.

It is worth noting that the Irrunytju people, due to their location close to South Australia and Northern Territory borders, align themselves with the communities and localities within the Anangu Pitjantjatjara Yankunytjatjara (APY) land. The APY land is a large Aboriginal local government area located in the remote north west of South Australia. It consists of the Pitjantjatjara, Yankunytjatjara and Ngaanyatjarra peoples (or Anangu), and has a population of around 2500 people (http://www.anangu.com.au/sa-communities.html accessed August 2014).

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While the Irrunytju people are located within Western Australia, dialogue with the Wingellina Community reveals a strong relationship with the APY lands and communities.

Figure 5 provides a map of the APY land and communities presenting difficulties in addressing some of the current socio-economic issues, responsibility and legislative jurisdiction given the straddling of three State boundaries.

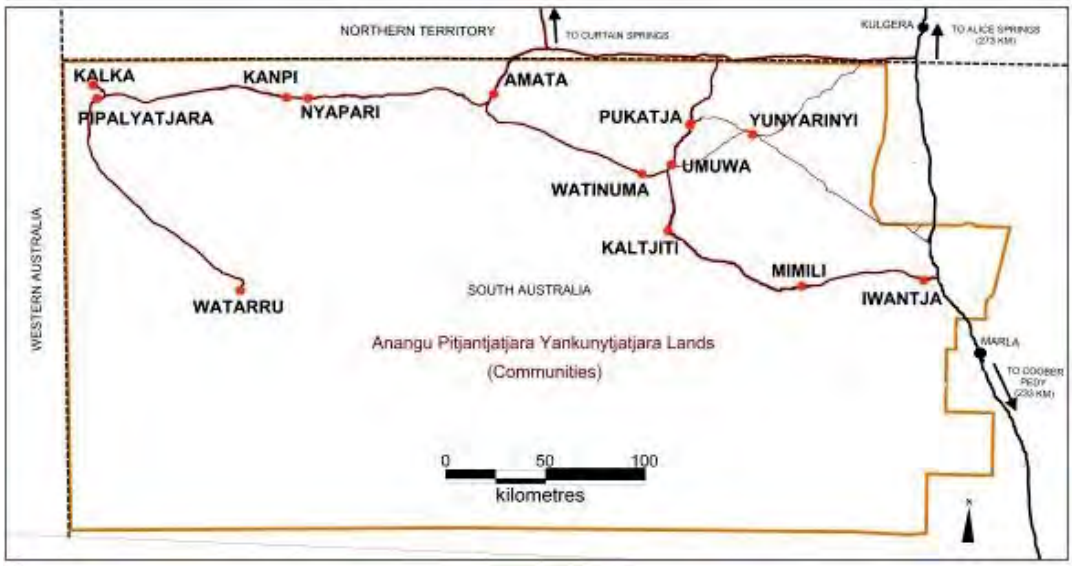

Figure 5 Anangu Pitjantjatjara Yankunytjatjara (APY) land and communities

The history of settlement at Wingellina is relevant to today's community profile. It gives insight into the positive and negative relationship mining has had in the past and provides lessons for future mine activities, particularly for the indicators of health and socio-economic factors.

The Wingellina mining camp in the 1950's and 60's attracted Aboriginal people to reside close by, either engaged in work and or motivated to protect and live near local sites of cultural significance, in particular those associated with the Papa (Dog) Dreaming (Ngaanyatjarra Council). Historical records of mine workers document good relationships with the Irrunytju community, with most mining companies respecting cultural sites of significance and employing Yarnangu guides. However, it was also a time of anxiety and stress for the local Aboriginal culture with some mining companies and activities damaging several sites. (Ngaanyatjarra Council website http://www.ngaanyatjarra.org.au/communities/irrunytju?more accessed July 2014).

Following the 1988 proclamation of Aboriginal Reserve 17614, the existing mineral exploration tenements in the region were terminated by government. The Yarnangu established a permanent community using the existing infrastructure (airstrips, shelters, water bores, windmills etc) left from the pre-existing Southwest Mining

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camp. The community also received significant funding from the Commonwealth Government to fund necessary repairs and expansion to facilitate permanent settlement in the area. The community became incorporated in 1976 and a member of the Ngaanyatjarra Council in 1981 (Ngaanyatjarra Council website). The Township has a growing awareness of both the positive and negative aspects of mining development near their close-knit Aboriginal community.

As a main sensitive receiver population, the Irrunytju Community has shown interest in the Project, and they have acknowledged the township may experience positive benefits arising from the mine, particularly the potential for employment and training opportunities and flow-on benefits for business opportunities from trade related to the mining workforce. However, the community is also aware of the negative impacts that may result, including the need to ensure that Aboriginal heritage, culture and physical environment are respected and protected.

Consultation undertaken in 2011 and 2012 with the Wingellina Township included the option of relocating the community a minimum of 10 km and a maximum of 50 km to avoid any negative impacts such as health and amenity related impacts which may be associated with the current location. In the consultation efforts, the Irrunytju Community accept the option of relocation, although some people expressed sadness about leaving their homes. However, there was genuine interest and positivity regarding new community housing, infrastructure and assets. As documented by URS (2012), the community members expressed interest in the construction of a new settlement as having an added bonus of implementing a Building Training Program to provide basic building maintenance skills to local people that assist them with on-going maintenance and up-keep.

Despite an option for relocation, the Environment Protection Authority requested the project be re-referred for the purpose of assessing the Project impacts on the community as remaining in its current location (ESD, 2014).

The following section therefore profiles the existing Wingellina Community, noting the current demographic, employment, health and social indicators that are heavily influenced by the typical characteristics of remote desert Aboriginal settlements.

3.2 Wingellina Community Profile

The Wingellina Community profile describes key aspects of the general make-up of the Irrunytju Community population, particularly in relation to the factors that are believed to be susceptible to change or that may act as indicators of anticipated health impacts. This section of the assessment enables identification of and characterisation of the potential health effects of the community by providing a baseline against which possible health impacts (both positive and negative) can be assessed.

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3.2.1 Demographic Profile

The population of the Shire of Ngaanyatjarraku covers more than 160,000 km^2 and consists of many towns, including Warburton as the largest town with over 400 people, through to smaller towns and settlements such as, Blackstone, Jamieson and Warakurna.

In the 2011 Census, the Shire of Ngaanyatjarraku had a total population of 1,437 people, of which 84 % or 1,213 persons identified as Indigenous (ABS, 2011). Figure 6 provides a total population distribution across ages.

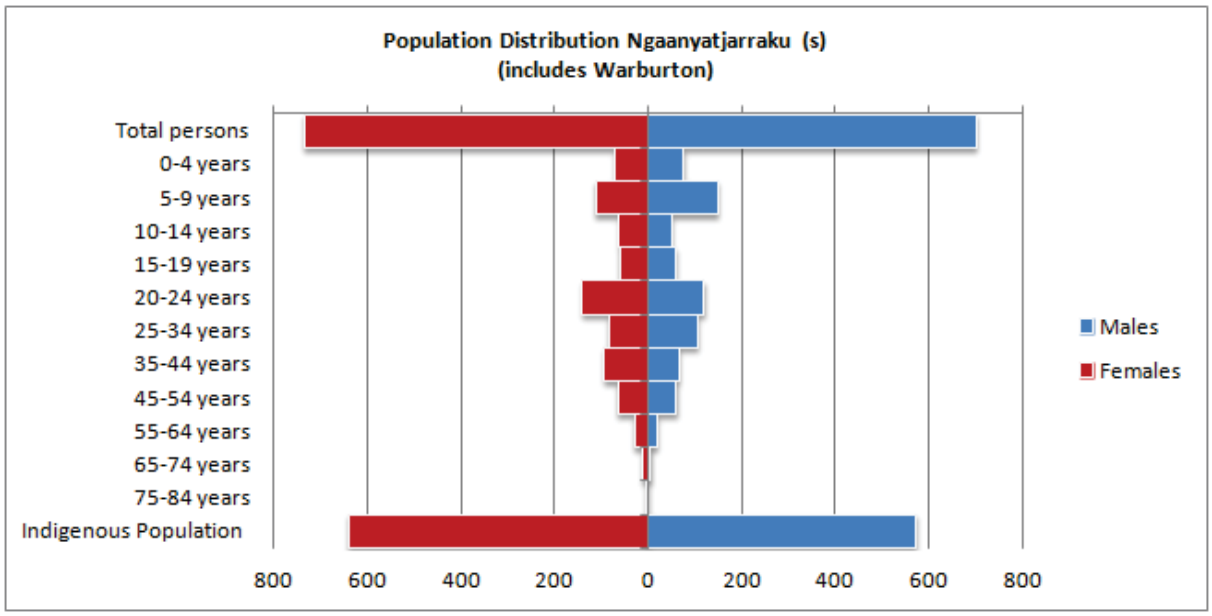

Figure 6 Population distribution for Ngaanyatjarraku Shire

Wingellina's population ranges from 60 to 100 people – 60 people who are generally permanent residents and an additional 40 people who are occasionally resident in the community (URS 2012).

The 2006 and 2011 Census Population data for Ngaanyatjarraku (excluding Warburton) notes the population is relatively young, with the median age of 30 in 2006 (URS 2012) and 28 in 2011 census (ABS, 2011). According to the 2011 census data, approximately one-third of Ngaanyatjarraku's population is 19 years and under.

With a young median age, and a large portion of the population accounting for children, including 144 persons in the Shire aged five and under, it is presumed that the Wingellina Township would have a similar population trend and include a relatively high proportion of the population aged under19 years.

The vast majority of the Indigenous population speak a language other than English, most identifying a 'Western Desert' language as the primary language spoken. According to consultations undertaken with the local Wingellina community,

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a mixture of Pitjantjatjara and English were spoken with very few persons identifying themselves as Ngaanyatjarra even though most people speak both Western Desert and Pitjantjatjara languages (URS, 2012).

3.2.2 Socio-economic Profile

Economic activity in the region is dominated by community services provision and infrastructure maintenance (URS 2012). Hinckley Range has provided opportunities for casual employment for a number of people in the area such as assisting with field work during exploration and the feasibility stage of the project (URS 2012). The Wingellina Township is remote and hence, there are very few opportunities for ongoing, full time work. Similarly, the remoteness has a number of other socio-economic detractions such as a lack of access to some services including health and education. There is a high cost of living that results from living in remote areas as the transport costs of goods is high making basic living items and food expensive, with fresh food lacking quality and freshness upon delivery to Wingellina.

3.2.3 Income

Excluding those from Warburton, the median weekly income for Aboriginal people in the Ngaanyatjarraku Shire is very low, below that is considered the poverty line in Australia. The 2006 Census data showed weekly income for Aboriginal people in the Indigenous Area (IARE) of Ngaanyatjarra Shire (s), excluding Warburton was $190 in comparison to $929 for non-Aboriginal people as shown in Figure 7. Household income were roughly half that of non-Aboriginal households.

The low income base of individuals and households is further accentuated in remote communities where overcrowding of Aboriginal households is frequent (URS, 2012). Although financial support is available through ‘Centrelink’ and other payments such as the Community Development Employment Programs (CDEP), there are examples of families going without food from time to time, and the MetalsX camp is regularly visited by local people requesting extra food and fuel (URS, 2012). The Social Impact Management Plan (SIMP) concluded that the standard of living for the Wingellina Township was low in comparison to less remote communities.

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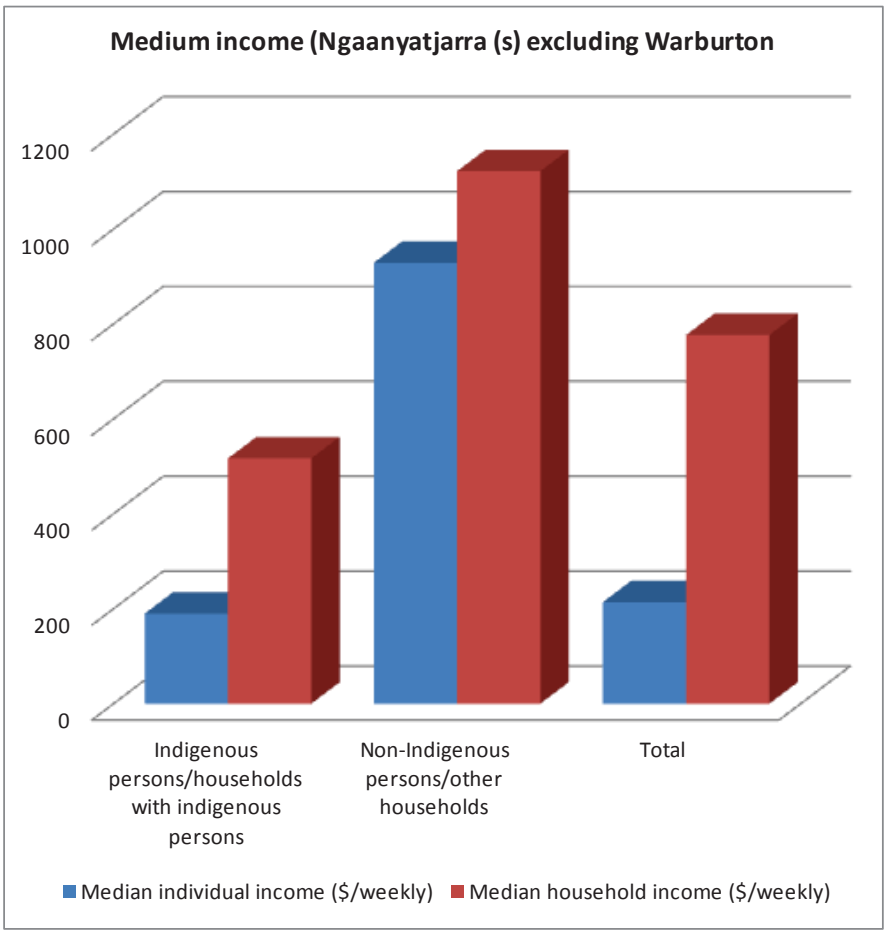

Figure 7 Medium Income for the Indigenous Area of Ngaanyatjarra Shire (excluding Warburton)

Adding to very low income levels, with little opportunity for employment to improve income, is the high cost of living given costs to transport goods and food. Social vulnerability is further exacerbated by issues such as overcrowding of accommodation, poor living conditions resulting in negative impacts on wellbeing and health.

3.2.4 Living conditions

During consultations with the Irrunytju Aboriginal community, the majority of housing in Wingellina was observed to be in a state of needing repair, with most of the infrastructure considered reasonably old and/or in poor condition (URS, 2012). As recorded by URS (2012) in consultations with the community and documented in the SIMP, a number of key issues exist which may have existing implications on the general well-being and health of the community:

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- An existing water supply that is problematic (one bore previously contaminated) with water pumped via mains power to an elevated storage tank on a 12m stand;
- A potable water reticulation system that does not meet current standards, specifically environmental health standards;
- Inefficient effluent disposal; and
- Infrastructure exhibiting neglect and in a poor condition.

An image of a typical house in the Wingellina Township is provided below in Figure 8 to demonstrate the current living conditions of many of the township's population. Exposed soils and poor housing quality promote some of the existing health issues as discussed in Section 3.2.6.

Figure 8 Typical accommodation in Wingellina Township

Overcrowding is typical in remote Aboriginal settlements with the standard three bedroom house accommodating at times large numbers of people. It is also noted that Sorry Camps[1] can exacerbate stresses on current accommodation, sanitation, potable water supply and waste disposal over extended periods of time.

3.2.5 Access to education, training and employment

The Ngaanyatjarra School is a remote multi-campus school with a campus at Wingellina accommodating students from kindergarten to year 10. Currently enrolments fluctuate between 24 and 31 students. There is a K–3 class and a year

[1] Temporary camps often away from original dwellings that are used by the wider family during the initial time following the death of a person in Aboriginal culture.

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4-10 class and Wingellina is staffed with a campus principal, two teachers and three part-time Aboriginal and Islander Education Officers. (http://www.nglandschool.wa.edu.au/gallery/campuses/campuses/wingellina-campus accessed August 2014). The school manages a '*home to school*' transition program that commences with breakfast and showers followed by a structured fitness program. During the year, students from Wingellina travel to Pipalyatjara Anangu School across the border in South Australia to use the pool for swimming lessons and swimming carnivals.

From the Ngaanyatjarra School Annual Report (2009), it was shown that primary school attendance was improving, with the rate of attendance consistently over 50% and growing between 2007 and 2009. Attendance for older grades, particularly secondary school was close to or less than 50% over the same period. Students wishing to continue their secondary education need to leave the community and attend boarding facilities away from the Ngaanyatjarra Lands. Education levels are generally low for the Ngaanyatjarra Lands due to the lack of school readiness, transient nature of families, sporting events rostered on school days and the difficulty in retaining staff in the health and education sectors.

Training facilities and resources available for accredited training are limited with no TAFE actively servicing the region. The nearest centre to deliver training services necessary to assist persons within the Ngaanyatjarra Lands into employment is Warburton. (URS, 2012)

In remote locations such as Wingellina, there are very few employment opportunities for the working-age population. The main provision of employment is the CDEP which in 2012 had 20 participants providing litter collection, tree pruning and general maintenance services. The CDEP programs are funded by the Commonwealth Department of Social Services (formerly Commonwealth Department of Families, Housing, Community Services and Indigenous Affairs (FaHCSIA)) and are managed via the Ngaanyatjarra Council for the Ngaanyatjarra Lands. Aside from the CDEP opportunities there is essentially no other employment available to local residents and any employment that is potentially available is predominantly going to people outside the community (URS,2012).

Opportunities for girls and young women gaining employment is further limited by lifestyle and culture compared to males. It is not uncommon for girls to become mothers at a very young age and therefore parenting responsibilities keep them out of the workforce. Other cultural factors also affect workforce participation. Many Aboriginal employees feel obliged and are pressured to share resources and income with family members which may lead to some reluctance to enter the workforce from the outset (URS, 2012).

3.2.6 Existing Health Profile

The Ngaanyatjarra Health Service (Aboriginal Corporation) (NHS) provides primary and preventative health care to communities widely scattered Ngaanyatjarra lands

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in Western Australia. There is no hospital or other health providers servicing or based in the Ngaanyatjarra Lands and most communities are at least 1,000 kilometres from a regional centre. Wingellina is one of the 12 remote communities with a NHS health clinic. (Shire of Ngaanyatjarraku, 2012)

The existing primary health conditions within the Irrunytju Aboriginal community (as treated by the Wingellina Health Clinic) include chronic diseases such as diabetes, chronic renal disease, cardiovascular disease and respiratory diseases (URS 2012). Mental health issues were also identified as a problem in for the Ngaanyatjarra Lands (URS, 2012).

The Shire of Ngaanyatjarraku (2012) acknowledges the Irrunytju Community is located on a very wind-swept and elevated site. The township, as a result of wind erosion, has become a barren landscape, with dusty housing allotments and bare, open spaces, with windblown dust causing an excess of eye, chest and nasal complaints throughout community members. Other key existing health conditions, resulting from a number of issues such as low socio-economic factors and remote location include poor nutrition, inactivity and high rates of smoking. These factors are contributing to the chronic diseases amongst the community. It was also noted by URS (2012) that respiratory disease is worsened by the lack of sealed roads throughout most communities in the Ngaanyatjarraku Shire.

The Health Clinic in Wingellina has been funded to have a resident nurse, however at the time of the SIMP preparation in 2012, there was no resident nurse on either a part-time or full-time basis. Currently, it is unknown whether a nurse (full-time or part-time) is stationed within the community. The remote location of Wingellina makes retaining health practitioners or service providers difficult. The clinic would normally handle one-off presentations, while serious injuries or conditions are treated in Kalgoorlie via the Royal Flying Doctor Service. The nurse can access a 4WD vehicle which serves as the community ambulance when required. The clinic sees between 90 and 200 presentations a month when a nurse is available. A GP from Kalgoorlie visits on a 6-monthly basis provided by the Division of General Practice. The division also provides outreach mental health services on a 6-monthly basis (URS, 2012).

Health data relating specifically to this population is difficult to obtain due to a number of factors such as the transitory nature of the population, the straddling of three jurisdictions where some services are obtained in South Australia or Northern Territory and the remote location which prevents regular access to some health services. The Western Australian Health Department (2010) notes the rate of potentially avoidable deaths among the Western Australian Indigenous population in 2006 was 830 per 100,000, more than five times the figure recorded for the total State population. While the proportion of deaths classified as avoidable was similar among both non-Indigenous and Indigenous persons aged less than 75 years, the leading causes differed. The proportion of deaths classified as potentially avoidable among Indigenous people were higher for diabetes, alcohol-related diseases,

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selected invasive bacterial and protozoal infections, birth defects and road traffic injuries, than among non-Indigenous people.

At the time of preparing the SIMP, a visiting dental health service didn't exist, although an extended service from Warakurna was being considered. Other identified health issues requiring access to medical services include podiatry for diabetes related foot complications, audiology particularly needed for children and additional mental health services for youth. Another issue raised by stakeholders is the need to encourage men to seek health services and the establishment of a 'men's shed' has been suggested for men to discuss physical and mental health problems in a non-confronting environment (URS, 2012).

The Ngaanyatjarra Shire (2012) reports an Environmental Health Program (delivered to Blackstone, Jameson, Warakurna, Tjukurla, Kiwirrkurra, Wanarn and Wingellina communities) exists currently. This program aims to improve health outcomes and healthy environments through the assessment, correction, control and prevention of environmental factors that adversely affect human health. It is reported the program recruits local people and works collaboratively with other services (e.g. housing) to deliver services and provide community education to improve environmental health conditions in the above communities.

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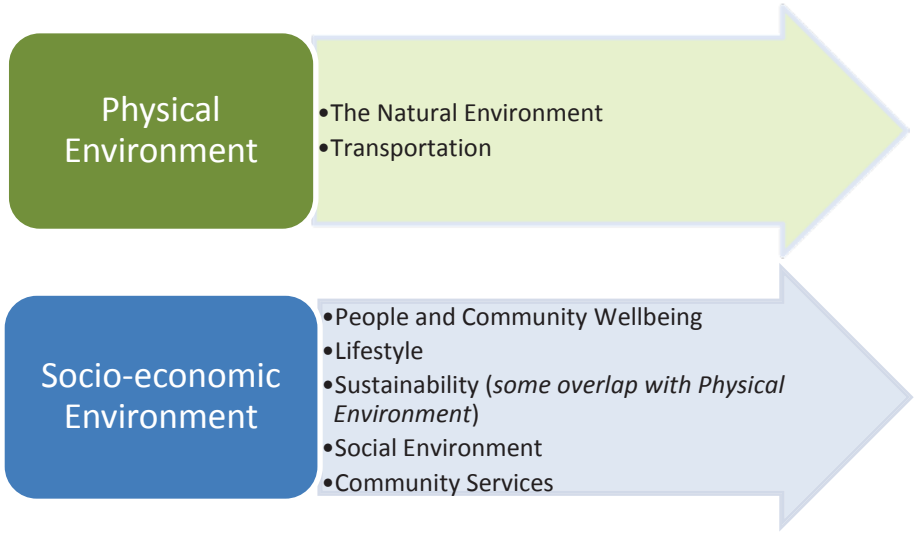
4.0 DETERMINANTS OF HEALTH

As discussed in Section 1.1, determinants of health are often influenced by the social and economic conditions, physical environment and individual's characteristics and behaviour.

According to the Western Australian Department of Health (2009) 'Indigenous Australians experience the worst health of any one identifiable cultural group in Australia' with life expectancy, infant mortality, access to early childhood education, education results and employment outcomes lagging behind non-Indigenous Australians.

These indicators can be even more exaggerated in remote communities, such as Wingellina. To provide a good cross-sectional comparison of the existing issues the community face, the following section details the 'baseline' conditions for Wingellina, as typical across the majority of the Ngaanyatjarra Lands.

As an important input into this comparison of the potential Project-induced risks and opportunities, Table 1 provides categories of health determinants (divided into Physical Environment and Social Environment) that are addressed or considered in Sections 7 and 8. These determinants guide the identification and assessment of health risks potentially resulting from the Project. The seven categories of health determinants considered in this HIA are:



Each health determinant category has a number of factors considered as part of the broader determinant. These are shown in Table 1.

Table 1 Consideration of Determinants of Health

Health determinant category	Likely Health determinants to be considered as part of this HIA
The natural environment	Air quality, and exposure to Nickel in dust

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Health determinant category	Likely Health determinants to be considered as part of this HIA
	Contaminated land: soil and groundwater
	Water quality: drinking, recycled, recreational, wastewater
	Vibration
	Noise, odour, dust, light
	Natural resources
	Green space
	Waste disposal/management
Transport	Access to transport
	Community structure
	Social contacts
	Community participation
	Crime & antisocial behaviour
People & Community Wellbeing	Discrimination
	Safe environments
	Social networks
	Feelings of trust
	Feelings of power and control over life decisions
	Exercise patterns
	Recreation choices
	Access to and use of leisure facilities
Lifestyle	Access to nutritional food
	Risk behaviours
	Communicable diseases
Sustainability	Disturbance of ecosystems or natural environments

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Health determinant category	Likely Health determinants to be considered as part of this HIA
Social Environment	Support for local businesses
	Effect on future generations
	Family structure & relationships
	Housing conditions
	Employment status
	Working conditions
	Income
	Education
	Workplaces
Community services	Leisure facilities
	Health services
	Police
	Transport
	Local community facilities & organisations
	Emergency services
	Schools and child care services

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5.0 ASSESSING THE HEALTH IMPACTS

5.1 Existing risks

A qualitative assesment of risks posed by the Project is discussed in Sections 7 and 8. To assess the Project induced risks, it is necessary to assess the existing level of risk for each of the determinants of health as a baseline. This baseline is then compared to the potential impacts (positive and negative) that may result from the Project.

To provide further comparison, a high-level and qualitative comparison is also made against Australia's Health 2010 and 2012[2] (Australian Institute of Health and Welfare, 2010 and 2012) indicators for both Indigenous and non-Indigenous Australians. This national report in 2010 concluded that the health status of Australians is generally high by international standards, however the report states "*Those living in areas outside capital cities do not enjoy the same levels of good health as their city counterparts, have higher rates of several risk factors and may have problems accessing some health services. Similarly, there are strong inequalities between the health status and determinants of Indigenous and non-Indigenous Australians, and between low and high socioeconomic groups*" (p493).

Further to this, the Australia's Health 2012 notes "*Health and wellbeing are influenced by broad but closely related socioeconomic factors, such as education, occupation and income. These factors help to explain many of the health inequalities in Australia today. In general, relatively disadvantaged members of the community live shorter lives and have higher rates of illness, disability and death than those who are relatively advantaged (*CSDH 2008).

This pattern occurs consistently within countries across the world, despite vast differences in their overall wealth. Variation in health status follows a gradient, with overall health tending to improve with each step up the socioeconomic ladder (Kawachi et al. 2002; Turrell & Mathers 2000). This is commonly known as the socioeconomic gradient of health, with those at higher rungs of the ladder tending to be healthier than those in the middle who, in turn, are healthier than those below them. Some population groups, such as Aboriginal and Torres Strait Islander people, have relatively high rates of socioeconomic disadvantage and relatively poor health." (p73)

The methodology for the assessment of risk is described below.

5.2 Risk assessment methodology

The Government of Western Australia, Department of Health provides Health Risk Assessment (Scoping) Guidelines (2010) and recommends a Risk Matrix for qualitative HIA. Table 2 provides the Risk Matrix to be applied to this HIA with the

[2] Australia's Health is a biennial report prepared by the Australian Institute of Health and Welfare providing the nation's premier source of statistics and informed commentary on determinants of health

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existing level of risk (determined through the technical papers prepared for the proposed mine) identified and compared to the proposed level of risk.

Table 2 Risk Matrix

Likelihood	Consequences					
	Negligible	Minor	Moderate	Major	Massive	Catastrophic
Certain	Low	Medium	High	Extreme	Extreme	Extreme
Likely	Low	Low	Medium	High	Extreme	Extreme
Possible	Very Low	Low	Low	Medium	High	Extreme
Unlikely	Very Low	Very Low	Low	Low	Medium	High
Rare	Very Low	Very Low	Very Low	Low	Low	Medium

Each determinant of health will be rated according to the existing and future (Project induced) risks as qualified by the technical papers and research that has been conducted for this Project, or more generally represented in publically available information related to the Indigenous and Non-Indigenous Australian populations.

It is noted by Harris et.al (2007) that risk assessments can be a problematic element for HIA's due to a primary focus on negative impacts only. HIA's need to identify and assess both positive and negative impacts. The HIA was completed to undertake a wholistic view of the Project's potential impacts on the Wingellina Township and other identified sensitive receivers. The HIA was able to identify both positive (benefits) and negative (detriments) impacts resulting from the Project, with the HRA investigating any negative impacts to quantify further the risks to health.

Once a level of risk (according to likelihood and consequence) is determined, Table 3 is used to graphically represent the HIA findings (using a scale of Extreme (±5) through to No change or Nil impact (0). This table applies a positive or negative rating to demonstrate the broader opportunities for the local community and what existing or new threats may be exacerbated or result from the Project.

Table 3 Impact Rating

Rating	Risk/Benefit Rating					
	Nil	Very Low	Low	Medium	High	Extreme
Positive	0	1	2	3	4	5
Negative	0	-1	-2	-3	-4	-5

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The final stage of this risk assessment section is to recommend the consideration and implementation of risk mitigation and management measures to improve the Project outcomes and the impact the Project will have on the existing physical, social and economic environment.

The format of the risk sections (Section 6 and 7) is provided below with discussion related to:

- Description of issue – provides a background on the particular issues;
- Current conditions – outlines the existing conditions for the population and describes the health baseline where available;
- Impacts on health – provides a brief analysis on whether the resultant health impacts are considered important for this population;
- Risk assessment – provides an overview of the future impacts and what are the key health impacts to manage or benefit from; and
- Management measures recommended – outlines what mitigation and ongoing management measures are considered relevant to this community and Project.

The risk assessment has been divided into two separate sections to assist the audience – the Physical Environment and the Socio-economic Environment.

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6.0 THE PHYSICAL ENVIRONMENT

6.1 The Natural Environment

The Referral Document (SNC-Lavalin, 2013) contained several studies that document the physical environment, with particular focus on air quality, soils and groundwater, potable water sources, background noise and vibration and physical environment.

Of all the natural environment determinants of health listed in Table 1, air quality, soils and water quality reflect the greatest influence on health for this population. The background levels of noise and vibration are low typically and light spill is also representative of a remote location with little development and sources of artificial lighting (SNC-Lavalin, 2014b).

6.1.1 Existing issues

Air Quality and Climate

The Ngaanyatjarra Shire notes that the Wingellina Township is located on a very wind-swept, elevated site. Degradation of land through bushfires and camel grazing, with the addition of unsealed road surfaces and bare allotments has increased potential for wind erosion to occur with the background air quality exhibiting consistent levels of windblown dust.

In this dry climate, bush fires are considered to be common particularly in summer with smoke and windblown dust the major contributors to air pollution. Particulate matter[3] concentrations in the Wingellina area were collected using depositional dust gauges from August 2008 to April 2011; and a continuous monitor to measure PM_{10} concentrations from the 20th October 2010 to 14th November 2011. Further data from surface soil sampling shows that naturally occurring high background levels of nickel, manganese and cobalt exist and it is assumed these metals are present in windblown dust. The dust depositional data relied upon in the HRA provides an indication of the metal concentration in the background PM_{10} levels. The presence of these metals in existing levels of dust represents a current health risk in terms of exposure levels in the ambient environment. Nickel exposure was calculated using the dust depositional data and predicted Project PM_{10} concentrations. These

[3] *"Particulate matter," also known as particle pollution or PM, is a complex mixture of extremely small particles and liquid droplets. PM is made up of a number of components, including acids, organic chemicals, metals, and soil or dust particles.*
The size of particles is directly linked to their potential for causing health problems. Of concern is particles that are 10 micrometers in diameter or smaller because these particles generally pass through the throat and nose and enter the lungs. Once inhaled, these particles can affect the heart and lungs and cause serious health effects. The US EPA groups PM into two categories:
"Inhalable coarse particles," such as those found near roadways and dusty industries, are larger than 2.5 micrometers and smaller than 10 micrometers in diameter.
"Fine particles," such as those found in smoke and haze, are 2.5 micrometers in diameter and smaller. These particles can be directly emitted from sources such as forest fires, or they can form when gases emitted from power plants, industries and automobiles react in the air.

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findings were compared against chronic health criteria such as the Western Australian Department of Health long-term nickel exposure criteria of 0.003µg/m^3.

Groundwater and Surface Water

The Wingellina Project area is underlain by the Musgrave Complex, which is surrounded by a series of groundwater basins, consisting of the Amadeus Basin, Canning Basin, the Officer Basin and the Gunbarrel Basin. The water table in the Project area is located within a range of approximately 30 to 60 m below the ground surface, and groundwater levels are affected by bedrock fractures and discontinuities (Coffey, 2008). The groundwater is moderately saline with recharge occurring by direct infiltration of rainfall. The Ngaanyatjarra Shire reports a field of three bores all within 2 km of the Wingellina Township, which currently provide an adequate supply of potable water within the community. It is reported that water is connected to all residents and community facilities with the existing water flow from the three potable bores sufficient for community housing and personal needs. There is not sufficient flow for the establishment of an Environmental Health Landscaping Program for the Community to increase ground vegetation coverage and create vegetation buffers to reduce windswept dust. Surface water assessment of the Project area identified three sub-catchments defined by the Hinckley Range and Wingellina Hills. Six clearly defined ephemeral drainage lines intercept the Project area with channels generally restricted to the flanks of the catchments where there is sufficient run-off and relief to generate confined surface water flows (Rockwater, 2010). There is no data to confirm whether the Wingellina community relies on the natural drainage and channels for a source of potable water. MetalsX representatives have noted that potable water is provided via bottled water to the Wingellina Township, possibly supplementing or replacing the need for potable bore water.

6.1.2 Existing health impacts (health baseline)

The Health Clinic in Wingellina reports a number of respiratory conditions within the population, with the prevalence of unsealed roads and level of windblown dust causing an excess of eye, chest and nasal complaints throughout community members (URS, 2012).

The SIMP (URS, 2012) reported that one potable groundwater bore was being treated due to contamination and was out of use. Waste water disposal is by on-site means consisting of septic tanks and leach drains with no reported regular pump-out program. It was noted in the SIMP that the existing water supply is problematic and water reticulation infrastructure did not meet current quality health standards. Additionally, inefficient effluent disposal was raised as a current problem, potentially a source of water and land contamination.

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6.1.3 Summary of existing risks

For the natural environment, a summary of existing health risks is provided below.

Health determinant category	Health determinants	Positive or negative	Level of existing risk/benefit
The natural environment	Air quality (including nickel exposure)	-ve	Medium
	Contaminated land: soil and groundwater	-ve	Low
	Water quality: drinking, recycled, recreational, wastewater	-ve	Low
	Vibration	+ve	Nil
	Noise, odour, dust, light	-ve	Nil
	Natural resources	+ve	Low
	Green space	+ve	Medium
	Waste disposal/management	-ve	Very Low

6.1.4 Future Issues

In terms of the natural environment, only air quality (to include dust), noise and vibration, light, vegetation clearing, groundwater contamination and waste disposal impacts were identified in the HRA as risks to be analysed based on the assessed risk rating. These project-induced issues are addressed in the following sections.

6.1.4.1 Air Quality – Project induced impacts

A local air quality impact assessment (Air Assessment, 2013) and a HRA (SNC-Lavalin, 2015) have been undertaken to assess the potential effects of air pollution from the Project. The Air Quality Impact Assessment (AQIA) determined that the construction and operation of the mine site has the potential to increase air pollutants at two receiver populations (the Mine accommodation and existing Wingellina Township). The AQIA modelled atmospheric emissions of predicted particulate concentrations through run-of-mine (ROM) activities and gaseous pollutants for the Project's HPAL plant considering the existing background concentrations, meteorological data and the key construction and operational activities.

Air contaminants of concern are limited to nickel dust (as found in particulate matter and windblown dust) and oxides of nitrogen (NOx), sulphur dioxide (SO_2) and oxides of sulphur (SOx) and sulphuric acid mist as generated from the HPAL plant.

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For the Project site, with a dominance of easterly winds, windblown dust would generally be away from the Wingellina Township and mine accommodation, respectively located south west and south of the mine site.

Emissions of particulate matter are generated from a number of sources, these being:

- Operations (excavations, truck haulage, crushing, loading);
- Vehicle movement (haulage of crushed material, light vehicles and general offsite haulage); and
- Wind Erosion (stockpiles, tailings, beach areas, and ROM pad areas).

Tailings Storage Facility

Potential chemicals of concern in the tailings include hexavalent chromium (Cr VI), and manganese (ATC, 2008). However addition of sodium metabisulphite within the process will convert Cr VI to the less harmful trivalent chromium.

It is anticipated that the tailings solutions will be left to evaporate, leaving a significant surface area subject to wind erosion. The tailings storage facility (TSF) is predicted to be approximately 1185ha of bare area. A conservative figure of 178ha (equating to a 15% uncontrolled area) may be dry and therefore subject to erosion and source of windblown dust. Application of average wind erosion based on metrological data suggests an erosion rate of 0.53 kg/ha/hr (exceeds the National Pollutant Inventory default of 0.2kg/ha/kg or the CSIRO tolerable soil loss of 0.4t/ha/yr), indicating an environment promoting windblown dusts. Crusting of the surface from saline tailings and the positioning of the TSF to capitalise on a less exposed area may actually reduce the risk of high levels of windblown dust being generated from this significant area.

Potential for offsite impacts

Air Assessment report findings

The air quality assessment separated the impacts of the mine's operations into two distinct emissions — gaseous emissions and dust (to include Total Suspended Particles and Particulate Matter). The first category of mine activities is concerned with the HPAL plant, stack and vent sources and as detailed in Table 4.1 and 4.2 (refer to Appendix 1). These tables provide the predicted concentrations of gaseous emissions at the worst-case location (as compared to the concentrations at the Wingellina Township and Mine Accommodation village) with and without the existing background air levels provided.

Whilst the TSF will have a number of measures in place to avoid the release of emissions via wind erosion, there is still potential for inhalation, ingestion and contact with these metal salts in the form of TSP.

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The background level of NO_2, SO_2 and Sulphuric Acid Mist are negligible for the Project area; however background levels show PM_{10} and $PM_{2.5}$ levels account for approximately 26% respectively of the 24hr maximum criteria.

For gaseous emissions resulting from the operation of the HPAL plant, Table 4.2 in Appendix 1 confirms that the addition of PM_{10} into atmosphere as a result of the project's HPAL plant is minor, adding less than 2% of the 24hr maximum PM_{10} criteria (50µg/m^3). There is no measure of $PM_{2.5}$ added to the atmosphere resulting from the operation of the HPAL plant.

The higher levels of SO_2 during start-up periods of the acid plant show 73% of the NEPM criteria reached at the worst case location (any location). The Mine Accommodation village and the Wingellina Township would experience 53% (300 µg/m^3) and 40% (230µg/m^3) respectively for the second highest 1-hour SO_2 concentration.

A maximum 1-hour SO_2 concentration of 240 µg/m^3 is predicted to occur in the vicinity of the Wingellina Township during start-up periods of the acid plant. The Air Assessment report notes the conservative nature of these predictions which were based on start up conditions for the whole of the year, when in reality it should only occur five times per year for two to three hours at a time. The 2005 WHO air quality guidelines (AQGs) have revised the SO_2 concentration values, noting that the 24-hr mean is 20 µg/m^3 and 10 minute mean is 500 µg/m^3. The AQGs note that a SO_2 concentration of 500 µg/m^3 should not be exceeded over average periods of 10 minutes duration.

Table 4.3 in Appendix 1 documents the predicted particulate levels for fugitive dust occurring from mining and stockpiling activities. The table shows both Project only contribution and the cumulative impacts (including background) at year 14, which is considered representative of maximum mine production rate. The prediction assumes some control measures would be in place such as covered stockpiles (reseeded during first two years), water spraying or chemical dust suppression and other practices utilised to minimise dust and water carts for roads and shallower pits.

Particulate levels from the mining and tailings are predicted to be below the criteria at Wingellina Township and the Mine Accommodation village. The PM_{10} concentrations are predicted to be up to 64% of the 24-hour NEPM standard at Wingellina, with $PM_{2.5}$ concentration at 39% and 79% of the respective 24-hour and annual average reporting standard. The 2005 WHO AQGs are referenced for health impact assessments concerning air quality. The AQGs note the PM_{10} concentration for the 24-hr mean is 50 µg/m^3 (same limit as NEPM criteria) and the annual mean is 20 µg/m3. For $PM_{2.5}$, the WHO AQG note a 25-hr mean of 25 µg/m^3 (same as the NEPM criteria) and annual mean of 10 µg/m^3. An annual average for PM_{10} was not recorded in the AQIA however the AQIA's predicted particulate levels from fugitive dust (refer to Table 4.3 in Appendix 1), show that the Project levels (to include background levels of both PM_{10} and $PM_{2.5}$) meet the WHO AQGs.

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Health Risk Assessment findings

The HRA referenced the Air Assessment findings and utilised a staged methodology with the issue and hazard identification steps highlighting gaseous and particulate matter emissions as potential hazards to health from the mine's operation. The hazard assessment stage considers the three main exposure pathways; ingestion of soil, inhalation of gases and particles, and dermal contact (to a lesser degree).

The project-induced gaseous emissions from the Air Assessment report show compliance with the AQGs and as such the HRA undertook further assessment of the project-induced particulate matter emissions. As such, run of mine (ROM) activities including stockpiling would generate the main source of fugitive dust (in the form of total suspended particulate, PM_{10}, $PM_{2.5}$) leading to dust deposition.

The main chemical of concern to health as contained in particulate matter is nickel. Other chemicals such as Chromium hexavalent (Cr VI) found in tailings would be treated to reduce Cr VI to Chromium III which is a stable, less toxic form. Refer to Appendix 1(Table 4.4 through to 4.7) to provide an overview of the HRA assessment using the depositional dust data.

The HRA assesses the project-induced air quality impacts against air quality criteria protective of health to determine the health risks for sensitive receivers (Wingellina Township and future Mine Accommodation). To supplement the dust depositional data collected at eight monitoring stations surrounding the Project site, the HRA hazard and exposure assessment also considered published National Environment Pollution (Contaminated Site Assessment) Measure 1999 Health Investigation Levels (HIL) for the most conservative residential scenario to reflect the potential impacts for the closest residential receivers.

The exposure assessment uses this residential HIL scenario to consider toxicological thresholds for nickel using typical Australian exposure factors for the most vulnerable persons within the population. Exposure characterisation for the main hazards including particulate matter (containing metal compounds), nitrous oxides, sulphur dioxide and sulphuric acid mist were used where deemed appropriate.

The exposure assessment determined the nickel concentration in particulate matter (PM_{10}) as based on the chemical analysis of depositional dust sampled across sites surrounding the Project, including the two sensitive receptor locations. The total nickel concentration in PM_{10} was compared against health-based investigation levels and guidelines protective of health to characterise health risks.

Results of the depositional dust analysis indicate the baseline average nickel concentration in existing PM_{10} emissions recorded for the Wingellina Township is 0.0006µg/m3 and at the proposed Mine Accommodation site, a baseline average concentration of 0.00180µg/m3 exists. The predicted cumulative nickel concentration was calculated by adding the project-contributed nickel and existing

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baseline nickel levels to determine a cumulative concentration for both sensitive receiver locations. The results of this cumulative assessment found that nickel concentrations in the annual average cumulative PM10 emissions are 0.0020µg/m3 at the Wingellina Township and 0.0023µg/m3 at the proposed Mine Accommodation Village.

Health outcomes

Health impacts resulting from air pollutants are closely related to particle size. Whilst there will be an increase in the numbers of heavy vehicles transporting material to and from the Project area (estimated to be 15 trucks per days during operations), in addition to the movements of heavy vehicles within the site, it is considered there is a low heath risk impact due to the negligible background of existing $PM_{2.5}$.

For PM_{10} and larger suspended particles carried in windblown dust, there remain current health issues for the existing population at Wingellina, particularly persons more vulnerable to respiratory illnesses, asthma and chronic lung diseases. The exposure to nickel concentration is largely dependent on the concentrations of $PM_{10.}$ The HRA assessed the background (existing) level of PM_{10} and project-induced levels of PM_{10} to assess a cumulative, long-term exposure to PM10 and particularly nickel concentrations.

The HRA findings support the conclusion that the Wingellina Township experiences more dust emissions (total suspended particulate and PM_{10}) however at a lower nickel concentration. The proposed Mine Accommodation Village would experience less dust emissions but at a higher nickel concentration. Predicted cumulative concentrations of nickel in PM_{10} meet the conservative Western Australian Department of Health long term health based guideline of 0.003µg/m3. As a result, the overall exposure to nickel dust contained in PM_{10} is considered to be low.

All air pollutants arising from the Project's operation are therefore predicted to be below relevant air quality criteria. Notwithstanding, windblown dust remains a key health hazard in the community and any exacerbation of this may lead to increased health risks. Health studies also indicate that a proportion of people with asthma experience changes in pulmonary function and respiratory symptoms after periods of exposure to SO_2 in as short as 10 minutes (WHO, 2005). While health outcomes resulting from increased air pollutants indicate these will be the biggest negative health impact for the community.

6.1.4.2 Air Quality Risk Assessment

The risk rating for air quality impacts is **medium**, with an impact rating of -3. This denotes a negative health impact, consistent with the existing health issues arising from ambient or background levels of windblown dust. These risks require operational management measures and air quality monitoring program to ensure dust levels are not increased by the Project operations.

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6.1.4.3 Air Quality Risk Management - Can impacts be mitigated/ enhanced?

Despite levels of both PM_{10} and $PM_{2.5}$ levels meeting the NEPM air standards and WHO AQG goals, monitoring for $PM_{2.5}$ and PM_{10} would be a recommendation as part of the Air Quality Monitoring program to be implemented by the mine operators.

In terms of the proponent's management response to the Project's air quality goals, a number of key management areas would need to occur in parallel. These would include activities that:

- Demonstrate adherence to air quality standards and guidelines;
- Design measures, technology and operational procedures that control air pollution at the source and have dilution control measures; and
- Information and education for sensitive receivers (Wingellina Township and mine accommodation camp).

For windblown dust, control measures would be in place such as covered stockpiles (reseeded during first two years), water spraying or chemical dust suppression and other practices utilised to minimise dust and water carts for roads and shallower pits.

Vegetation buffers (shelter belts) and increased 'green space' through vegetating exposed soils may help to reduce the level of dust experienced by this community. This requires adequate non-potable water supply and ongoing maintenance to ensure vegetated areas survive establishment period, species selected for revegetation would need to be drought tolerant.

The Project's design will play a critical role in reducing windblown dust with the location roads exiting the site positioned away from the township and accommodation village. It is also acknowledged that placing the mine pits east of the existing Wingellina Township location will reduce the amount of dust generated from the Project affecting the community given the prevailing wind direction is generally south-easterly or north-easterly. The concept design of the proposed mine roads does not detail whether roads are sealed, this will be determined during detailed design with a recommendation for compaction as a minimum design measure. The operational conditions for the plant will also note the HPAL start-up and shut-down procedures to be carried out with favourable weather conditions where possible to reduce impacts to Wingellina Township and mine accommodation receivers.

Air quality is the key health risk for the Project's sensitive receivers and the recommendations provided in the AQIA would need to be followed. The preparation and implement of an Environmental Management System as per the requirements of the EPA is important in capturing the safeguards and management measures to be in place to reduce air quality impacts resulting from the Project.

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6.1.4.4 Noise and Vibration – Project Induced Impacts

The predicted noise levels at noise sensitive receptors during the operational phase of the Project are provided in Table 4.4, with 35dB L_{A10}, 45dB L_{A10} and 55dB L_{Amax} noted as the noise criteria to be achieved, taking into consideration the low ambient background levels. Criteria for airblasting and ground vibration levels have also been taken into account (using the appropriate reference guidelines) as part of the predicted noise levels at the most sensitive of locations.

Table 4 Predicted Operational noise levels for the Project

Sensitive Receptor	Predicted Airblast Level ($L_{Linea\ peak}$ dB)	Compliant with Noise Regulations	Predicted Ground Vibration Level (mm/s)	Compliant with AS2187:2006	Predicted Operational Noise Level (LA_{10} dB)	Compliant with Noise Regulations
Wingellina Township	100	✓	0.22	✓	34	✓
Mine Accommodation	100	✓	0.08	✓	30	✓

The results of the noise assessment show that the noise emissions during operation of the Project (at maximum capacity and during noise enhancing meteorological conditions), complies with the assigned noise criteria under the Western Australian Environmental Protection (Noise) Regulations 1997, at all noise sensitive premises.

Potential for Offsite Impacts

It is noted however that whilst compliant, the noise levels are close to the criterion at the Wingellina Township and additional mitigation measures will be required such as frequent machinery and plant maintenance and ongoing monitoring of noise emissions to ensure continuing compliance.

Health Outcomes

Exposure to higher noise and vibration levels over a long-term period may induce stress and anxiety for some individuals (depending on vibration perception and noise threshold levels). Other health impacts may include sleep disturbance, reduced school performance and impacts to cardiovascular health.

There is no additional data available to suggest the noise and vibration impacts of the Project during operational phases (to include airblasting and ground-borne vibration) will be a significant cause of unacceptable health impacts to the population located within the Wingellina Township or the future employee population to be located at the mine accommodation.

6.1.4.5 Noise and Vibration Risk Assessment

The overall risk rating for noise and vibration impacts is **low**, with an impact rating of -2. This denotes a negative health impact as some members of the community may experience stress and anxiety during airblasts from mining operations.

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Additional traffic noise and noise generated from the ROM operations may also detract from the current amenity levels and considered to be a nuisance.

6.1.4.6 Noise and Vibration Risk Management - Can impacts be mitigated/ enhanced?

The mine operator is recommended to consider as part of the mine's operational regime limiting noisy activities during the Irrunytju Community ceremonial or culturally significant periods such as funerals.

Limiting noisy activities where possible and using best-available technology within noisy equipment or vehicles to reduce noise generation. It may also be necessary to limit some operational activities to the suggested daytime period of 7am to 6pm to reduce impact on night-time and evening background noise limits.

Employees working at the mine will be impacted by noise and vibration however a number of state and national entities legislate and provide guidance as to the importance of employee health and safety. The provision of personal protective equipment (PPE) is one effective way of reducing exposure to a workplace hazard, particularly where that hazard cannot be eliminated. The HRA looks at the occupation safety impacts and mitigation measures.

6.1.4.7 Lightspill and visual impacts – Project Induced Impacts

Outback Ecology (2012) prepared a visual impact assessment for the Project. The overarching objective of the assessment was to ascertain the visual impact of the construction and operation of the Project upon existing social and cultural visual receptors, taking into account environmental factors of distance, elevation profile and natural vegetation screening.

This visual impact assessment was not comprehensive in its scope. Accordingly, a Light Impact Study (SNC-Lavalin, 2014b) was undertaken to assess the potential lighting impacts from the Project on the local region including Wingellina community, as representing the closest existing settlement, approximately 5km from the proposed processing plant.

To determine the impact of lighting on the township, low ambient light was first modelled and included the surrounding landforms. A typical moon lit night was simulated as ambient conditions and provided a comparison between the vista without the plant (existing background conditions) and with the plant.

Two rendered images were generated at each viewing location:

- No lights other than ambient to simulate a moon light night to give a comparative context to the full lights on scenario; and
- Full lights on with ambient to give the most realistic final lighting image.

Potential for Offsite Impacts

Due to the immediate proximity of the Project to the proposed Giles to Mulga Park Road diversion the Project will dominate the southern view shed, partially to completely reducing the visual line of sight to background environmental features.

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The Project will be a dominant visual feature from the Surveyor Generals' Corner, which is a non-residential location.

The findings showed that low landforms largely obstruct the view of the plant from the existing Wingellina Township however the top of the 60m tower (as part of the HPAL plant) would be visible to the Wingellina Township with a slight halo predicted to exist above the hills. The operational safety lighting of the plant during night-time hours has the potential to cause nuisance impacts at the Wingellina Township and the nearest public road (Diversion 2 of the Giles to Mulga Park Road) is severely impeded by landforms. This in conjunction with the physical distance between the viewpoints and the plant, combine to make the resultant impact on communities and passersby (motorists) negligible.

Health Outcomes

Light pollution can be considered in two different forms, the first being annoying, nuisance type impacts which affect an otherwise natural setting or low-light setting or in the second form as excessive light leading to discomfort and adverse health effects. Those health impacts may include sleep disturbance or excessive glare causing unsafe driving conditions for motorists.

6.1.4.8 Lightspill Risk Assessment

The impacts were assessed as being **very low** with a rating level of -1. This denotes a negative impact acknowledging some minor nuisance impacts..

6.1.4.9 Lightspill Management - Can impacts be mitigated/ enhanced?

The Project design is encouraged to include low light spill, unobtrusive lighting sources through selecting low voltage lights (where feasible), directional lighting and positioning lights towards the ground and not towards the surrounding environment.

6.1.4.10 Waste management, groundwater and surface water contamination – Project induced impacts

The TSF will collect the processing plant tailings, piped at a rate of 5.0Mtpa. The tailings will contain a number of soluble metal salts including magnesium (5300mg/l), calcium (550 mg/l) and manganese (14 mg/l).

It is noted that local groundwater is potable; hence it is important to rule out the potential for groundwater contamination via the TSF. As described above, the tailings will contain some chemicals of concern and metals which, if leached into the groundwater may cause risks to the health of the Wingellina Community and Accommodation camp.

Drainage controls have been designed to a concept level based on a comprehensive hydrological and hydraulic assessment, including (Rockwater 2011):

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- Identification of catchment areas and natural water courses likely to impact the pits and mining infrastructure;
- Hydrological analyses to estimate peak flows of 2, 5, 10, 20, 50 and 100 year average recurrence interval (ARI) rainfall events from all catchment areas that are likely to adversely impact the Stage 1 mine pits, landforms and infrastructure locations; and
- Surface water hydraulic analyses at critical locations and sections where natural water courses approach the pits and infrastructure.

Potential of Offsite Impacts

The 2010 Pit dewatering and permeability study undertaken for the project (Rockwater, 2010) determined that given the depth of clay, attenuation for metals in tailings and the low permeability of tailings will significantly reduce any likelihood of surface water and groundwater contamination by the TSF. As such, a low potential to contaminate ground and surface waters and soil exists, particularly during the process of piping, storage and handling of tailings or from potential spills. The existing water table is also sufficiently located within a range of 38 to 58m below ground level further making groundwater contamination a very low possibility.

The mine accommodation facilities will include adequate waste management measures, including appropriate refuse collection and disposal, the design and implementation of a septic system that is appropriate to the location and approved disposal methods according to the WA EPA and Health Department guidelines.

Health Outcomes

Contaminated groundwater may have serious health impacts for populations reliant on potable groundwater sources. While the Wingellina community does access bore water as a source of potable water, it is very unlikely any impacts from the mine will negatively affect current water supplies or quality of water given the separation distance between the mine (nearest pit) and the Wingellina Township.

The injection of investment into the community may have a positive impact on the provision of infrastructure with the probable improvement in both the potable water distribution network and sewerage system. This would improve health outcomes for the existing Wingellina Township through better environmental health and hygiene.

6.1.4.11 Waste Management, Groundwater and Surface Water Contamination Risk Assessment

The risk rating for ground and surface water contamination is **very low**. While a negative impact, this reflects the rare likelihood of groundwater contamination occurring as the water table is located at a sufficient depth to not be affected by the Project, even if a spill of tailings was to occur. The Wingellina Township is also located at a sufficient distance away to not be directly affected by contaminated groundwater. If the Project is approved, it is likely some improvement to the town's

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current water reticulation and sewage system will occur. This may actually improve the risk rating to a positive rating of **low to medium** with a range of +2 to +3.

6.1.4.12 Waste Management, Groundwater and Surface Water Contamination Risk Management - Can outcomes be enhanced/mitigated?

Mine pits will be protected by a levee/drain system, with approximate levee heights of one metre, lengths ranging from 350 – 2000 m, drain bed widths ranging from 1 – 4 m and drain depths ranging from 0.6 – 2.0 m (Rockwater 2010). These designs represent the minimum requirement to contain a 1 in 100 year ARI peak flow from the relevant catchment or series of relevant catchments. Excess flow will run on the surface of the natural ground alongside the drains.

The TSF will be constructed on built-up compacted local clay as a best-practice mine design. Notwithstanding these findings, recommendations in the 2008 Waste Classification letter report (Outback Ecology, 2008) for the Project suggests information regarding tailings properties should continue to be collected, with tailing geochemistry further investigated. Metallurgical testing to date has only identified one significant potential contaminant in the form of hexavalent chromium (Cr (VI). However this will be eliminated within the process using sodium metabisulphite (SMBS) to convert any hexavalent chromium back to the stable trivalent state.

Approximately 13 road crossings may require culverts and floodways. Almost all of the waterways at the proposed road crossings appear to be in the form of wide sheet flows with no defined channels and probably minimal flow velocity (Rockwater 2011). Culverts of nominal 450 mm diameter will be installed to take the normal annual flows, and floodways with scour protection installed to take the larger 1 in 100 year ARI peak flows. Sedimentation basins will be installed where required to minimise sediment emissions to the catchments.

The design of the mine accommodation and mine facilities need to ensure (to satisfaction of the Department of Health) that appropriate provision of solid waste management and wastewater disposal systems adequately meets:

- The predicted population size within the development;
- Connection to a reticulated sewerage system where the capacity of the local reticulated mains can handle fluctuations in employee population;
- The mine site facilities and accommodation villages connected to onsite wastewater systems noting groundwater resources and soil type; and
- An adequate wastewater system is proposed (i.e. septic tanks or aerobic treatment unit) with sufficient area is available to accommodate onsite wastewater treatment systems and the effluent disposal area required. Waste management strategy includes a hierarchy of elimination, reduce, reuse and recycle before considering waste disposal options.

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6.2 Transportation

The WHO recognises transport as a social and economic determinant of health with evidence of transport effecting health in the following ways:

- Accidents between motor vehicles, bicycles and pedestrians (particularly children and young people);
- Air and noise pollution;
- Psychosocial effects such as severance of communities by large roads and the restriction of children's movement;
- Climate change due to CO2 emission;
- Loss of land;
- Improved physical activity from cycling or walking; and
- Increased access to employment, shops and support services and contributing to economic development.

6.2.1 Existing issues

Access to transport

The remoteness of the community presents issues for personal travel. Despite this many of the people of Wingellina are well-travelled and have visited many of the local communities and regional centres around Wingellina. Residents of communities within the Ngaanyatjarra Lands are very mobile, travelling between towns frequently and at all hours of the day and night. There is no public transport service available to community members such as a bus service to other communities or air services to major centres and as a result, people are generally reliant on personal vehicles for travel.

According to the WA Police, most people in Wingellina who drive posses a valid driver's licence, however of concern is the number of unlicensed and unsafe vehicles that are being used.

The *Centre Bush Bus* is a bus service between Docker River (NT) and Alice Springs (NT) delivering a twice weekly service and between Pipalyatjarra (SA) and Alice Springs on a weekly basis which services Kalka (SA). To access this service, people from Wingellina need to get to Kalka either on foot or through other means of vehicular travel.

6.2.2 Existing health impacts (health baseline)

As outlined as an air quality risk, there are no sealed roads within or outside the Wingellina Township, making windblown dust a potential health problem for those affected by respiratory issues when roads are heavily used.

An unsealed, well-compacted airstrip is located immediately adjacent to and north of the community and residents can access air travel via the mail plane with this

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twice a week service utilised for transferring medical patients out of Wingellina to Alice Springs and Kalgoorlie.

The lack of available transport has an impact on many aspects of life for much of the community despite their apparent mobility. A lack of frequent and accessible local public transport provides a further limitation for attendance at training or work opportunities outside of the community. Further, this has a detrimental impact on accessing essential heath services that are not provided in the community.

There is no data available to suggest the rate of vehicle accidents in this specific location, however 2014 Fatal Traffic Crashes and Fatalities (from 1 January to 30 June 2014) (WA Police, 2014) suggest in the Goldfields-Esperance region, there have been 5 fatal crashes, with 5 fatalities recorded. The Goldfields-Esperance region is extremely large and the data does not provide further detail as to location of these fatalities with this region. The 2010 WA Police data for Serious Injuries and Fata Accidents Summary Report suggests that in regional WA, 45% of fatal injury crashes are caused by alcohol and speed. The SIMP (URS, 2012) states that the WA Police find it difficult to administer unlicensed and unsafe vehicles being used at Wingellina due to the large distances involved to reach Wingellina and the frequent turnover of vehicles. Safety of road users is therefore a primary concern that currently exists in this community.

6.2.3 Risk Assessment for existing baseline risks

For transportation, the summary of existing risks is as follows.

Health determinant category	Health determinants	Positive or negative	Level of existing risk/benefit
Transport	Access to transport	-ve	Medium

6.2.4 Future Transportation Issues

As documented in the project Pre-Feasibility Study (2008), MetalsX anticipates the Project will generate approximately 15 trucks per day travelling on the roads, transporting product out and transporting goods in. There is estimated to be up to approximately 80 movements per day (worse case) associated with the Project.

Potential for offsite impacts

Concerns were raised by the community regarding the potential for increased traffic movements, leading to generation of more windblown dust, heavy traffic noise and the potential for more accidents with other road (motorists and pedestrian) users. Other impacts have been captured in the air quality and noise and vibration impact assessment sections.

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Health outcomes

Given that all roads in the Project area are unsealed, there is a concern that level of dust will create an increased health and environmental (flora and fauna) risk. There is also concern that given the Irrunytju Community is highly mobile, travelling between towns frequently and at all hours of day and night. With an increase in heavy vehicles using same routes, there is a risk a higher rate of accidents will occur.

There is also an indirect health risk associated with an increase in transport to and from the township with the potential for 'grog running' and increased transport making illegal drugs and alcohol more accessible to Wingellina.

As a positive impact, more frequent use of roads increases surveillance and reporting of breakdowns and stranded motorists when vehicles breakdown in isolated stretches of road. There are no anticipated changes to public transport options to or from Wingellina as a result of the Project, however it is unknown at this stage whether future public transport options will improve with the mine's development given the influx of mine employees at the proposed Mine Accommodate village.

Should access to transport improve as either a direct or indirect result of the Project, this may empower the community to access training, employment and health services in areas outside of Wingellina. As such, there may be an increase of informal travel arrangements made between employees and members of the Wingellina Township accessing surrounding communities or larger regional centres. The Wingellina air strip may also be more frequently used with fly-in/fly-out (FIFO) employees accessing the mine. Project employee movement hasn't been assessed at this stage of the project, with these details to be determined upon detailed design and planning stages.

6.2.5 Transportation Risk Assessment

The health risk rating for traffic and transport is **medium** with the scale ranging from -3 to +1. There are a number of positive and negative health impacts that may result due to the Project Positive impacts reflect the likelihood of access to transport options improving either directly or indirectly as a result of the Project. Increased movement of heavy and light vehicles creates negative health impacts with poorer air quality (dust generation on unsealed roads) and increased road traffic noise.

6.2.6 Transportation Risk Assessment - Can impacts be mitigated/enhanced?

Community members have expressed desire for the roads to be sealed for some distance on either side of the community (URS, 2012). However, the predominance of calcrete (forming a crust or hard mineral layer) in this location may make sealing the road surface difficult. It is recommended the Proponent consider design

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solutions (such as chemical dust suppression) and other options that may reduce dust from use of unsealed roads.

A number of traffic management measures would need to be incorporated into a Traffic Management Plan for the Project particularly where Project traffic anticipates using existing routes used by motorists and pedestrians accessing the Wingellina Township. These may include reducing speed limits, flashing/warning lights, reversing alarms and horns to reduce or prevent the potential for conflicts between road users and Project-related traffic. A recommendation to place safety barriers along well-used roads within the Project-travel routes may be feasible in some locations to separate on-coming traffic.

It is recommended that the use of heavy vehicles accessing the Project via public roads would occur between daylight hours where feasible to further reduce the potential for accidents with other road users, particularly pedestrians.

Consultation with the community should occur regularly to ensure any planned increases in Project-related traffic is communicated adequately. This allows community members (particularly those travelling between surrounding communities or more vulnerable community members such as children and the elderly) to be aware of increased traffic movements and to raise road-user safety.

- Prepare and implement a Communications Strategy that provides information to Ngaanyatjarra Lands People about environmental management and monitoring related to the operation of the mine;
- Prepare and implement a Traffic Management Plan;
- Prepare and implement Environmental Management System and Plans to manage dust and noise from traffic movements; and
- Liaison with state and federal government agencies responsible for road maintenance to ensure roads are in good repair.

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7.0 THE SOCIO-ECONOMIC ENVIRONMENT

7.1 People and Community Wellbeing

Wingellina is considered one of the more remote Aboriginal communities in Australia, and living in a remote location leads to social inequity, such as access to employment, education and health services. Infrastructure and housing is generally in poor condition, with the community expressing some frustration that they are overlooked by the Western Australian Government in the delivery of services and maintenance of housing and hard and soft infrastructure. Section 1 provides further detail related to the current socio-economic and health conditions of the Irrunytju Aboriginal community.

The Wingellina community lies between two cultural zones – the Ngaanyatjarra and the Pitjantjatjara Lands, hence the community structure is typical of Aboriginal culture with a hierarchy of elders and tight-knit community. As is common across remote Aboriginal lands, people will travel frequently between communities and towns for cultural reasons, to maintain the close links with family and to obtain services (URS, 2012). The population does fluctuate owing to transient nature of this Aboriginal culture, with commitments to '*Country*', family, sorry business, cultural business, sporting events such as football carnivals taking high priority.

Social contact is high, with the social and community network strongly defined by familial and kinship systems and language or nation groups. Connection to animals and the physical environment is extremely important to Aboriginal culture, identifying their connection to 'Country' and Dreamtime, thus providing the framework for their community structure and way of life. (http://www.aboriginalculture.com.au/socialorganisation.shtml. accessed August 2014).

7.1.1 Existing baseline risks – Community and Wellbeing

For Community and Wellbeing, the summary of existing risks is as follows.

Health determinant category	Health determinants	Positive or negative	Level of existing risk/benefit
People and Community Wellbeing	Community structure	+ve	Medium
	Social contacts	+ve	Medium
	Community participation	+ve	Medium
	Crime & antisocial behaviour	-ve	Low
	Discrimination	-ve	Very Low

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Health determinant category	Health determinants	Positive or negative	Level of existing risk/benefit
	Safe environments	-ve	Medium
	Social networks	+ve	Medium
	Feelings of trust	+ve	Medium

7.2 Existing Lifestyle

As noted in Section 3.2, the community profile raises the issue of poor living conditions, resulting from Wingellina's remote location and limited access to services.

Section 3.2.6 recognises that poor nutrition, inactivity and high rates of smoking are main contributing factors to chronic diseases and levels of poor health in some community members. Access to recreational facilities is limited with the community recreational facilities either falling into disrepair (such as the Community Hall) or being overgrown and untended, as evidenced in the current condition of the Football Oval. Community facilities such as a swimming pool and health services are only accessible within other communities, requiring the need to travel.

A lack of facilities generally, the poor level of maintenance of facilities that do exist and limited access to facilities located large distances from the community results in restricted recreational choices contributing to inactivity. The remote desert location may also restrict a balanced diet with poor nutrition a result of reduced access to fresh foods which require transportation from Perth some 1,800 km away by road. Reliance on frozen, expensive and highly processed foods from the Wingellina General Store is common, although hunting for tradition food sources is also part of the diet.

The Community Office serves many functions of the government and non-government agencies and assists people with banking, accessing social security payments, liaising with law and order agencies and authorities, contacting relatives and provides a pivotal service for the community.

Other important services used by and located within the community include the General Store, the Ngaanyatjarra Media Centre and Ngaanyatjarra Pitjantjatjara Yankunytjatjara (NPY) Women's Council Centre. Together with the Community Office, these outlets provide valuable social services for the community.

Where police discretionary powers permit it, visiting police have empowered Irrunytju Community leaders to deal with offenders within the community. The basis of this system is that the community seeks to assist offenders by analysis of their problems, provision of remedial care, and imposition of appropriate supervised community-based punishment. Where necessary, offenders are dealt with by police in the orthodox way and summarily charged before the Court of Petty Sessions,

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Warburton, for judgement and sentencing. (http://www.ngaanyatjarraku.wa.gov.au/index.php/our-region/community-information/wingellina, accessed 7 August 2014).

7.2.1 Existing baseline risks – Lifestyle

The following shows baseline risks for Lifestyle

Health determinant category	Health determinants	Positive or negative	Level of existing risk/benefit
Lifestyle	Exercise patterns	-ve	Medium
	Recreation choices	-ve	Medium
	Access to and use of leisure facilities	-ve	Low
	Access to nutritional food	-ve	Medium
	Risk behaviours	-ve	Low
	Communicable diseases	-ve	Low

7.3 Existing Sustainability

Biodiversity

The natural environment is under pressure from existing threats such as camel grazing and bushfires; hence there is an existing level of disturbance to the biophysical ecosystem from feral animals and past mining and mining exploration activities. Ecosystems and species are currently subject to a large number of threatening processes, and the trend is not known in many cases. Impacts identified in the bioregion by recent biodiversity surveys include changed fire regimes, feral animals, weeds and vegetation clearing. These factors are deemed to be causing a general loss of vegetation cover in the bioregion, with a consequent loss of native species.

The native flora and fauna is important to Aboriginal culture; connecting them to 'Country', dreamtime and traditional sources of food. A number of flora and fauna surveys were undertaken by Outback Ecology (2008 and 2009) in the proposed project footprint. A total of 66 terrestrial vertebrate fauna species were recorded during the survey including: 17 mammal species (10 native and 6 introduced), 26 reptiles and 23 bird species.

One species of conservation significance was recorded during the survey, the Australian Bustard (*Ardeotis australis*) which is listed as a Priority 4 species under WA Department of Environment and Conservation (DEC) Priority Species List.

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Species of conservation significance that were not recorded during the survey that are considered likely to occur over the project area, at least intermittently, include: the Princess Parrot (*Polytelis alexandrae*) which is listed as Vulnerable under the Commonwealth Environment Protection and Biodiversity Conservation Act, 1999 (EPBC Act); and the Rainbow Bee-eater (*Merops ornatus*) and Fork-tailed Swift (*Apus pacificus*), which are listed as Migratory species under the EPBC Act.

No critical habitat is located over the Project area, and no World Heritage Properties, Ramsar Wetland Sites or Nationally Important Wetland sites are in the vicinity. All broad terrestrial fauna habitat types identified over the project area are represented elsewhere in the bioregion, and none is considered of regional significance.

The Irrunytju Aboriginal community still practices traditional hunting and gathering methods, relying on a variety of flora and fauna. The environment is not under threat through traditional methods of land use. The levels of windblown dust resulting from traffic, exposed soils and soil erosion contribute to risks to biodiversity and the biophysical environment.

Support for local businesses

The Wingellina Township has only one general store which provides access to a number of good and services such as foods, petrol and diesel, gas bottles, clothing and household goods. The store also has an ATM allowing the community members to access bank accounts. All supplies are provided from Perth by the Ngaanyatjarra Agency and Transport Service (NATS). Profits made by the store are returned back to the community, hence the store performs an important function within the community.

Effect of future generations

Intergenerational equity is a one of the four principles of ecologically sustainable development which refers to ‘inheriting the Earth from previous generations with an obligation to pass it on in reasonable condition to future generations’ (Weiss, 1990). In the context of the Irrunytju Community and this HIA, effect on future generations may contain a number of outcomes surrounding the concept of ‘what is inherited’. As discussed briefly in 8.1, Aboriginal social and community networks are strongly defined by familial and kinship systems and language or nation groups with a connection to the physical environment. The passing down of cultural past-times, language and way of life is extremely important to Aboriginal culture and identifies their inherent association to ‘Country’ and Dreamtime. While Wingellina may exhibit a poor standard of living compared to ‘western’ standards and expectations, the remote location and autonomy to participate in traditional past-times and cultural activities is something future generations will also be encouraged to do. The framework for Aboriginal culture and community structure relies on the future generations to continue in traditions and relationship with Country.

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What is not evident from the existing technical studies, such as the SIMP, what is the sustainable livelihoods approach for future generations (as discussed by Holcombe, 2010) which defines sustainable livelihoods in marginalised communities as *'focussing on existing capabilities and strengths of individuals, families and households, rather than their needs and deficits'*. It is also understood that the Commonwealth Government together with State and Territory governments are trying to 'close the gap' for Indigenous Australians. The impact of the current funding and focus on improving various socio-economic including health and education outcomes would assume an improvement in current conditions , particularly for future generations in Wingellina.

7.3.1 Existing baseline risks – Sustainability

The following shows the baseline risks for Sustainability

Health determinant category	Health determinants	Positive or negative	Level of existing risk/benefit
Sustainability	Disturbance of ecosystems or natural environments (biodiversity)	+ve	Low
	Support for local businesses	-ve	Medium
	Effect on future generations	-ve	Low

7.3.2 Future Issues

7.3.2.1 Biodiversity

The Project would result in the removal of approximately 2,543 hectares of vegetation. The majority of the clearance would be of vegetation community *5b: Sparse Tall Shrubland of Acacia aneura*. Approximately 1,134 ha of this community will be cleared for the proposed mine site infrastructure.

Potential for impacts

The potential impacts of the Project to terrestrial fauna and flora could be expected to be associated with:

- Loss of fauna and habitat due to vegetation clearing and topsoil removal;
- Alterations to surface hydrology;
- Effects of noise and dust;
- Potential to introduce weeds and increase populations of exotic species;
- Secondary impacts due to increased traffic and off-road vehicles access; and
- Increased risk of fire.

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Managed appropriately, the proposed mine will have only a localised direct impact on the flora and vegetation of the Study Area or region. However, indirect impacts could affect a larger area and requires special consideration. Of particular concern are: the potential spread of weed (Buffel Grass) during road construction and other earth works; associated increases in the frequencies and intensity of fire; spread of new species of weeds from any new gardens or landscaping established at the site; increased rabbit and camel numbers due to increased availability of water and feed (e.g., lawns); the potential impact of dust on native vegetation; and potential damage to native vegetation and spread of weeds by offroad vehicles driven by mine staff and contractors for work or recreational purposes. These impacts may lead to a decline in available species for traditional hunting and gathering, leading to less reliance on traditional diets.

Health outcomes

The health outcomes of vegetation loss and potential habitat clearance will be broadly negative and with limited positive impacts. Losses among some native terrestrial (vertebrate and invertebrate) species may occur, however it is noted existing stresses on populations exist through feral animal (camel, wild dogs and cats) and weed species (Buffel grass) is already impacting native species numbers. A decrease in native species may decrease availability of food sourced through hunting and gathering methods. An increase in feral animals may increase the general food stock for the Wingellina Township with rabbit numbers and other opportunistic animals increasing in numbers. Culling of feral animal numbers (as direct and indirect impacts resulting from the Project) may improve population numbers for some native species numbers and quality of native flora habitat outside of the Project area. A decrease in wild cat and wild dog numbers through forced culls may also improve general health and hygiene in the Wingellina Township through reducing potential animal bites, opportunistic feeding on rubbish and excrement left by feral animals.

7.3.2.2 Biodiversity Risk Assessment

The health risk rating for biodiversity is **low**, noting a negative impact overall.

7.3.2.3 Biodiversity Risk Management - Can impacts be mitigated/enhanced?

General management guidelines to minimise potential impacts of the Project on the fauna and flora include:

- Reduce vegetation clearance to an absolute minimum;
- Conserve topsoil and progressively rehabilitate waste dumps, tailings dams and pits to an appropriate standard;
- Avoid clearance or disturbance to probable Mulgara habitat within dense Spinifex over sand habitat;
- If possible avoid disturbance to Rocky Escarpment habitat within the project area;

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- Minimise impacts to surface hydrology by avoiding drainage features wherever possible;
- Assess the likely impact of dewatering and any groundwater drawdown on vegetation;
- Discourage the establishment of artificial water supplies. Assess impacts on artificial water sources on migratory birds and waders and implement management strategies to discourage the attraction of these species;
- Implement standard dust suppression strategies across the project area, during both construction and operation periods, to reduce impacts to surrounding vegetation;
- Systematic culling of camels where practicable to reduce the negative impacts on surviving Mulga woodlands;
- Prevent the establishment of new weed species, and the further spread of existing weed Species;
- Develop strategies to reduce the likelihood of increased populations of feral and pest animals, and dingos by appropriate refuse management and education of mining personnel to prevent feeding feral animals [4];
- Consider the preparation and implementation of a succinct Fire Management Plan, not only to reduce the risk of unplanned fire emanating from the project area, but also to mitigate against wildfire from off-site ignition sources [2];
- Establish and support an Implementation and Review Committee to act as a forum to consult with Ngaanyatjarra Lands People on environmental management concerns and other matters as described in the Wingellina Project Agreement;
- Prepare and implement a Communications Strategy that provides information to Ngaanyatjarra Lands People about environmental management and monitoring related to the operation of the mine;
- Establish a 'hot line' to allow concerned parties to report concerns or complaints related to environmental impacts; and
- Establish mine tours during operations to allow interested community members to tour the operation and witness the monitoring activities that take place.

7.3.2.4 Support for businesses and effect on future generations

There is a general recognition that income levels may increase as a result of better training, employment and new business opportunities as a direct benefit of the Project. As previously stated, job readiness and existing low levels of education (numeracy and literacy skill) will prevent large numbers of the locally available

[4] It is acknowledged the Project will have limited control on the number of domestic cats and dogs from within the community adding to feral animal populations, nor traditional burning practices for renewal of country purposes. The mitigation measures proposed are to minimise Project related impacts.

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working-age population to be employed or trained as part of the Project (at least in the initial phases), however the Project may generate the start of improved levels of income over time (providing sustainable business opportunities develop).

The Wingellina Project Agreement provides for the payment of financial compensation to the beneficiaries of the Agreement (i.e. Ngaanyatjarra Native Title Holders). The Agreement sets out conditions and schedule of payments aligned with the Project's development. Providing the mine is approved, these payments will effectively increase income within the Township, positively impacting the living conditions of the Irrunytju Aboriginal Community.

Potential for impacts

Potential business opportunities may be created as a direct result of the Project, requiring some assistance from MetalsX to identify services that could be provided from existing businesses within the Ngaanyatjarra Lands. There may also be the potential for new businesses to be created (providing they are sustainable businesses) with opportunities for fencing, capping drill holes, rubbish collection, camp maintenance and cleaning services, seed collection and rehabilitation works and transport (goods and people).

Health Outcomes

Improved income for community members that can capitalise on new business opportunities can empower not only those directly benefiting from more income, but this can have wider benefits for existing and future generations leading to better standards of living and improved health indicators.

7.3.2.5 Risk Assessment - Support for businesses and effect on future generations

The health risk rating for support for local businesses and effect on future generations in **medium**, noting a positive impact overall.

7.3.2.6 Risk Management - Support for businesses and effect on future generations

There are two key management measures, these include

- Establish and support an Implementation and Review Committee to act as a forum to identify and review economic opportunities for the Ngaanyatjarra Lands People and other matters as described in the Wingellina Project Agreement; and
- Prepare and implement a Contracting and Procurement Strategy and work with Ngaanyatjarra Lands businesses to assist entry to procurement and contracting opportunities.

7.4 Existing Social Environment

The existing socio-economic factors for the Irrunytju Aboriginal Community have far reaching impacts for the current generation and their living conditions. It is likely future generations will continue to be affected by the impacts of living remotely. The

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WA Government has committed significant funds (over the period from 2009 to 2014) to closing current health and socio-economic gaps compared to non-Indigenous Australians. Refer to Section 8 for further discussion on the National Partnership Agreement and WA Government initiatives currently being addressed

Section 3.2 details the community profile, outlining the current state of affairs for the community's income, health, education and living conditions. Employment is extremely limited and access to higher education, training and health services necessitates travelling outside of the community itself.

In remote Aboriginal settlements, access to affordable and functional housing is dependent on the successful management and maintenance of essential services infrastructure, with access to these services a direct measure of the settlement viability. Research by Anda and Dallas (2005) included case studies of 12 remote Aboriginal desert settlements in an attempt to identify knowledge gaps and opportunities for improving the maintenance of essential services. The research conducted concluded that 'rarely did the case studies show resource agencies delivering full cyclical maintenance programs for the power and water services assets in the outstations. Skilled personnel were often able to sustain a program of ad hoc maintenance driven by emergency repairs or other services such as carting fuel, water or firewood, where other maintenance activities would be conducted on such visits.' (Anda and Dallas, 2005 p310). The SIMP (URS, 2012) documented the community's general attitude is that Wingellina is often at the 'end of the line' for services and maintenance, noting 'maintenance is delivered out of Perth through Ngaanyatjarra Services and has been infrequent or difficult to procure' (URS, 2012 p.52). Issues may also exist as a result of the Irrunytju Aboriginal Community seeking services and facilities in communities located within the APY Lands in South Australia rather than the Ngaanyatjarra Lands located in Western Australia.

Poor infrastructure and housing conditions contribute to existing health and wellbeing factors, generating further pressures on family structure, relationships and community cohesiveness. Apart from the chronic diseases already experienced in the community, mental illness and services to support Wingellina's youth are key issues for the community (URS, 2012). At the time of the SIMP, there was no community youth worker located at Wingellina although a visiting service was provided. The provision of youth services is typically the responsibility of local governments in Western Australia.

Given the vast areas needed to service, access to police and law enforcement is not always frequent or easily accessible.

7.5 Community Services

Wingellina is one of the most remote Aboriginal communities in Australia and as such it is difficult to attract and retain staff in health and education. Travelling to other communities to seek health services is common, particularly when there is no resident nurse or medical service available in Wingellina.

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The community is essentially “at the end of the line” for other services. Road and infrastructure maintenance is generally lacking and the SIMP reports that the police infrequently visit the settlement, unless there is a serious offence to investigate.

It was noted in the SIMP that the existing water supply is problematic (subject to contamination at times) and water reticulation infrastructure did not meet current drinking water quality standards. Additionally, inefficient effluent disposal also was raised by locals, with poor quality of major infrastructure apparent due to neglect and lack of maintenance over time.

Section 3.8 details the community facilities that either provide a pivotal level of service for the community or are no longer used due to disrepair or lack of maintenance. Figures 9 and 10 provide some photos of community services and facilities.

Figure 9 Community Facilities (Store)

Figure 10 School Facilities

The SIMP (URS, 2012) found that the current standard of living for people in Wingellina is low in comparison to less remote communities and whilst the community expresses a connection to the Wingellina locality and town, there is acknowledgement within the community that infrastructure is poorly maintained; income is low, services are inadequate and economic opportunities remain limited.

7.5.1 Existing baseline risks – Social Environment and Community Services

The Social Environment covers the main categories of Health determinants, these being People and Community Wellbeing, Lifestyle, Social Environment and Community Services.

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Health determinant category	Health determinants	Positive or negative	Level of existing risk/benefit
Social Environment	Family structure & relationships	+ve	Medium
	Housing conditions	-ve	High
	Employment status	-ve	High
	Income	-ve	High
	Education	-ve	High
Community Services	Leisure facilities	-ve	Low
	Health services	-ve	Medium
	Police	-ve	Low
	Transport	-ve	Medium
	Local community facilities & organisations	-ve	Low
	Emergency services	-ve	Medium
	Schools and child care services	-ve	Low

7.5.2 Future Issues for Wingellina's Social Environment

It is assumed that for most socio-economic health determinants, the Project will actually deliver benefits by investment into the existing community infrastructure (or potentially develop new infrastructure if relocated). Additionally, issues such as water quality and waste disposal within the community may improve as a result of the Project.

In the majority of cases, there is a positive knock-on effect for socio-economic factors through the improvement of the social environment and related soft-infrastructure. This is aided through a commitment to improve education and training, employment and business opportunities. With the mine having a considerable design life of 30 to 40 years, it is assumed that even if the current population does not derive significant social benefits from the mine straight away, the potential for future generations to realise benefits in training, employment and better access to services is high.

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There may also be some health draw-backs for the Wingellina Township, particularly if a higher level of shared wealth in the community leads to poorer diets (processed, energy dense foods), more access to drugs and alcohol or the potential for anti-social behaviour. The following sections cover some of the health determinants, as grouped within the category of health determinants.

Employment and Training

In the Wingellina Project Agreement, MetalsX acknowledge that the Ngaanyatjarra Lands People want improvements in their education, training, employment and social circumstances as a result of the mining operations. There have been undertakings made relating to employment and training, however while MetalsX will attempt to source employees locally, it is probable that most employees will be sourced outside of the Wingellina Community due to the low numbers of job-ready individuals in the local and regional area. Employment is anticipated to peak at 1,500 workers in the construction period with an operational workforce of 450 personnel. An additional 500 positions may be evident during periods of maintenance shutdown.

The Irrunytju Aboriginal Community have expressed eagerness for the employment and business opportunities that a new mine may promote, however the SIMP recognises that the level of real understanding about what this may entail may be limited and there is recognition barriers to employment exist including low-levels of literacy and numeracy and general lack of work-readiness.

Income and direct Economic Impacts

There is a general recognition that income levels may increase as a result of better training, employment and new business opportunities that may be created as a direct benefit of the Project. As previously stated, job readiness and existing low levels of education (numeracy and literacy skill) will prevent large numbers of the locally available working-age population to be employed or trained as part of the Project (at least in the initial phases), however the Project may generate the start of improved levels of income over time (providing sustainable business opportunities develop).

The Wingellina Project Agreement provides for the payment of financial compensation to the beneficiaries of the Agreement (i.e. Ngaanyatjarra Native Title Holders). The Agreement sets out conditions and schedule of payments aligned with the Project's development. Providing the mine is approved, these payments will effectively increase income within the Township, positively impacting the living conditions of the Irrunytju Aboriginal Community.

Relationship between mine and community

MetalsX will need to consider and make decisions upon the level of interaction between the mine, its workers and the community; and how this impacts upon relationships of trust. The approach to managing interaction will be developed through the creation of Workforce Management Plans and other internal policy to

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guide operations. A key concern for community elders is the illegal transfer of alcohol and drugs.

Given the existing community's limited previous involvement with external parties coming into their land, the management and strengthening of relationships will need to receive priority.

Heritage

Irrunytju Aboriginal Community has a strong attachment to 'Country' and access to their land and sacred sites is culturally important. Maintaining access to heritage site and culturally significant areas will be a critical factor for the community, with particular importance to places such as the cemetery. The exclusion zones for these areas will need to be kept accessible at all times and protocols governing access can be articulated and managed in the development of the Cultural Heritage Management Plan which is a MetalsX commitment, as part of the Wingellina Project Agreement.

Community Infrastructure and housing conditions

The Wingellina Township has access to a range of community infrastructure however the reality is that these structures are run-down, poorly maintained or not in use. The condition of housing is poor, with many houses exhibiting broken windows, doors and non-functioning air conditioning units. Several people who were consulted with as a result of the SIMP preparation expressed an interest in learning the skills necessary to maintain some of the community infrastructure, as well as their own houses. Through a training program that MetalsX may be able to sponsor, relevant training could be developed to assist the local population improve their own living conditions.

Access to community services and recreation

One of the key issues raised during consultation was the lack of services and support for the community's youth. Similarly, the attraction and retention of staff for education and health services and lack of access to some health services was also noted in discussions and observations of the Wingellina Community. There may be feasible opportunities for MetalsX to support youth development through a number of ways, including encouraging employees to volunteer time and expertise as coaches and mentors to community, hosting events such as sporting carnivals or simple provision of recreational equipment. There may be other avenues for MetalsX to support health and education services which could be determined upon the Project's approval and further consultation with the community.

It is noted that the Wingellina Project Agreement provides for the construction of a public swimming pool and changing facilities and outdoor multipurpose sports court with night-lighting.

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Potential for offsite impacts

It is likely the impact to the social environment will be significant for the local community resulting from this project, not due to the mine competing with the local township for goods and services, rather the Wingellina Township benefitting from the mine's direct compensation and potential investment and programs provided to the Wingellina Township via the Wingellina Project Agreement.

Health outcomes

The SIMP picks up on concerns the community members have related to their health and the impact the Project may have on the general health of the Wingellina population. Two main health determinant areas were highlighted, including People and Community Wellbeing, and Lifestyle. The concerns broadly related to the mine indirectly encouraging the accessibility of alcohol and drugs, with increased traffic into and out of Wingellina generating the potential increased "grog running" and marijuana drug dealing. The other concern is access to higher incomes resulting from potential employment or payments from the Indigenous Land Use Agreement which leads to poorer nutrition as community members can afford to purchase more highly processed food rather than consuming traditional foods for their main diet.

Reference to health services was not a key issue raised directly by the community during consultation sessions, however current limitations on health services were highlighted during general discussions.

Can impacts be mitigated/enhanced?

A number of management measures have been identified in the SIMP as a means to guide both the Ngaanyatjarra Lands People such as the generation of an Aboriginal Employment Strategy. The strategy aims to identify Aboriginal Employment Growth Targets and identifies MetalsX business needs, outlines career goals and pathways and aims to embed a commitment to Aboriginal employment at the highest level. The following enhancements to the project are recommended by the SIMP.

Supporting Employment, Training and Education

- Prepare and implement a Communications Strategy that provides information to Ngaanyatjarra Lands People about job entry requirements, training opportunities, drug and alcohol requirements for employees, and services requirements for the operation of the mine;
- Cooperate with relevant government agencies, schools, colleges and training providers to encourage participation by local job-seekers in training and employment opportunities generated by the Project;
- Prepare and implement Aboriginal Employment Strategy;
- Prepare and implement a Workforce Management Plan that includes clear protocols for employees to guide their interaction with local community members and stipulate consequences if protocols are not followed;

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- Identify entry level positions that might be available to lower skilled workers. This might include such activities as seed collection, fencing, labouring;
- Consult with Ngaanyatjarra Lands People to identify flexible work practices that will encourage Aboriginal participation in the workforce (e.g. shift rostering, recognition of cultural practices);
- Implement Mentoring Program for Ngaanyatjarra employees and consider providing traineeships for local youth;
- Investigate opportunities to link with other mining operations entering the Ngaanyatjarra Lands on developing a coordinated training package and joint scholarships;
- Identify and support students in primary and secondary schools who demonstrate a desire for learning through mentoring; and
- Provide assistance for community members to attend vocational education and training at Ngaanyatjarra Community College in Warburton.

Supporting economic and business opportunities

- Establish and support an Implementation and Review Committee to act as a forum to identify and review economic opportunities for the Ngaanyatjarra Lands People and other matters as described in the Wingellina Project Agreement; and
- Prepare and implement a Contracting and Procurement Strategy and work with Ngaanyatjarra Lands businesses to assist entry to procurement and contracting opportunities.

The opportunities to improve other key areas related to social cohesion and establishing and maintaining a good relationship with MetalsX (Proponent) and the Irrunytju Community include:

Heritage

- Prepare and implement a Cultural Awareness training program for the mine employees to be delivered by senior Ngaanyatjarra Lands People .Prepare and implement a Cultural Heritage Management Plan in consultation with Traditional Owners that identifies how heritage sites will be protected and maintained during construction and operation; and
- Prepare and implement a Mine Closure Plan that details how heritage sites will be protected and maintained following mine closure.

Coordinated effort for the management of alcohol and drugs

- The Wingellina Project Agreement recognises the mine operator's responsibility to manage liquor and harmful substances and commits to using its best endeavours to ensure mine employees do not commit breaches of regulations; and

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- Instant dismissal for mine employees found to be trading in illicit drugs or alcohol.

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8.0 SUMMARY OF HEALTH RISKS AND RISK MANAGEMENT

The Proponent recognises the remote location, combined with a dusty environment, low levels of education and limited access to health services, the Wingellina Township is a vulnerable and disadvantaged community in comparison to Non-Indigenous populations and less remote Aboriginal communities. The current health and education outcomes demonstrate the need for significant improvements for this small remote desert Aboriginal Community.

The National Partnership Agreement on Closing the Gap in Indigenous Health Outcomes, as signed by the Australian Commonwealth and State and Territory governments, recognises five target areas where initiatives are required to close the gap, these include:

- Tackling smoking;
- Providing a healthy transition to adulthood;
- Making Indigenous health everyone's business;
- Delivering effective primary health care services; and
- Better coordinating the patient journey through the health system.

These initiatives are being driven at the government level with the WA Government providing significant expenditure on these projects in the period 2009 to 2014.

The project presents a number of opportunities to make a positive contribution to the existing social environment through investment into community infrastructure, potential training and development programs, youth mentoring and employment for job-ready individuals. These opportunities to improve outcomes for the Wingellina Community aligns with the initiatives of the National Partnership Agreement documents.

In meeting the enHealth methodology for HIAs, risk management measures and recommendations are highlighted, addressing risks and benefits in Section 6 and 7. The following risk management criteria is applied as sourced from the Health Risk Assessment (Scoping) Guidelines (WA Government, Department of Health, 2010), as provided in Table 5.

Table 5 Risk Mitigation/Management Criteria

Risk Rating	Risk Mitigation/ Management Criteria
Extreme	Potentially unacceptable: modification of proposal required.
High	Major mitigation/management (including offsets) may be required – Assessment required of health hazards.
Medium	Substantial mitigation/management may be required –assessment of health hazards required.

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Risk Rating	Risk Mitigation/ Management Criteria
Low	Some mitigation/management may be required – No detailed assessment of health hazards required but addressed with routine controls.
Very Low	No further assessment required.

Section 6 and 7 provide an assessment of health risks (as prompted by the determinants of health) and recommend mitigation measures and management strategies to reduce risk and capitalise on potential benefits for the Wingellina community.

Table 6 provides a summary of the key mitigation measures to reduce negative impacts or enhancements to positive impacts. Residual risks are rated to show that all risks can be reduced to low (with exception of Air Quality which has been subject to further assessment in the HRA).

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Table 6 Summary of key and management recommendations

Health Aspect/ Impact	Potential for impacts (-ve or +ve impact)	Key Management Measures *(not this is not an exhaustive list, but aims to address key management strategies and actions)*	Pre-construction	Construction	Operation	Residual risk/ benefit rating
Air Quality	Medium (-ve)	• Air Quality Management Plan which includes and an air quality monitoring schedule in line with routine and non-routine maintenance events such as start-up and shut down of HPAL plant and at-boundary monitoring of dust from ROM and TSF areas. Included in the Air Quality Management Plan will be an appropriate dust management plan (DMP) to include monitoring for PM_{10} and Nickel dust using hi-volume air samplers (HVAS). The location of HVAS to include representative sensitive receiver locations. • Dust sampling regime and analysis would be carried out in accordance with the relevant Australian Standards and EPA approved methodology so that results are compared against the existing WA health guidelines. • Dust suppression measures on unsealed roads, stockpiles, TSF and ROM areas. • Air Quality Management Plan which includes an air quality monitoring schedule in line with routine and non-routine maintenance events such as start-up and shut down of HPAL plant and at-boundary monitoring of dust from ROM and TSF areas. • A continuous emissions monitoring system (CEMS) will be operated to monitor stack emissions. • Soil stockpiles to be covered and exposed soils reseeded/revegetation where possible. • Complaints register and response process for managing emission as described in the Air Quality Management Plan (Appendix 1).	✓	✓	✓	Low - Medium

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Health Aspect/ Impact	Potential for impacts (-ve or +ve impact)	Key Management Measures *(not this is not an exhaustive list, but aims to address key management strategies and actions)*	Pre-construction	Construction	Operation	Residual risk/ benefit rating
Noise and Vibration	Low (-ve)	• Construction Noise and Vibration Management Plan. • Operational Noise and Vibration Management Plan (no air-blasting or noisy activities during Aboriginal cultural events such as funerals).	✓	✓	✓	Low to Very Low
Contaminated land and water (surface and groundwater) quality	Very Low (±ve)	• Construction Soil and Water Management Plan with Spill Management procedures and management of chemical storage areas and refueling locations according to relevant safety and environmental protection legislation. • Mine design to include levees at pits, contained drainage to avoid contamination of existing surface water and groundwater and stockpiles away from streamlines. • Waste disposal areas constructed outside of known drainage lines with contained drainage discharging into sediment sump. • Groundwater monitoring bores and routine groundwater monitoring program.	✓	✓	✓	Very Low
Visual Amenity (light)	Low (-ve)	• Design measures to reduce lightspill and appropriate location of infrastructure to minimise light emissions on sensitive receivers. • Constructions measure such as light shields to minimise illumination levels.		✓	✓	Very Low

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Health Aspect/ Impact	Potential for impacts (-ve or +ve impact)	Key Management Measures *(not this is not an exhaustive list, but aims to address key management strategies and actions)*	Pre-construction	Construction	Operation	Residual risk/ benefit rating
Biodiversity and natural resources	Low (±ve)	• Minimising clearing footprint and complete clearing in progressive manner to reduce bare soils (subject to wind erosion and dust generation). • Vehicle access to be within cleared footprint to reduce impacts on flora, reduce spread of weeds and control any potential fire sources. • Construction Environmental Management Plan to include Flora and Fauna Management Plan.	✓	✓	✓	Low
Waste Management	Low (±ve)	• Construction and Operational Waste Management Plan which include heirarchy of waste (avoid, reduce, reuse and recycle). • Waste to be handled and disposed of appropriately during construction and operational phases.		✓	✓	Very Low
Access to transport	Medium (±ve)	• Traffic Management Plan. • Traffic Control measures to avoid conflict with pedestrian, motorists and other road users. • Road safety campaign to educate primary and secondary student. • Project transport routes to avoid existing township.	✓	✓	✓	Low
Feelings of trust	Medium (+ve)	• Early and ongoing consultation with Aboriginal stakeholders to actively engage with the community to protect cultural values, sites and places through cultural awareness training delivered by senior Ngaanyatjarra Lands people.	✓	✓	✓	Low

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Health Aspect/ Impact	Potential for impacts (-ve or +ve impact)	Key Management Measures *(not this is not an exhaustive list, but aims to address key management strategies and actions)*	Pre-construction	Construction	Operation	Residual risk/ benefit rating
		• Emphasis should be placed on all employees to be 'good neighbours', employees (construction and operations) to be aware of and not enter heritage exclusion zones. • Formation of the Implementation and Review Committee acting as a forum to consult with Ngaanyatjarra Lands People and maintain good relationship with the Irrunytju Community from the outset ensure success during all stages of the Project. • Undertake all of the relevant SIMP recommendations.				
Recreational facilities	High (+ve)	• Wingellina Project Agreement to include investment in improved community facilities. This would also include mechanisms for coordination and communication with State and Federal departments and local councils to fund infrasturcture improvements beyond the Project investments.	✓			Low
Support for local businesses	High (+ve)	Implement all relevant SIMP recommendations including: • Preparing a Contracting and Procuring Strategy aimed at the Ngaanyatjarra Lands people. • Work with Ngaanyatjarra Lands businesses and develop a Communications Strategy that inform the Ngaanyatjarra Lands people about business development opportunities. • Prepare and Implement Aboriginal Employment Strategy.	✓		✓	Low

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Health Aspect/ Impact	Potential for impacts (-ve or +ve impact)	Key Management Measures *(not this is not an exhaustive list, but aims to address key management strategies and actions)*	Pre-construction	Construction	Operation	Residual risk/ benefit rating
Income	High (+ve)	• Prepare and Implement Aboriginal Employment Strategy that enables the employment of suitably qualitfied Ngaanyatjarra Lands people and includes flexible work proactices that encourage Aboriginal participation. • Traineeships for youth and identification of all levels of skills required, including low-level skills such as seed collection and fencing. • Mentor and support school students and improve work-readiness.	✓		✓	High
Training and Education						
Employment			✓		✓	High
Infrastructure and housing = **Access to health services**	High (+ve)	• If relocation of existing township does not occur, then investment by MetalsX or proponent in improving housing and community infrastructure. • Proponent to sponsoring training in building repairs and maintenance to help local community maintain their own houses where relevant. • Encouraging the community/MetalsX to fund through compensation payments and Wingellina Project Agreement new facilities or improvement to existing structures. • Coordination and communication with state and federal government department and local councils (as noted in the SIMP) to facilitate combined efforts to improve current infrastructure.	✓	✓	✓	Low
	Low (+ve)	• If relocation of existing township does not occur, then investment by MetalsX in improving housing and community infrastructure, including health facilities.	✓	✓		Low

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8.1 Summary of findings

From the analysis of potential risks and benefits that the Project may present according to the determinants of health, Figure 11 provides an overview of the existing health conditions for Wingellina as compared to the predicted Project impacts on this community. The rating scale reflects the impacts assessment and ratings provided in Tables 2 and 3. Figure 11 shows that with adequate mitigation measures in place, the Project will have a positive impact overall for the Wingellina Township, with significant benefits.

shown across five of the seven health determinant categories. There are some negative impacts on the Natural Environment as a result of the Project however these impacts can be managed through environmental management plans to reduce the impact to a lower (acceptable) level.

Figure 11, together with Table 6, quantify the risk assessment findings using the existing conditions at Wingellina as the baseline to compare against the Project-induced impacts. The higher-level quantitative comparison demonstrates that even with the positive impacts the benefit may provide, the Irrunytju Community are still likely to experience health determinant levels below that of the national health standards for both Non-Indigenous and Indigenous Australian populations.

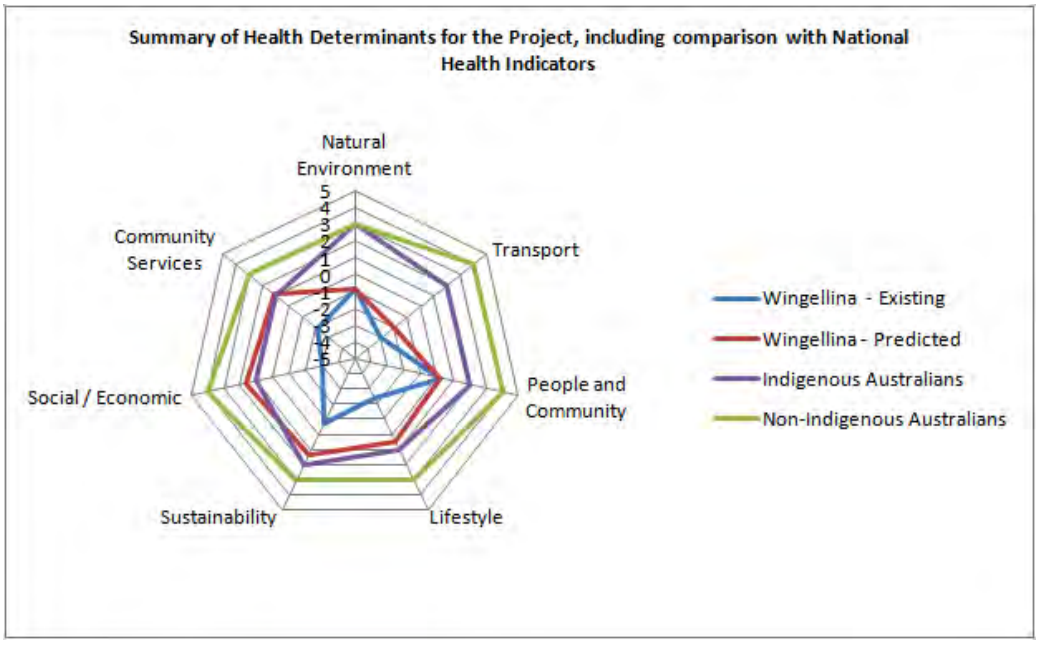

Figure 11 Health Determinants

The Project proponents are aware of the existing gaps between Non-Indigenous and Indigenous Australian populations and the SIMP has raised some of the

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existing health conditions, as consistent trends in Wingellina, that may be improved directly and indirectly through the Project's development.

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9.0 MONITORING AND EVALUATION

A number of the Project-induced impacts to the natural environment will require on-going monitoring and evaluation, particularly where the potential for on-going and negative risks exist. This would include primarily air emissions and noise pollution (and other amenity-related factors) over the life-time of the mine operations. Management measures to mitigate and reduce these impacts will be critical to the success of the Project along with the management of good relationship with the existing communities. Management measures such as ensuring machinery, equipment and plant are frequently maintained and the start-up and shut-down procedures are undertaken to ensure there is strict compliance with air quality criteria and noise and vibration criteria.

Monitoring will involve a hierarchy of controls, including continuous stack monitoring for SO_2 and at boundary monitoring for fugitive dust and other air quality pollutants, but there will also be a rigorous operational site audits conducted frequently where observations, data interpretation and analysis, and resulting improvements are made to operating procedures where deemed necessary. It is the aim of the mine proponent to continue demonstrating good operating practices that aim to reduce environmental and social impacts over the life time of the Project.

Maintaining an open relationship with the Wingellina Community will be imperative to ensuring the Project is a 'good neighbour' to the community, providing a balance of positive impacts to counteract any negative impacts.

The Project presents the real potential for positive socio-economic impacts for the Wingellina Township. As the more detailed management plans are developed following Project approval (such as. Workforce Management Plan, Aboriginal Employment and Training Plan, Aboriginal Business Development Plan, Procurement and Contracting Plan) existing performance indicators will be supplemented with more detailed specific indicators. Further recommendations can be adopted from the experiences of other Western Australian resource projects, such as the the Browse LNG project, which provides some good benchmarks in terms of the Precinct Control Committees and Social Management strategies in place to ensure the management plans as discussed above are implemented with continuous monitoring and follow-up.

Each of the individual management plans developed (particularly those as recommendations in the SIMP) will include specification of accountabilities for key actions and information on the extent and frequency of reporting and monitoring required.

Table 6 provides a summary of management measures and recommendations, however, it is not possible to further describe all the management measures required or performance indicators until such time as the Project is approved and specific project parameters and design are finalised.

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9.1 Recommendations - Decision Making and On-going Management

The representatives for the Project will be required to submit results of monitoring and environmental performance reporting and other documentation detailing the evaluation and review of operational processes to show the Project is maintaining environmental and health protection measures and adhering to commitments and conditions in a resulting Ministerial Statement approving the project.

In addition, MetalsX will establish a process wherein performance criteria and indicators will be monitored by a Social Impacts Management Team in collaboration with the Implementation and Review Committee on a time basis including:

- Six monthly prior to a decision to proceed to mining;
- Quarterly (where possible) to monitor progress and identify corrective actions where required; and
- Annually, for reporting.

The monitoring process will be in place within 6 months of the Financial Investment Decision with the first annual report due in the financial year following, and annually thereafter.

MetalsX and the mine operator will have a critical, ongoing role and responsibility to the local community, hence positive interactions and communication with the Wingellina community is imperative to developing and maintaining trust within this vulnerable community. Engaging with this community in an 'often and consistent' manner that reflects respect and cultural understanding will benefit the Project's operation and provoke positive community-based outcomes.

Opportunities for joint working groups with the Ngaanyatjarra Councils, relevant state and federal government authorities and community representatives is important to a successful mine operation which respects, empowers and engages with this nearby Aboriginal community.

9.2 Learning from other Projects

As mentioned earlier in this Section, the Browse Basin Project in Western Australia has some good practices that could be employed by MetalsX. The Browse Project Precinct Management Committee (PMC) is constituted under the Precinct Project Agreement between the State, the Native Title Party, the Foundation Proponent and any Additional Proponent(s). The PMC aims to monitor the implementation of each party's responsibilities contained in the schedules to the Agreement and in State and Federal environmental approvals. This includes monitoring compliance with management plans related to;

- Environment;
- Cultural heritage and cultural awareness training;
- Employment and training;
- Business development and contracting; and
- Decommissioning and land access commitments in the Project Agreement.

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The PMC receives and assesses monitoring reports to review the efficiency of management plans and implementation of Project Agreement commitments; identify where compliance with management plans can be improved and where required, recommend amendments to management plans.

The PMC is supported by a Technical Working Group which consists of technical experts from the broad public service and technical experts of the proponents.

Similarly, Pilbara Iron (Rio Tinto) through the Yandiccgina Land Use Agreement and Gumala Aboriginal Corporation showed some good success in supporting Aboriginal community development programs and regional participation by Aboriginal people in the Pilbara mining industry (Holcombe, 2010).

9.3 CONCLUSIONS

Positive benefits are predicted to result from the Project which may improve the general health and well-being of the Wingellina Township through employment, access to services and better infrastructure.

In terms of health-based risks, air and noise quality have been identified as presenting medium to low-level risks, The HRA concluded that these risks can be broadly managed through:

- Project design, sympathetic to the natural environment and Wingellina Township;
- Construction and operational environmental management plans;
- Best practice operational procedures protective of environmental and health factors; and
- Ongoing monitoring and reporting during the operational phase.

Specific risk management measures will be developed upon preparation of detailed design, analysing current risks and hazards according to the Health Risk Assessment findings and drawing upon recommendations resulting from community consultation and stakeholder engagement.

The Project also has the potential to demonstrate a number of positive outcomes for the community through compensation payments and other investment initiatives aimed at improving infrastructure and contained in the Wingellina Project Agreement. Opportunities for local employment and business ventures, as well as wider participation in training and development programs provides positive outcomes to improve skills, job-readiness and potentially increase income levels.

The flow-on effects of these positive outcomes are expected to generate further improvements to current living conditions, highlighting the current gaps faced by this community to relevant authorities in anticipation of better coordination of services (such as infrastructure maintenance programs and better access to currently lacking health services).

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When considering the Project induced health risks and opportunities for the existing Irrunytju Community compared to existing health and socio-economic conditions, the Project on-balance presents more benefits than risks for this population.

The greatest area of improvement will be achieved through the Social Environment, with expected improvements in income, housing conditions and employment status and training/education compared to existing conditions.

Despite this, comparison against National Health indicators demonstrates that the Irrunytju community are still likely to experience health determinant levels below that of the national health standards for both Non-Indigenous and Indigenous Australian populations, due largely to the remote location. As such the expected health improvements as a result of the proposed mining project is only a first step and further efforts by State and Federal Governments would be required to lift the overall health for the people of Wingellina to that of the general Indigenous population.

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APPENDIX 1

Air Quality Impact Assessment Findings

The National Environmental Protection Measure (NEPM) considered applicable to the Project included three main standards including:

- Ambient Air Quality NEPM Standards (1998) covering six criteria pollutants;
- Ambient Air Quality NEPM Advisory Reporting standard (2005) for PM2.5; and
- Air Toxics NEPM (2004).

The desired environmental outcome NEPM is ambient air quality that allows for the adequate protection of human health and well-being. For assessing pollutants not covered by NEPM, other guidelines are used such as the air quality guidelines provided by World Health Organisation (WHO) and air quality criteria by the US EPA.

The air quality assessment separated the impacts of the mine's operations into two distinct emissions — gaseous emissions and dust (to include TSP and PM). The first category of mine activities is concerned with the HPAL plant, stack and vent sources and as detailed in Table 4.1 and 4.2. These tables provide the predicted concentrations of gaseous emissions at the worst-case location (as compared to the concentrations at the Wingellina Township and Mine Accommodation village) with and without the existing background air levels provided.

Whilst the TSF will have a number of measures in place to avoid the release of emissions via wind erosion, there is still potential for inhalation, ingestion and contact with these metal salts in the form of TSP.

Table 4.1 Predicted Concentrations from the HPAL plant stack and vent sources (including background)

Source	Averaging Period	Criteria	Concentration (µg/m3)			Percentage of Criteria (%)		
			Any Location	Wingellina	Accom. Village	Any Location	Wingellina	Accom. Village
Normal Operation with Acid Plant Operating (74% of operating time)								
NO_2	1-hr (max) 1-hr (2nd) Annual Ave	- [(2)] 246 62	7 5 2.2	4.4 4 2.03	4.4 4 2.02	- 2.0 3.5	- 1.6 3.3	- 1.6 3.3
SO_2	1-hr (max) 1-hr (2nd) 24-hr (max) 24-hr (2nd) Annual Ave	- 570 - 228 57	403 305 118 111 9.5	240 190 35 25 1.9	230 180 50 45 2.5	- 54 - 49 17	- 33 - 11 3.3	- 32 - 20 4.3
PM_{10}	**24-hr (max)**	**50**	**13.16**	**13.02**	**13.03**	**26**	**26**	**26**
Sulphuric Acid Mist	1-hr (max)	120	15	9	7	13	7.5	6
Normal Operation with Acid Plant Offline (26% of operating time)								
NO_2	1-hr (max)	-	8	4	7	-	-	-

Source	Averaging Period	Criteria	Concentration (µg/m3)			Percentage of Criteria (%)		
			Any Location	Wingellina	Accom. Village	Any Location	Wingellina	Accom. Village
	1-hr (2nd) Annual Ave	246 62	5 0.3	3 0.05	4 0.04	2.0 0.5	1.2 0.08	1.6 0.06
SO_2	1-hr (max) 1-hr (2nd) 24-hr (max) 24-hr (2nd) Annual Ave	- 570 - 228 57	Negl Negl Negl Negl Negl	Negl Negl Negl Negl Negl	Negl Negl Negl Negl Negl	- 0 - 0 0	- 0 - 0 0	- 0 - 0 0
PM_{10}	**24-hr (max)**	**50**	**13.7**	**13.15**	**13.17**	**27**	**26**	**26**
Sulphuric Acid Mist	1-hr (max)	120	0	0	0	0	0	0
Non Normal - Start Up of Acid Plant (2 to 3 hours duration)								
NO_2	1-hr (max) 1-hr (2nd) Annual Ave	- 246 62	57 34 NA	14 12 NA	13 12 NA	- 14 -	- 4.9 -	- 4.9 -
SO_2	1-hr (max) 1-hr (2nd) 24-hr (max) 24-hr (2nd) Annual Ave	- 570 - 228 57	660 417 NA (1) NA NA	240 230 NA NA NA	400 300 NA NA NA	- 73 NA NA NA	- 40 NA NA NA	- 53 NA NA NA
PM_{10}	**24-hr (max)**	**50**	**13.7**	**13.08**	**13.15**	**27**	**26**	**26**
Sulphuric Acid Mist	1-hr (max)	120	0	0	0	0	0	0

Notes:

1) NA is not applicable. The 24-hour and annual average concentrations are not predicted for the acid plant start up, as start up only occurs for 2 to 3 hours duration and 5 times per year.

2) The NEPM 1-hour NO_2 and SO_2 and 24-hour SO_2 standards allow for no more than one exceedance and therefore should be compared to the second highest prediction. This is in line with the DEC's modelling guidance "For NEPM pollutants, results should be presented for both maximum concentrations and concentrations at the allowed exceedance level (e.g. for SO_2, 2nd highest 1-hour average on a day different to that on which the highest occurred)." (DEC, 2006). For 24-hour PM_{10}, the DEC require the predicted maximums to be presented.

Table 4.2 Predicted gaseous concentrations from plant operations excluding background

Source	Averaging Period	Criteria	Concentration (µg/m3)			Percentage of Criteria (%)		
			Any Location	Wingellina	Accom. Village	Any Location	Wingellina	Accom. Village
Normal Operation with Acid Plant Operating (74% of operating time)								
NO_2	1-hr (max) 1-hr (2nd) Annual Ave	- (2) 246 62	5 3 0.2	2.4 2 0.03	2.4 2 0.02	- 1.2 0.3	- 0.8 0.05	- 0.8 0.03
SO_2	1-hr (max) 1-hr (2nd) 24-hr (max) 24-hr (2nd) Annual Ave	- 570 - 228 57	403 305 118 111 9.5	240 190 35 25 1.9	230 180 50 45 2.5	- 54 - 49 17	- 33 - 11 3.3	- 32 - 20 4.3

Source	Averaging Period	Criteria	Concentration (µg/m3)			Percentage of Criteria (%)		
			Any Location	Wingellina	Accom. Village	Any Location	Wingellina	Accom. Village
PM_{10}	24-hr (max)	50	0.16	0.02	0.03	0.3	0.04	0.06
Sulphuric Acid Mist	1-hr (max)	120	15	9	7	13	7.5	6
Normal Operation with Acid Plant Offline (26% of operating time)								
NO_2	1-hr (max) 1-hr (2nd) Annual Ave	- 246 62	8 5 0.3	4 3 0.05	7 4 0.04	- 2.0 0.5	- 1.2 0.08	- 1.6 0.06
SO_2	1-hr (max) 1-hr (2nd) 24-hr (max) 24-hr (2nd) Annual Ave	- 570 - 228 57	Negl Negl Negl Negl Negl	Negl Negl Negl Negl Negl	Negl Negl Negl Negl Negl	- 0 - 0 0	- 0 - 0 0	- 0 - 0 0
PM_{10}	24-hr (max)	50	0.7	0.15	0.17	1.4	0.3	0.3
Sulphuric Acid Mist	1-hr (max)	120	0	0	0	0	0	0
Non Normal - Start Up of Acid Plant (2 to 3 hours duration)								
NO_2	1-hr (max) 1-hr (2nd) Annual Ave	- 246 62	57 34 NA	14 12 NA	13 12 NA	- 14 -	- 4.9 -	- 4.9 -
SO_2	1-hr (max) 1-hr (2nd) 24-hr (max) 24-hr (2nd) Annual Ave	- 570 - 228 57	660 417 NA (1) NA NA	240 230 NA NA NA	400 300 NA NA NA	- 73 NA NA NA	- 40 NA NA NA	- 53 NA NA NA
PM_{10}	24-hr (max)	50	0.7	0.08	0.15	0.14	0.16	0.3
Sulphuric Acid Mist	1-hr (max)	120	0	0	0	0	0	0

The higher levels of SO_2 during start-up periods of the acid plant show the highest percentage of NEPM criteria reached at 73% at the worst case location (any location). The Mine Accommodation village and the Wingellina Township would experience 53% (300 µg/m3) and 40% (230µg/m3) respectively for the second highest 1-hour SO2 concentration.

A maximum 1-hour SO_2 concentration of 240 µg/m3 is predicted to occur in the vicinity of the Wingellina Township during start-up periods of the acid plant. The Air Assessment report notes the conservative nature of these predictions which were based on start up conditions for the whole of the year, when in reality it should only occur five times per year for two to three hours at a time. The 2005 WHO air quality guidelines (AQGs) have revised the SO_2 concentration values, noting that the 24-hr mean is 20 µg/m3 and 10 minute mean is 500 µg/m3. The AQGs note that a SO_2 concentration of 500 µg/m3 should not be exceeded over average periods of 10 minutes duration. The second category of mine activity deals with the mining and stockpiling

activities where fugitive dust (in the form of total suspended particulate, PM_{10}, $PM_{2.5}$) and dust deposition are predicted.

Table 4.3 documents the predicted particulate levels for fugitive dust occurring from mining and stockpiling activities. The tables show both Project only contribution and the cumulative impacts (including background) at year 14, which is considered representative of maximum mine operation. The prediction assumes some control measures would be in place such as covered stockpiles (reseeded during first two years), water spraying or chemical dust suppression and other practices utilised to minimise dust and water carts for roads and shallower pits.

Table 4.3 Predicted Particulate Levels from Fugitive Dust (including background levels)

Pollutant	Averaging Period	Criteria Value	Units	Back-ground value	Predicted Value			Percentage of Criteria (%)		
					Air Strip	Wingellina	Accom Village	Air Strip	Wingellina	Accom Village
TSP	24-hr (max) Annual Ave	90 90	µg/m3 µg/m3	26 23	63 34	60 32	45 27	70 38	67 36	50 30
PM10	24-hr (max) 24-hr (5th)	50 -	µg/m3 µg/m3	13 12	33 31	32 28	23 21	66 -	64 -	46 -
PM2.5	24-hr (max) Annual Ave	25 8	µg/m3 µg/m3	6.5 5.5	11.3 6.4	9.7 6.3	8.4 5.9	45 80	39 79	39 74
Dust Deposition	Monthly	2	g/m2/mth	0.9	1.8	1.6	1.3	45	40	33

Particulate levels from the mining and tailings are predicted to be below the criteria at Wingellina Township and the Mine Accommodation village. The PM_{10} concentrations are predicted to be up to 64% of the 24-hour NEPM standard at Wingellina, with $PM_{2.5}$ concentration at 39% and 79% of the respective 24-hour and annual average reporting standard.

It is noted that background levels of TSP and PM_{10} at Wingellina are about 29% and 26% of the standard at the existing Wingellina air strip.

Notwithstanding that existing and predicted dust levels will be below recognised guidelines, further characterisation of metal concentrations (specifically Nickel) in respirable dust is required to fully understand the health risk to the Wingellina community.

Depositional dust sampling results

Sampling of depositional dust was undertaken and analysed with monthly dust depositional samples collected over a 29 month period (between June 2008 and November 2010). As shown in Figure 1, monthly dust deposition samples were collected across eight dust monitoring stations (DMS) positioned around the Project area, including the ore body (DMS1, DMS2,

DMS4, DMS7 and DMS8), the Wingellina town site (DMS3), the proposed tailings storage facility (DMS6) and the proposed accommodation village (DMS5). The samples were analysed for nickel, chromium and zinc content, with nickel levels further evaluated and compared to criteria protective of health.

For DMS3 and DMS5, both stations were situated downwind of the proposed mine site to measure existing dust levels (baseline) and compare to predictive levels (project-contribution) once construction and operation of the mine commences. DMS3 is located within the Wingellina Township and provided the opportunity to measure the background level of dust for this existing sensitive receiver population.

Table 4.4 provides the average nickel concentration per DMS over the 29-month period. The maximum nickel concentration has excluded any 'limit of detection' value where this was the highest concentration included in the depositional dust data. The maximum nickel concentration reflects the highest concentration that was able to be detected by the laboratory for the relevant DMS. The date of highest reading has been recorded to determine if there was a climatic, data collection or data analysis error that may have contributed to this maximum reading. Appendix 1 provides the sampled dust deposition data and methodology used to sample dust and calculate nickel concentrations as contained in background PM_{10}.

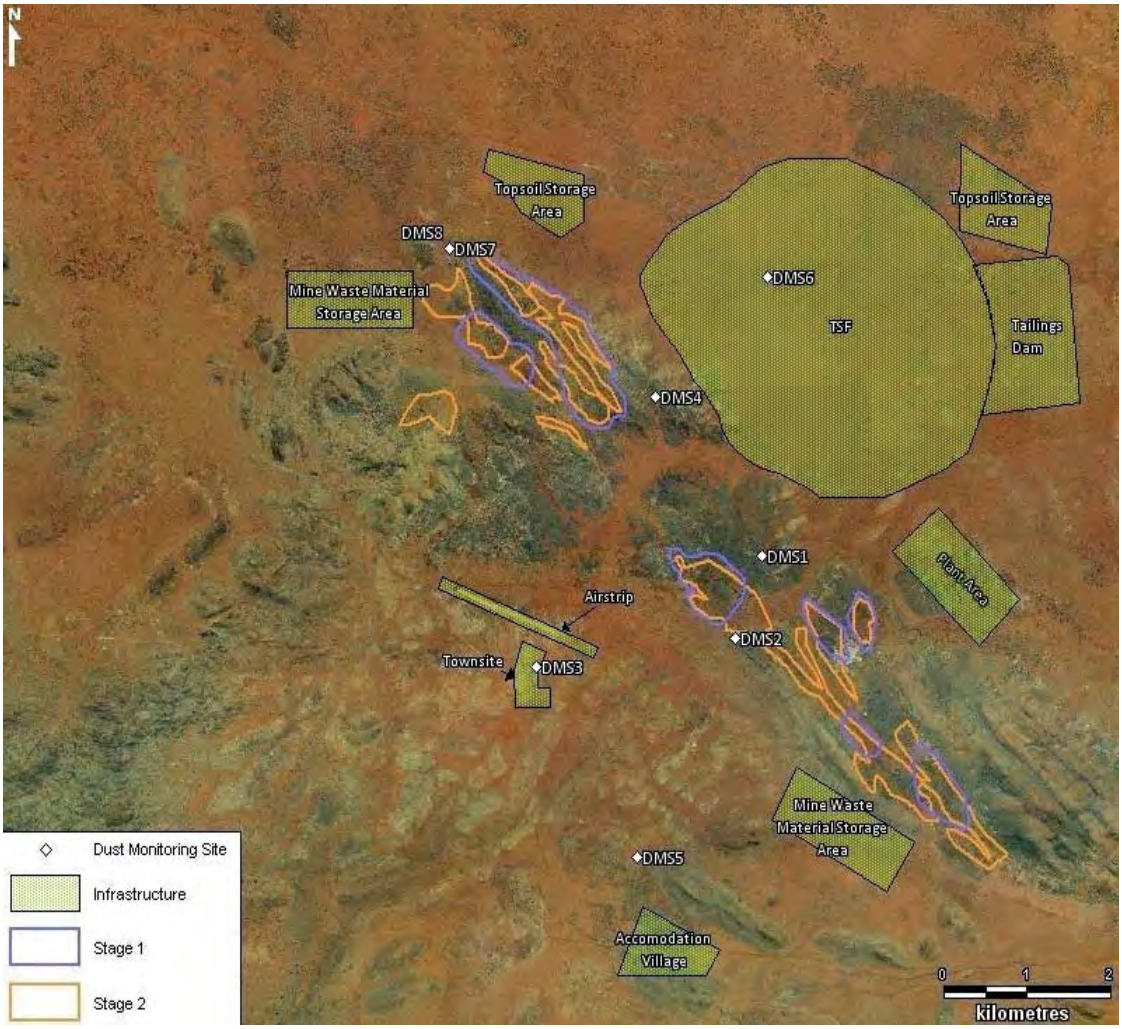

Figure 1 **Dust Monitoring Stations**

Table 4.4 Average nickel concentration per DMS samples

DMS location (in relation to proposed mine site)	Average Nickel Concentration ($\mu m/m^3$)#	Maximum Nickel Concentration ($\mu m/m^3$)	Date of highest reading
DMS1 (Ore Body)	0.0025	0.0063	07/02/2010
DMS2 (Ore Body)	0.0033	0.0058	01/06/2009
DMS3 (Wingellina Village)[1]	0.0006	0.0009	02/08/2008 (decommissioned after October 2008)
DMS4 (Ore Body)	0.0035	0.0046	11/07/2010
DMS5 (Accommodation Village)	0.0018	0.0058	01/06/2009
DMS6 (Tailings Dam)	0.0033	0.0069	11/07/2010
DMS7 (Ore Body)	0.0037	0.0104	11/07/2010
DMS8 (Ore Body)	0.0031	0.0035	11/07/2010

Note: the average nickel concentration is also taken to be the background Nickel concentration in existing PM_{10}.

Table 4.4 shows that both DMS3 and DMS5 have the lowest level of nickel concentration in background particulate matter (PM_{10}). DMS3 also shows the lowest maximum recorded, however it is noted that much of the sampling period was abandoned for this site due to vandalism.

Cumulative nickel concentrations

To estimate the nickel concentration in background PM_{10}, the dust depositional data collected over the 29-month period (across the eight dust monitoring stations DMS1 to DMS8) has been relied upon. The background PM_{10} as an annual average is 11.5µg/m^3 (Air Assessments, 2013).

Particular focus is placed on the two locations of sensitive receivers, these being the existing Wingellina Township and the future Mine Accommodation village.

Table 4.3 provides the Air Assessments (2013) predicted particulate levels from fugitive dust (including and background) for the PM_{10} 24hr (max). Table 4.4 expressed the background nickel concentration in existing PM_{10} emissions. Further to this analysis is the annual average for PM_{10}, as shown in Table 4.5 below for the two sensitive receiver locations.

Table 4.5 Predicted Particulate levels from Fugitive Dust

Pollutant	Averaging period	Units	Criteria	Predicted value (excluding background)		Predicted value (including background)	
				Wingellina	Accommodation Village	Wingellina	Accommodation Village
PM_{10}	Annual Ave	$\mu g/m^3$	20 (WHO AQG)	4.9	1.9	16.40	13.40

Calculations were completed to determine the Nickel concentrations in the cumulative PM_{10} concentration. Table 4.6 provides these calculations based on assumptions listed in Section 8.3.4 of the HRA:

Table 4.6 Cumulative Ni concentration within PM10 at the sensitive receiver populations

PM_{10} Averaging period	Units	Predicted Nickel concentration in cumulative PM_{10}	
		Wingellina	Accommodation Village
24hr (Max)	($\mu g/m^3$)	0.016	0.012
Annual Average	($\mu g/m^3$)	0.0020	0.0023

The annual average concentration of Nickel in PM_{10} can be compared to the WA DoH chronic exposure health guideline of 0.003 $\mu g/m^3$.confirming the existing and project contribution of Nickel in PM_{10} meets health-based guidelines protective of health.

Table 1 Cumulative Ni concentration within PM10 at the sensitive receiver populations

PM10 Averaging period	Units	Predicted Nickel concentration in cumulative PM10	
		Wingellina	Accommodation Village
24hr (Max)	($\mu g/m^3$)	0.016	0.012
Annual Average	($\mu g/m^3$)	0.0020	0.0023

The annual average concentration of Nickel in PM_{10} (considering the existing and project contribution of Nickel in PM_{10}) meets the health-based guidelines protective of health, particularly the WA DoH chronic exposure health guideline of 0.003 $\mu g/m^3$.

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WINGELLINA NICKEL PROJECT HEALTH IMPACT ASSESSMENT: PEER REVIEW

Thank you for the opportunity to participate in the peer review process for the Health Impact Assessment undertaken for the Wingellina Nickel Project, which is to be located approximately 1450 km east-northeast of Perth.

The Peer Review process was initiated through contact between Adam Parker from SNC- Lavalin and Dianne Katscherian and Jeff Spickett (the Consultants) to discuss the Wingellina Nickel project and the requirement for a Health Impact Assessment. An initial meting discussed the project, the objectives of the peer review process and the process to be followed.

The Terms of Reference were to review and comment on:

- Methodology and Summary of initial findings on Health determinants (early advice)
- The proposed Sampling and Analysis plan for collection of soil samples and validity of information for use in baseline dose response assessment of the draft HRA.
- First draft of the HIA and a letter report on findings for formal response and attachment to the final documents.

The peer review process

- Documents provided for background information included:
  - Draft Health Risk Assessment: Wingellina Nickel Project
  - Draft Sampling Analysis Plan: Wingellina Nickel Project
  - Wingellina Nickel Project, Environmental Scoping Document
  - Social Impact Analysis and Management Plan: Wingellina Nickel Project
  - Indigenous Employment Strategy Summary – Wingellina Nickel Project
- Documents provided for review and comment included:
  - Wingellina Nickel Project: Health Impact Assessment
  - Wingellina Nickel Project PER: Chapter 7, Health
- The review process was based on the application of the general procedures and principles used for HIA which included consideration and use of the determinants of health, vulnerable sections of the community, stakeholder involvement, public participation, health risk assessment and strategies to minimise the potential adverse impacts and enhance the positive/ benefits of the proposed development. This latter part is an important component of the HIA process that is not normally as part of the approvals process with EIA.

- The initial part of the review was to comment on the draft. After the comments were sent to Adam Parker and the draft HIA revised by the team at SNC-Lavalin another meeting was held to discuss further revisions to the draft. The main features discussed were the key components of the HIA process as outlined above with the addition of the Health Risk Assessment section. The inclusion of this allowed a ranking/classification of the potential risks and benefits of the developments.
- From this mitigation strategies were proposed that would reduce risks as far as reasonably practical and that would enhance the positive outcomes for the health and well-being of the affected population.
- The draft was revised further by the SNC-Lavalin team and sent to the consultants for final review. A few more comments were made and the document was finalised.
- A summary table of the main comments made by the consultants and the actions taken in response by the SNC-Lavalin team is attached.

Summary Comments

The consultants appreciated the opportunity of being involved in the review process of the HIA for this project. The process was carried out in a collegiate environment and the various points were raised and fully discussed in an open and constructive manner to arrive at a mutually agreed outcome. It is anticipated that, should the proposal proceed and that the company MetalsX progresses the issues as identified and responded to in the Health Impact Assessment, then the outcomes should result in improved health outcomes for the local community.

Yours faithfully

Jeff Spickett and Dianne Katscherian

23 October 2014

ATTACHMENT– PEER REVIEW COMMENTS AND RESPONSE

Response to Rev 2 (Peer review comments – September 9)

Section	Text	Comment	Response
1.0	In 2012, URS were engaged to prepare a Social Impact Management Plan (SIMP), documenting the current social environment and existing socio-economic landscape for this Aboriginal Community. The SIMP profiled the existing community, documented existing health issues, identified social indicators and recorded community and stakeholder consultation. The report concluded the quality of housing and infrastructure wais poor, with and neglect over time has attributed to a number of key health hazards and outcomes.	Stakeholder consultation undertaken at that time by URS?	Yes, stakeholder consultation was undertaken by URS in 2012. This stakeholder consultation is what the HIA is relying upon. Wording changed to reflect this
1.0	The Project has the potential to demonstrate a number of positive outcomes for the community through compensation payments and other investment initiatives aimed at improving infrastructure and these are documented in the 'Wingellina Project Agreement'.	Is the potential to demonstrate or actually put in place?	To implement – wording changed to reflect this
1.0	Opportunities for local employment and business ventures, as well as wider participation in training and development programs will aim provide positive outcomes to improve skills, job-readiness and potentially increase income levels	Some or all?	Positive outcomes would directly benefit some members of the community (through employment) but would indirectly benefit all the community (through compensation payments).

Section	Text	Comment	Response
	and thus provide positive outcomes for members of the community.		
1.0	The flow-on effects of these positive outcomes may in turn generate further improvements to current living conditions through highlighting the current gaps faced by this community in anticipation of better coordination of services (such as infrastructure maintenance programs and better access to currently lacking health services).	This needs clarification. Will these improvements result in closing these gaps or be a trigger for doing something about them? If the latter what guarantees are there from decision-makers that this may happen? It is important that the community is not given "false hopes". Is the company willing to intercede on behalf of the community or have other actions been identified?	The Project may act as a trigger to improve services such as health which the Project will not directly address.
1.0	The results of the assessment of the Categories of Determinants for Health for the Irrunytju community at Wingellina are shown in figure S1.	Not sure about this terminology! Also, the choice of these categories should be clarified.	Paragraph restructured to address peer review comments and use correct terminology.
1.0	The ranking for the existing situation at Wingellina has been compared to the anticipated outcomes following mine development and also to other National Health indicators for the general population.	It is not clear as to who is covered in each of the 4 categories.	This has been made clearer in text describing Figure S1.
1.0	Despite this, comparison against National Health indicators demonstrates that the Irrunytju community are still likely to experience health determinant levels below that of the national health standards for both Non-Indigenous and Indigenous	Health Status levels!!	Changed to health status levels rather than health determinant levels.

Section	Text	Comment	Response
	Australian populations, due largely to the remote location.		
2.0	Consultation has not been undertaken with the affected sensitive receivers as part of this HIA, however it is noted that consultation is an on ongoing process.	May need more to justify lack of consultation.	Consultation relied upon as part of SIMP rather than specific consultation for the HIA has been justified in this section.
2.0	URS has documented consultation with members of the Wingellina community, which addressed health-related issues.	Were these incorporated into the HIA?	Yes, the health-related issues raised during consultation with the community were incorporated into HIA
	The Wingellina Township (also referred to as the Wingellina Community or Irrunytju Aboriginal Community) is located between two and three kilometres west-southwest from the nearest planned pit and five kilometres from the proposed HPAL processing plant.	HPAL - Which is?	High Pressure Acid Leachate – abbreviation was already provided in full prior to this paragraph. No change required.
3.2	The existing Wingellina Township or the Irrunytju Community is the closest existing resident community to the Project site, located on land within the Determined Ngaanyatjarra Lands (Part A) Native Title Claim (WC04/03). The Irrunytju Aboriginal Community (Wingellina Township) is located at the former Wingellina exploration camp. The townsite was initially erected as the exploration camp in the late 1950s by Southwestern Mining Co (a subsidiary of	Presumably by the Irrunytju people?	Yes, clarified occupation by Irrunytju Community

Section	Text	Comment	Response
	International Nickel Company of Canada) and was then occupied after the company vacated the lands (URS, 2012).		
3.2	The Kalka Community is located approximately16 km south-east of the Project site, within South Australia.	These people visit?	Yes, clarified in text that Irrunytju Community members often visit members of the Kalka Community.
4.1	Following the proclamation of Aboriginal Reserve 17614 the existing mineral exploration tenements in the region were terminated by government,	When?	Added' proclamation in 1988'.
4.1	and Yarnangu established a permanent community using the existing infrastructure (airstrips, shelters, water bores, windmills etc) left from the pre-existing Southwest Mining camp.	Is this another group?	Yarnangu had already been defined earlier as Traditional owners – no change required.
4.2.1 fig. 5	Figure 5 Population distribution for Ngaanyatjarraku Shire	Does the diagram include non-indigenous people. Visitors not included!!	Figure 5 description to clarify it is Total population (visitors not included).
	The vast majority of the Indigenous population speak a language other than English, most identifying a 'Western Desert' language as the primary language spoken. According to consultations undertaken with the local Wingellina community, a mixture of Pitjantjatjara and English were spoken with very few persons identifying themselves as Ngaanyatjarra even though most people speak both languages	Is this English plus Pitjantjatjara or two Aboriginal languages?	Text amended to make this clearer "According to consultations undertaken with the local Wingellina community, a mixture of Pitjantjatjara and English were spoken with very few persons identifying themselves as Ngaanyatjarra even though **most people speak both Western Desert and Pitjantjatjara languages** (URS, 2012).

Section	Text	Comment	Response
	(URS, 2012).		
4.2.2	Adding to very low income levels, with little opportunity for employment to improve income, is the high cost of living given costs to transport goods and food. Social vulnerability is, which further exacerbated by issues such as overcrowding of accommodation, poor living conditions and negative impacts on wellbeing and health.	Arising from…?	Text amended to reflect "conditions resulting in negative impacts on wellbeing and health."
4.2.3	• an existing water supply that is problematic	Which means?	Potential for contamination (as past history has shown) and lack of maintenance.
4.2.3	• a water reticulation system that does not meet current standards, specifically environmental health standards	Potable?	Added potable (drinking) water reticulation system.
4.2.3	• infrastructure exhibiting neglect and in a poor condition.	These dot points are not very informative as they stand. Is it possible to add more?	Added more to clarify poor condition.
4.2.3	It is also noted that Sorry Camps can exacerbate stresses on current accommodation, sanitation, potable water supply and waste disposal over extended periods of time.	What are these?	Sorry camps have been defined as a footnote.
4.2.5	Other key existing health conditions, resulting from a number of issues such as low socio-economic factors and remote location include poor nutrition, inactivity and high rates of smoking.	Presumably these were identified by URS or is this Dept of Health information from the clinic?	The Shire of Ngaanyatjarraku and URS report smoking.
4.2.5	The Health Clinic in Wingellina has been funded to have a resident nurse, however at the time of the	How long had this situation existed? Has this changed since 2012?	Relying on information from the SIMP (as per my scope) and assuming in 2014 that there is a nurse stationed within the community.

Section	Text	Comment	Response
	SIMP preparation in 2012, there was no resident nurse on either a part-time or full-time basis.		
5.0	5.0 DETERMINANTS OF HEALTH	Need an introductory paragraph to explain determinants of health, how they are useful in HIA.	The report was restructured to provide a definition of Determinants of Health. Refer Section 5.
5.0	These indicators can be even more exaggerated in remote communities, such as Wingellina.	Needs some definition see determinants?? See ICMM document	Addressed now in Introduction section 2.2
5.0	The following sections assess the health determinants as reflected in the existing health and wellbeing baseline, as determined through the Project's technical studies and field investigations.	This doesn't actually explain what was actually done. Is the following an assessment of the changes that would arise from the implementation of the Project against the existing health and wellbeing baselines for each of the relevant health determinants?	Document was restructured to provide a better understanding of the HIA's methodology.
	The background data for dust in Wingellina showed that the dust deposition levels are on average low and less than the NSW maximum criteria of 4 g/m2/month criteria from all sources.	Basis for these criteria – needs context.	Text amended "the commonly used criteria stated in the *Approved methods for the modelling and assessment of air pollutants in New South Wales* (DEC 2005). In the absence of a Western Australian or national criteria, the NSW maximum criteria are 4 g/m^2/month from all sources is adopted.
5.1	There is not sufficient flow for the establishment of an Environmental Health Landscaping Program for the Community.	Explain more??	The borefield supplies enough flow to provide town drinking water and domestic uses but not enough for landscaping purposes. Text amended to "…to increase ground vegetation coverage and create vegetation buffers to reduce windswept dust. "
5.2	The Centre Bush Bus is a bus service between Docker River (NT) and Alice Springs (NT) delivering a twice weekly service and between Pipalyatjarra (SA) and Alice	Does this go to Wingellina?	No, service does not go to Wingellina.

Section	Text	Comment	Response
	Springs on a weekly basis which services Kalka (SA).		
5.4	With a lack of facilities and limited access to facilities located large distances from the community, recreational choices are disadvantaged lacking, which contributes to inactivity.	Is maintenance of these a problem?	Yes, maintenance is a problem.
5.5	The WA Government has committed significant funds to closing current health and socio-economic gaps compared to non-Indigenous Australians.	Examples? And time frames? Is this ongoing or is this what has happened in the past?	Beyond the scope of this document.
5.6	The provision of youth services is typically the responsibility of local governments in Western Australia.	Is this provided by local Govt – if not why not?	Beyond the scope of this document to answer.
6.1	6.1 Methodology	The format of the discussion for each of the determinants assessed could be outlined here. It would then be useful to provide the information for each potential health impact in a specific format: • Description of the issue • Current issues • Impacts on health (need to be a little more specific about the health impacts of these for some of the outcomes from the SIMP) • Risk assessment • Management solutions/Recommendations	Report restructured according to peer review comments and guidelines.

Section	Text	Comment	Response
		Or similar. At the moment some of the sections have potential options for management while others not. This inconsistent approach makes it difficult to determine what the outcomes might be. It would also be appropriate to not only have the risk tables as shown here, but also include discussion about the management approaches that are broadly applied through risk assessments and then provide specific ones for each determinant group for this proposal. Include brief discussion about the development of the risk map/spiderweb. The list of management options at the end could be included in each section as well as within the tables.	
6.2	Table 3	The justification for these estimates are required.	Restructured the information in table - Section 7 provides a summary of existing risks.
6.3	It is assumed that for most socio-economic health determinants, the Project will actually deliver benefits by investment into the existing	Predicted	

Section	Text	Comment	Response
	community infrastructure (or potentially develop new infrastructure if relocated).		
6.3	Additionally, issues such as water quality and waste disposal within the community may improve as a result of the Project.	There is no statement as yet to indicate that the Project will provide improvements to the community by provision of services such as these. If these improvements are to be the case, then reference here to management commitments further down should be identified.	Restructured to justify negative and positive impacts – See Section 7 and 8.
6.3.1	Application of average wind erosion based on metrological data suggests an erosion rate of 0.53 kg/ha/hr.	This seems to come across as a negative but may not be?	Updated with reference to CSIRO soil erosion rates in agriculture to demonstrate the soil loss and dust deposition rates.
6.3.1	The background level of NO2, SO2 and Sulphuric Acid Mist are negligible for the project area;	Anything on PM 2.5 or ultrafines??	is addressed in discussion around Table 4.3.
6.3.1	(including background) at year 14, which is considered representative of maximum mine operation.	Production?	Changed text to Production rather than operation.
	This denotes a negative health impact, consistent with the existing health issues arising from ambient or background levels of windblown dust. These risks require operational management measures and monitoring program to ensure dust levels are not increased by the project operations.	More details? See management of risks table HRA document	These risks require operational management measures and air quality monitoring program to ensure dust levels are not increased by the Project operations.

Section	Text	Comment	Response
6.3.1	For windblown dust, control measures would be in place such as covered stockpiles (reseeded during first two years), water spraying or chemical dust suppression and other practices utilised to minimise dust and water carts for roads and shallower pits.	How much impact do the existing roads in the mine site area have on the dust generation that is affecting the town and the people? Since most of the winds are easterlies it would be useful to indicate that these measures will potentially reduce dust to the town.	Note to answer the first question regarding existing roads in mine area, there are no existing roads currently to make a comparison on impact to Wingellina.
6.3.1	The provision of PPE is one effective way of reducing exposure to a workplace hazard, particularly where that hazard cannot be eliminated.	Presumably OHS issues are covered elsewhere!!	Dealt with in the HRA.
6.3.4	This reflects the rare likelihood of groundwater contamination as the water table is located at a sufficient depth to not be affected by the Project, even if a spill of tailings was to occur.	Spillage risk is low? Containment?	Groundwater contamination through tailings and spills.
6.4	As a positive impact, more frequent use of roads increases surveillance and reporting of breakdowns and stranding.	Could be made clearer!	Amended text to clarify “As a positive impact, more frequent use of roads increases surveillance and reporting of breakdowns and stranded motorists when vehicles breakdown in isolated stretches of road.
6.4	Community members have expressed desire for the roads to be sealed for some distance on either side of the community (URS, 2012). However, due to the calcrete near the surface in this location this may not be practical.	Needs further explanation.	Text made clearer to explain issues with calcrete, other dust suppression methods recommended.
6.5	The Irrunytju Aboriginal Community have expressed eagerness for the employment and business	What can be done to change this?	Document deals with education and work-readiness programs as a key social priority for Metals X to manage.

Section	Text	Comment	Response
	opportunities that a new mine may promote, however the SIMP recognises that the level of real understanding about what this may entail may be limited and there is recognition that there may be barriers to employment including low-levels of literacy and numeracy and general lack of work-readiness.		
6.5	There is a general recognition that income levels may increase comparative to the training, employment and new business opportunities that may be created as a direct impact of the Project.	The meaning of this is not clear. What is the comparison?	Text amended to clarify that income is directly related to education levels and training.
6.5	The other concern is access to higher incomes resulting from potential employment or payments from the Indigenous Land Use Agreement. Increased incomes may which leads to poorer nutrition, as community members can would have the means to afford to purchase more highly processed foods rather than consuming traditional foods for their main diet.	Where would this food be purchased from?	Wingellina General Store.
6.5	Can impacts be mitigated/enhanced	Rather than have these listed here, it might be better to provide a recommendations section within the discussion for each of the potential health impacts and then summarise these in a table within the executive summary.	Document restructured to show recommendations as a separate section and summarized in table 6 (also provided in executive summary).

Section	Text	Comment	Response
		See the comments above about formatting of each of the potential health impacts	
7.0	To provide further comparison, a high-level and quantitative comparison is also made against Australia's Health 2010 and 2012 (Australian Institute of Health and Welfare, 2010 and 2012) indicators for both Indigenous and non-Indigenous Australians.	This should be included in the methodology	Added into methodology (restructured).
	Opportunities that the Project presents in making a positive contribution to the existing social environment through investment into community infrastructure improvements, potential training and development programs, youth mentoring and employment for job-ready individuals, align with the initiatives of the National Partnership Agreement documents.	And principles?	Added 'Principles' into text.
7.1 Table 6	The biggest risk is via the TSF tailings. The water table is located at a sufficient depth to not be affected by the Project, even if a spill of tailings was to occur. The Project will not impact upon drinking water bores.	This is not actually management	Table amended to only document mitigation and management rather than statements.
7.1 table 6	Town water supply is sufficiently removed from potential sources of contamination associated with the project so there is no apparent exposure pathway.	This is not written as a management measure. It needs to indicate how this will occur	Table amended to only document mitigation and management rather than statements.

Section	Text	Comment	Response
	Notwithstanding the project will provide an improved reticulated potable water system to the town as part of the project development.		
	The Project to fund improved water reticulation and water supply infrastructure as part of the Wingellina Project Agreement.	And implement?	Text amended to include “implement”.
7.1 table 6	See section 6.3.5	If this table is an overall summary then the management measures should be included here.	Table amended to only document mitigation and management rather than statements.
7.1 table 6	Better waste management through improved community infrastructure. Very Low	A clearer description of the infrastructure is required	Description clarified as per comment.
7.1 table 6	Safety barriers applied to separate pedestrian and car/truck travel modes.	Where?	Within the road centre line and median.
7.1 table 6	Liaison with state and federal government agencies responsible for road maintenance to ensure roads are	Which ones?	Not listed as until the detailed design and mine planning has been undertaken the relevant transport routes and roads would not have been determined.
7.1 table 6	An integrated advisory board (consisting of community elders and mine representatives) to frequently meet and discuss current issues agree to appropriate solution and management measures to improve an issue or resolve any pending problems	Regularly?	Management measure has been restructured and reworked to make recommendations and mitigation measures clearer.
7.1 table 6	communities access of new and maintained recreational facilities.	Who will be responsible for long term maintenance?	MetalsX
7.1 table 6	Establish a ‘hot line’ to allow concerned parties to report concerns or complaints related to environmental impacts	Response mechanisms to these?	Management measure has been restructured and reworked to make recommendations and mitigation measures clearer.

Section	Text	Comment	Response
7.1 table 6	Management of alcohol and drug use is important to avoid any negative impacts form increase in income.	What is the management measure?	Management measure has been restructured and reworked to make recommendations and mitigation measures clearer.

Response to Rev 3 (Peer review comments – October 5)

Section	Text	Comment	Response
1.0	a number of positive outcomes, or at least influence positive impacts on the socio-economic landscape for the community through compensation payments	Is this Ok? Can this be written in a less severe way?	Compensation payments were discussed in the SIMP hence for consistency in the HIA, this stays as it is.
1.0	members of the community. The flow-on effects of these positive outcomes may in turn generate further improvements to current living conditions through ~~highlighting the current gaps faced by this community in anticipation of better~~ improved coordination of services (such as infrastructure maintenance programs and better access to currently lacking health services).	Cross reference this with the comments on the table from the Health Chapter of the PER.	The Chapter and HIA are aligned.
1.0 table 1	• Coordination and communication with state and federal government department and local councils (as noted in the SIMP) to facilitate combined efforts to improve current infrastructure and improvement of .	Something missing here	Coordination and communication with state and federal government department and local councils (as noted in the SIMP) to facilitate combined efforts to improve current infrastructure and improvement of **services**.
	These determinants of health were initiated by the Western Australian Department of Health with sub categories selected according to relevance for the existing Wingellina Township and the Project. The residual risk ranking takes into	Include reference here	These determinants of health were initiated by the Western Australian Department of Health as part of the scoping discussions for this HIA. The process and background of how the health determinant were arrived is the reference rather a specific document.

Section	Text	Comment	Response
2.0	The mine would include on-site processing to produce an immediate mixed nickel-cobalt hydroxide product. Mine infrastructure would be developed to include tailings storage facility, mine accommodation, roads and various other components as part of the Project.	Is there anything in the PER about the transport of the product from the site to export point? Are the health impacts of this part of the process covered?	No there isn't however the transport of product would follow relevant standards and legislation that are protective of health.
2.0	This HIA has a number of or gaps in data, particularly accurate data on health, education and the status of health services currently provided to the community.	Might be worth including a comment that indicates the reason for these are identified later in the document.	New sentence added: This HIA has a number of or gaps in data, particularly accurate data on health, education and the status of health services currently provided to the community. **The reasons for these gaps are identified in later sections of this HIA.**
2.0	There is also an element of subjective risk rating completed where information currently available on the existing community does not provide a clear capacity to assess the level of health risk.	The meaning is not clear here	Agree, the word 'risk' has been removed as it is more the status of health which may be subjective according to limited information and the lack of documented health outcomes for this community. New text reads "where information currently available on the existing community does not provide a clear capacity to assess the level of health or where documented health outcomes for this particular community are lacking."
4.2.4	• an existing water supply that is problematic (one bore previously contaminated) with water pumped via mains power to an elevated storage tank on a 12m stand • a potable water reticulation system that does not meet current standards, specifically environmental health standards • inefficient effluent disposal	Previous peer review comment was to add more information on why the existing water supply is problematic. Maybe needs a comment to indicate that maintenance on the infrastructure is limited and water supply is thus inconsistent?	New text added as per comment " • an existing water supply that is problematic (one bore previously contaminated **and low levels of maintenance**) with water pumped via mains power to an elevated storage tank on a 12m stand

Section	Text	Comment	Response
	• infrastructure exhibiting neglect and in a poor condition.		
4.2.6	Other key existing health conditions, resulting from a number of issues such as low socio-economic factors and remote location include poor nutrition, inactivity and high rates of smoking (URS, 2012).	The Shire of Ngaanyatjarraku and URS report smoking.	Reference added as per suggestion.
4.2.6	The Health Clinic in Wingellina has been funded to have a resident nurse, however at the time of the SIMP preparation in 2012, there was no resident nurse on either a part-time or full-time basis.	It would be better if knowledge of the current situation is known.	Modified text: Currently, it is ~~unknown whether~~ assumed a nurse (unknown if full-time or part-time) is stationed within the community given the Shire of Ngaanyatjarraku funds this position although it is noted that the remote location of Wingellina makes retaining health practitioners or service providers difficult.
7.1.3	For the natural environment, a summary of existing health risks is provided below.	Cross check this with table from Health Chapter in PER.	Tables in both the HIA and PER Chapter are aligned.
7.1.4.1	Application of average wind erosion based on metrological data suggests an erosion rate of 0.53 kg/ha/hr	Is this a high erosion rate?	Comparison against CSIRO agricultural rate. The context of soil loss may be different to the definition of soil based on agricultural conditions and slope, soil thickness.
7.1.4.1	There is no measure of PM2.5 added to the atmosphere resulting from the operation of the HPAL plant.	JS46 is addressed in discussion around Table 4.3. The Health chapter includes a comment on PM 2.5. The two docs need to align.	The documents do align. There are two categories of mine activities assessed in the Air Quality Assessment, the first gaseous emissions from the HPAL Plant and the second from ROM, mining and stockpiling. PM2.5 is only emitted as a result of the second category of mine activity.
7.1.4.1	he tables show both Project only contribution and the cumulative impacts (including background) at year 14, which is considered representative of maximum mine operation.	Should this be <u>production</u> here rather than operation	Changed wording to reflect ‘production’ as per comment.
7.1.4.3	Despite levels of both PM10 and PM2.5	WHO AQGs	As stated previously, PM2.5 is included in the

Section	Text	Comment	Response
	levels meeting the NEPM air standards		Air Quality Assessment noting that PM2.5 is only emitted as a result of the second category of mine activity.
7.1.4.3	It is also acknowledged that placing the mine pits east of the existing Wingellina Township location will reduce the amount of dust generated from the Project affecting the community given the prevailing wind direction is generally south-easterly or north-easterly.	Addresses comment DK52	Note to answer the first question regarding existing roads in mine area, there are no existing roads currently to make a comparison on impact to Wingellina.
7.1.4.6	The provision of personal protective equipment (PPE) is one effective way of reducing exposure to a workplace hazard, particularly where that hazard cannot be eliminated. The HRA looks at the occupation safety impacts and mitigation measures.	This comment is difficult to understand. Does the HRA consider OHS issues? They do not usually do this as it is covered by Worksafe???	Taking comment out. The HRA does discuss briefly the use of PPE for employees but defers further discussion to occupational health and safety issue.
8.3.1	The following shows the baseline risks for Sustainability	Cross check with table from health Chapter	Tables align in both PER and HIA.
8.3.1 table	+ve	The statement below says the outcomes will be negative. This needs sorting.	Rating has been clarified – natural environment is largely undisturbed and hence a positive rating for the existing environment.
Table 6	Table 6 Summary of key and management recommendations	Cross check with the table above and in the Health chapter of the PER.	Table 6 has been cross-checked with PER chapter.
10	Table 6 provides a summary of management measures and recommendations, however, it is not possible to further describe all the management measures required or performance indicators until such time as the Project is approved and specific project parameters and design are	Is it worth indicating again that where relevant some of these, particularly the social components, will be developed in collaboration with the community?	Added new text as comment suggests.

Section	Text	Comment	Response
	finalised.		
10.1	In addition, MetalsX will establish a process wherein performance criteria and indicators will be monitored by a Social Impacts Management Team in collaboration with the Implementation and Review Committee…	Made up of representatives from…?	The Social Impacts Management Team would be formulated with representatives as deemed appropriate in consultation with MetalsX, Ngaanyatjarra Councils, relevant state and federal government authorities and community representatives.

Social Impact Analysis and Management Plan

Wingellina Nickel Project

4 JANUARY 2012

Prepared for

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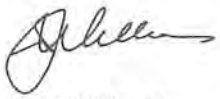

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Status:

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Abbreviations

Abbreviation	Description
ABS	Australian Bureau of Statistics
APY (Lands)	Anangu Pitjantjatjara Yankunytjatjara (Lands)
CMEWA	Chamber of Minerals and Energy Western Australia
DMP	Department of Mines and Petroleum
EPA	Environmental Protection Authority
FaHCSIA	Department of Families, Housing, Community Services and Indigenous Affairs
GTO	Group Training Organisation
IARE	Indigenous Area
NgC	Ngaanyatjarra Council
NgLC	Ngaanyatjarra Land Council
PER	Public Environmental Review
RAESP	Remote Area Essential Services Program
RTO	Registered Training Organisation
SALM	Small Area Labour Markets
SIA	Social Impact Assessment
SIMP	Social Impact Management Plan
URS	URS Australia Pty Limited

1

Introduction

This Report describes the potential social and economic impacts arising from the development of the Metals X Wingellina Nickel Project as evidenced during the consultation period occurring between April and May 2011. The report sets out recommendations for a **Social Impact Management Plan (SIMP)** for implementation by the company and stakeholders in the event that the project proceeds.

The Social Impact Management Plan has been undertaken in accordance with Clause 15.4(b) and (c) of the Wingellina Project Agreement (July 2010). This clause is presented below.

> (b) The social impact study is to include an assessment of the social and economic impacts of the development and operation of the Project on the Ngaanyatjarra Lands People.
>
> (c) The Social Impact Management Plan is to include:
>
> i) A plan for the implementation of any recommendations of the social impact study; and
>
> ii) Other measures that reduce the potential negative impacts of the development and operation of the Project and increase the potential positive impacts of the development of and operation of the Project on the Ngaanyatjarra Lands People.

The outcomes of the Social Impact Analysis also inform the documentation produced for the environmental approvals process, specifically as an inclusion in the Public Environmental Review (PER) report required by the Environmental Protection Authority (EPA). The PER calls for the proponent (Metals X) to provide a description of the existing environment in a local and regional context, with an emphasis on those aspects that may affect or be affected by the proposal, including:

- key ecosystem processes;
- biodiversity;
- existing site condition; and
- other environmental issues that may be constraints or fatal flaws to the proposal

Information for all environmental factors are to be responded to under the three categories of biophysical, pollution management and *social surroundings*. Thus, the consultation for Social Impact Analysis conducted by Metals X has been undertaken to also provide for this EPA process.

The **purpose** of the SIMP is to set out a management approach to address the identified social impacts, mitigate negative impacts and enhance opportunities for positive impacts, and as a means of identifying actions that will facilitate delivery on the commitments agreed to by the parties to the Wingellina Project Agreement (See Section 1.1.4). The SIMP is a stand-alone document but does capture elements of the Project Agreement in several areas, namely:

- employment and training;
- business development;
- Aboriginal cultural heritage management;
- environmental management; and
- the relocation of the community.

Where possible, but also recognising the confidential status of the Project Agreement, this report describes the commitments made by Metals X in respect of those matters noted above and the proposed management plan at Section 4 reflects those commitments.

It must be noted at the outset that until such time as a financial investment decision is made to develop the project, after all approvals necessary for the project to proceed have been obtained, financing for the project has been completed and is in place, and the company has approved final

construction of the project, will the SIMP be finalised and subsidiary management plans and policies developed. It is recommended that the Implementation and Review Committee established as a result of the Wingellina Project Agreement be closely involved in the subsequent development of more detailed management plans described in this Social Impact Management Plan (at Section 4), particularly those that detail specific management actions around Aboriginal employment and business development.

The Report has been prepared by URS Australia Pty Ltd under instruction from Metex Nickel Pty Ltd (herein referred to as Metals X as this is the entity name familiar to Traditional Owners) and reflects the conditions encountered at the time of the consultations – April to May 2011. The report has been reviewed by the Ngaanyatjarra Council's Land and Culture Unit (including a review by an external consultant commissioned by the Council).

1.1 Project summary

1.1.1 The Metals X Wingellina Nickel Project

Metals X Limited is a diversified resource group with exposure to tin, nickel, copper, zinc, phosphate, uranium and lead. The Company is Australia's largest tin producer with its 50% owned Tasmanian Renison tin assets. Additionally, the company holds a number of strategic investments in independence group Limited (nickel, gold, zinc and copper), Westgold Resources Limited (gold, phosphate) and Alamar Resources (gold, coal and iron ore) and (the unlisted) Aziana (gold, alumina).

The company controls the Wingellina Nickel Project which forms part of the wider Central Musgrave Project in central Australia (Western Australia and South Australia). Wingellina contains over 180 million tonnes (Mt) of ore at 1% Nickel of which 167 Mt is categorised as probable mining reserves.

Metals X has been undertaking detailed investigations at Wingellina since 2005 when it entered into an earn-in Agreement with Acclaim Exploration NL. Metals X subsequently acquired 100% ownership of the project in 2006.

A Phase One feasibility study was completed in 2008 and confirmed a project concept for the construction of a nickel and cobalt operation producing approximately 40,000 tonnes per annum (tpa) of nickel and 3,000 tpa of cobalt. The initial mine life is expected to be 40 years.

The Wingellina deposit is made up of a number of zones over a strike length of around 10 km. It is exposed at the surface, has a very low stripping ratio and allows, in most, for excavation without blasting for most of the material (some blasting is required in harded rock units). The Project will consist of open pit mining of nickeliferous limonite ore, and on-site processing using a high pressure acid leach process to produce an intermediate mixed nickel-cobalt hydroxide product.

Process water will be sourced from a borefield in either the Cobb Depression (part of the Canning Basin) or the Gunbarrel Basin (part of the Officer Basin) located approximately 100 km to the Northwest and Southwest of the Project area respectively. Water will be piped to the Project.

Energy will be supplied through steam generation from the burning of sulphur on site for the production of sulphuric acid and from natural gas sourced from an existing Amadeus gas field and piped to the site. The most likely gas field to be accessed is in the operational Amadeus Basin in the southern Northern Territory. This will require a gas pipeline of approximately 450 km to the Project site. Other gas fields are being considered and the final source will be based upon commercial

negotiation. The natural gas will be used in conjunction with the steam produced from a sulphuric acid plant to generate power for the Project.

After processing the nickel-cobalt hydroxide product will be transported to the Darwin or Adelaide Ports via road and rail for export to international markets.

The project is expected to have a ramp-up period of up to four years with production peaking at 4.3 million Tonnes per annum (Mtpa) within four years of commencement of the operation.

Employment is expected to peak at 1,500 workers in the construction period with an operational workforce of 450 personnel. An additional 500 positions may be evident during periods of maintenance shutdown.

1.1.2 Environmental Approvals

In 2010 Metals X submitted its environmental referral for the Wingellina Nickel Project including a scoping document, required as part of the Western Australian approvals process, to the Environmental Protection Authority (EPA). The EPA has set the level of assessment for the Wingellina project at Public Environmental Review (PER) with an eight-week review period.

Metals X is progressing final environmental studies with a view to submitting its final PER documentation in late 2011.

1.1.3 Project location

The Project is located in Western Australia approximately 1,540 km east-northeast of Perth within the Shire of Ngaanyatjarraku. It is 5km from what is known as the Surveyor Generals' Corner representing the junction between Western Australia, South Australia and the Northern Territory.

Wingellina is one of 11 autonomous incorporated Aboriginal communities located in the area known as the Ngaanyatjarra Lands. The Ngaanyatjarra Lands cover a total area of 250,000 square kilometres - of which 98,000 square kilometres forms the Indigenous Protected Area, declared in 2002. While the focus of this study is upon Wingellina community, who will experience any social impacts more directly, it is noted here that the Wingellina Project Agreement is between Hinckley Range Pty Ltd (for Metals X) and the Ngaanyatjarra Lands people represented by Yarnangu Ngaanyatjarra Parna Aboriginal Corporation, Ngaanyatjarra Council and the Ngaanyatjarra Land Council (Aboriginal Corporation). Therefore, in investigating the social impacts the wider Ngaanyatjarra Lands are considered.

Wingellina lies approximately 1,200 km by road from Kalgoorlie (WA) to the south-west, and 275 km from Yulara (NT) and 525 km from Alice Springs (NT) to the north east. The section of road from Laverton (WA) to Wingellina is unsealed and subject to wet weather closure. Whilst numerous other roads exist, they are generally poorly (if at all) maintained and require special permits for transit.

There are no rail services in the immediate vicinity. The Malcolm railhead near Leonora (WA) that provides a link to Kalgoorlie then to Esperance Port and Fremantle Port lies 800 km to the southwest of Wingellina via the Great Central Road. The Kulgera railhead is located 440km to the east-northeast of the Project in the Northern Territory via the Giles-Mulga Park Road. This provides a rail link to Darwin on the Central Australian Railway.

1 Introduction

The Wingellina community is serviced by road with weekly delivery of goods as well as a small charter aircraft delivering mail and providing a limited passenger service from an existing gravel airstrip. This airstrip is also utilised by the Royal Flying Doctor Service.

The Accessibility/Remoteness Index of Australia[1] (ARIA) rates Wingellina as "very remote – locationally disadvantaged - very little accessibility of goods, services and opportunities for social interaction".

While the mine and associated infrastructure are to be located in Western Australia there will be aspects of the project that will involve access to, and impacts on Aboriginal lands in South Australia and the Northern Territory. For example, the likely gas pipeline route will need to pass through Northern Territory Aboriginal land and a new road may need to be constructed to provide for transport of project supplies and product. Additionally, there is a requirement to quarry calcrete in South Australia to supply the plant with calcium carbonate. Further, nickel-cobalt resources have been identified in South Australia that may be mined at some future date and treated at the Wingellina site. Note this Social Impact Management Plan will not specifically address social impacts that result from activities taking place outside of the Western Australian study area.

1.1.4 The Wingellina Project Agreement

In July 2010 an agreement was reached between Hinckley Range Pty Ltd (the 'Company') and the Yarnangu Ngaanyatjarraku Parna Aboriginal Corporation, Ngaanyatjarra Council (Aboriginal Corporation) and Ngaanyatjarra Land Council (Aboriginal Corporation). The Agreement is in the process of being registered on the Register of Indigenous Land Use Agreements. **The Agreement is confidential between the parties.**

In the lead up to the signing of the Agreement Metals X engaged in a comprehensive program of community consultation and continues to do so. Consultations conducted to develop the Agreement included numerous community meetings held at the Wingellina Community, consultations with the Wingellina Community Council, the Ngaanyatjarra Council, Shire of Ngaanyatjarraku and with relevant government stakeholders. Through this consultation the Company has gained considerable insight into the wants and needs of the Wingellina community and of the Ngaanyatjarra Lands People more broadly.

To a large extent the Company has identified the potential social impacts of its proposed operation and has, through the Agreement, made commitments to addressing the negative impacts and enhancing the opportunities, particularly in the areas of employment and training, environmental protection and heritage protection.

The Agreement provides for the payment of compensation to Ngaanyatjarra Lands People. Without disclosing the specifics of the Agreement and notwithstanding that decisions regarding distribution of

[1] ARIA was devised by the Commonwealth Department of Health to calculate remoteness as accessibility to some 201 service centres based on road distances. ARIA values are grouped into five categories:
1. Highly Accessible (ARIA score 0 - 1.84) - relatively unrestricted accessibility to a wide range of goods and services and opportunities for social interaction.
2. Accessible (ARIA score >1.84 - 3.51) - some restrictions to accessibility of some goods, services and opportunities for social interaction.
3. Moderately Accessible (ARIA score >3.51 -5.80) - significantly restricted accessibility of goods, services and opportunities for social interaction.
4. Remote (ARIA score >5.80 - 9.08) - very restricted accessibility of goods, services and opportunities for social interaction.
5. Very Remote (ARIA score >9.08 - 12) - very little accessibility of goods, services and opportunities for social interaction.
Wingellina (Irrunytju Aboriginal Community) scored 12.0

the compensation will be managed by the Trust, there is an expectation that compensation will be used for *the benefit of the Ngaanyatjarra Lands People*. To that extent it would be expected that the Beneficiaries to the Agreement would also take some responsibility for enhancing potential opportunities and minimising negative impacts as a result of the mining operation.

1.2 People and land tenure in the Project Area

1.2.1 The Wingellina Community

Wingellina, also known as Irrunytju was named after the nearby Irrunytju rockhole, is an area important for (Y)Anangu (people)[2] because of the permanent water in the foothills of the Tomkinson Range south of the community. There are several nearby homelands including Kunmanara Bore and Ngururrpila but none of these are now permanently occupied (courtesy of http://irrunytju.ngurra.org/). The townsite was initially erected as the exploration camp in the late 1950s by Southwestern Mining Co (Inco) and was then occupied after the company vacated the lands.

It is home to approximately 80 people who speak primarily Pitjantjatjara language, with some Ngaanyatjarra people also resident. As is common in remote Aboriginal lands, people will travel frequently between communities and towns for cultural purposes, to maintain links with family and to obtain services. Therefore the population of Wingellina may vary between about 50 and 100 people, and this may increase greatly above this number for short periods during events in the community, such as funerals. This fluctuating population has implications for the delivery of services (e.g. in housing, health and education) by a 'western' system that assumes a relatively sedentary population.

1.2.2 Land tenure

The area around the project site shows a number of complexities.

- It is subject to a native title determination encompassing six claim applications (Gibson Desert, Tingarri Tjina, Tjirrkarli Kanpa, Warburton-Mantamaru, Irrunytju Papulankutja and Baker Lake, and the previously unclaimed Watalya) with native title being held by the Yarnangu Ngaanyatjarraku Parna Aboriginal Corporation. The area is part of the Ngaanyatjarra Native Title Determination WAG 6004, 2004. Ngaanyatjarra Council is the agent for Ngaanyatjarra Land Council and Yarnanu Ngaanyatjarraku Parna. The land is held for the use and benefit of Aboriginal people;
- The Project area is located entirely within Aboriginal 'A Class' Reserve A17614, Part III which is a 99 year lease granted to the Ngaanyatjarra Land Council in 1982;
- The area is covered by an Indigenous Land Use Agreement;

[2] Both Yanangu and Anangu means 'people' however Yanangu are those of the Western Desert region including the Ngaanyatjarra Lands while the Anangu occupy Pitjantjatjara country mostly in the north-west of South Australia, extending north into the Northern Territory and west into Western Australia.

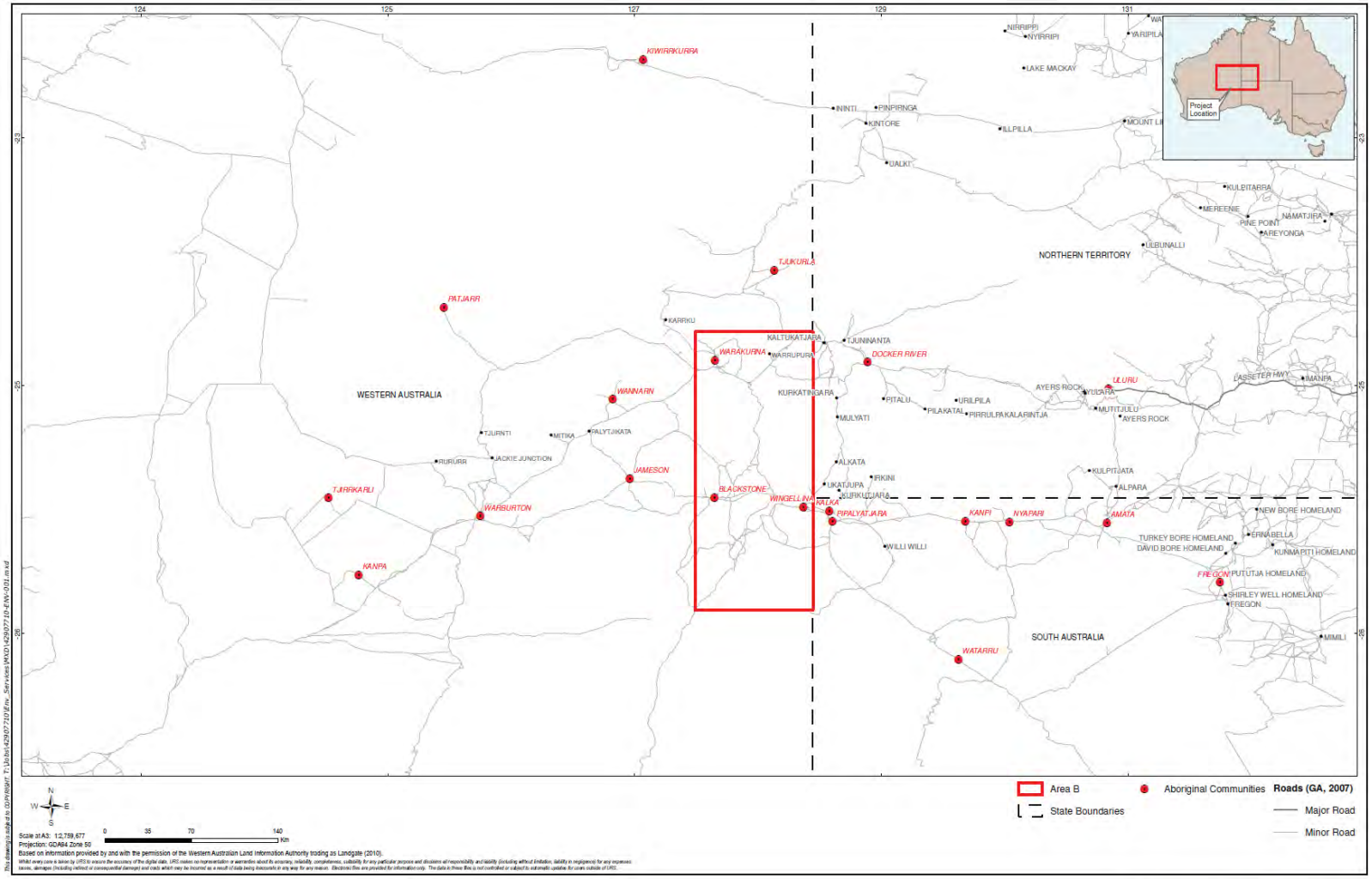
- It is an Indigenous Protected Area (IPA) declared in 2002. It is a voluntary declaration and allows for economic activity to be carried out within the IPA; and
- Wingellina is in the Shire of Ngaanyatjarraku. The shire offices are in Warburton.
- It is subject to shared administration between the Shire of Ngaanyatjarraku and the Ngaanyatjarra Council (NgC).

1.2.3 Nearby communities

There are several communities located near to Wingellina and to which members of the Wingellina community frequently travel. The nearest communities are Kalka (20 km) and Pipalyatjara (25 km) in the Anangu Pitjantjatjara Yankunytjatjara (APY) lands of South Australia. In Western Australia the nearest community is Blackstone (approximately 70 km west of Wingellina) with Jamieson (250 km west-north-west) and Warburton (375 km west and the largest of the 12 indigenous communities of the Ngaanyatjarra Lands) being the two other WA communities near Wingellina (see Figure 1-1). Warburton is also the administrative centre for the Shire of Ngaanyatjarraku.

Travel between these communities and Wingellina is frequent.

In addition to the centres noted above the other large regional centres in proximity and to which Wingellina and to which community members have said they travel is Yulara in the Northern Territory, some 220 km north east. It is also not uncommon for the people of Wingellina to travel to Alice Springs in the Northern Territory some 720 km to the north east particularly for medical services and access to Commonwealth agencies. People in Wingellina will, although infrequently, also travel to Kalgoorlie in Western Australia, a distance of 1,100 km.



METEX NICKEL PTY LIMITED

MAP OF SURROUNDING COMMUNITIES

URS | SOCIAL IMPACT MANAGEMENT PLAN | Figure: X | File No: 42907710-ENV-001.mxd | Drawn: CJT | Approved: VW | Date: 09/06/2011 | Rev. A | A3

Figure 1-1 Map of surrounding communities

1.3 Methodology

1.3.1 Confirming the methodology

In response to a request from Metals X to provide a quote for services to conduct a social impact analysis and prepare a Social Impact Management Plan URS submitted a proposal in November 2010. This proposal was provided to the Land and Culture Unit of the Ngaanyatjarra Council on 31 December 2010 for review. Minor comment on the proposal was provided by the Land and Culture Unit of the Ngaanyatjarra Council to Metals-X and URS on 28 January 2011. The content of the proposal was further discussed in a tele-conference on 21 February 2011 attended by representatives of URS, Metals and the Ngaanyatjarra Council. The proposal, and specifically the methodology, was further discussed at a face-to-face meeting at the Metals X Offices in Perth on 8 March 2011. Minor changes were made to the methodology proposed by URS at these meetings. An extract from the URS proposal describing the proposed methodological approach is presented in Appendix A.

1.3.2 Review of existing information

URS reviewed the material provided by Metals X being the Wingellina Project Agreement (July 2010) and the Project Scoping Document. Available data and information on community demography and social and economic indicators have been obtained from public domain sources (e.g. ABS, the websites of Shire of Ngaanyatjarraku, Tjulyuru Regional Arts Gallery, Western Australian Department of Education; Training and Workforce Development; Regional Development and Lands; Housing, Health, Planning; and Stat Development, Commonwealth agencies including Centrelink, Department of Families, Housing, Community Services and Indigenous Affairs, Goldfields-Esperance Development Commission, Western Desert Native Title Services and others).

1.3.3 Consultation approach

The following section outlines the overall approach to consultation undertaken during the social impact study. The consultation process was designed to gather the views and opinions of key community and government stakeholders about the proposed project to inform the development of this Social Impact Management Plan.

Stakeholder identification

Stakeholders to the Metals X Wingellina Nickel Project are those individuals, communities, government agencies, non-government organisations, local government authorities, private organisations, small businesses and others who have an interest or “stake” in the project.

A preliminary stakeholder list was developed through discussions held between Metals X, Ngaanyatjarra Council Land and Culture Unit and URS, desktop research, and analysis of existing information. The preliminary stakeholder list was expanded through recommendations made by stakeholder participants during implementation of consultation activities.

Stakeholders identified as relevant to the Metals X Wingellina Nickel Project include:

- Wingellina community members;
- Service providers to Wingellina;
- Community members in Pipalyatjara, Kalka, Blackstone;
- Ngaanyatjarra Council;
- Ngaanyatjarra Services;
- Ngaanyatjarra Agency and Transport Services (NATS);

1 Introduction

- Ngaanyatjarra Health;
- State government authorities and agencies;
- Local government authorities; and
- Employment Training Services.

In identifying project stakeholders, the project team was able to establish anticipated levels of impacts the project may have on the particular stakeholder groups (positive or negative) and/or the level of likely stakeholder influence over the Project for all stages of development. To assess the potential level of stakeholder involvement in the Metals X Wingellina Nickel Project, a matrix of interest and influence was prepared, (refer to Table 1-1 below). The matrix is based on the following elements:

- Interest: the level of interest of the stakeholder grouping (high, medium or low); and
- Influence: the level of influence of the stakeholder grouping (high, medium or low). The level of influence is determined by the stakeholder group's position in the community, political influence or their attitude to project specific issues.

The interest and influence ratings are used to determine the potential involvement for each of the stakeholder groups. Where stakeholders are perceived to have a high level of potential project involvement, it was considered more appropriate to hold face-to-face meetings/briefings. For those stakeholders who were considered to have a medium or low potential involvement, phone interviews and/or correspondence by email was used.

Table 1-1 Stakeholder interest and influence matrix

	Interest		
Influence	**High**	**Medium**	**Low**
High	High potential involvement	Medium potential involvement	Medium potential involvement
Medium	High potential involvement	Medium potential involvement	Low potential involvement
Low	Medium potential involvement	Low potential involvement	No potential involvement

Table 1-2 below outlines the level of interest and influence of each stakeholder group.

Table 1-2 Stakeholder interest and influence level

Stakeholder Group	Potential Involvement
Wingellina community members	High
Service providers to Wingellina	High
Community members in Pipalyatjara, Kalka, Blackstone	High
Ngaanyatjarra Council	High
Ngaanyatjarra Services	High-Medium High
Ngaanyatjarra Health	High-Medium
State government authorities and agencies	Medium
Local government authorities	Medium
Employment Training Services	Low-Medium

1 Introduction

1.3.4 Consultation with the Wingellina and Pipalyatjara communities

Consultations with community members and service providers in Wingellina, Blackstone and Pipalyatjara occurred between 14 and 21 April 2011. The consultations focused upon the potential social impacts that may result from the commencement of mining and the relocation of the settlement. Other consultations conducting by telephone occurred subsequent to the site visit through May and June of 2011. The methodology has been described elsewhere (Section 1.3). The people who were involved in those consultations are shown in Table 5-1.

The nature of the interviews

The interviews with community members and others were not formal structured interviews. The interviews were partially structured by written prompts to ensure that they focused on the issue at hand, but stay conversational enough to allow participants to introduce and discuss aspects that they consider to be relevant. Several of the interviews were conducted as informal discussions with community members outside the stores in Wingellina and Pipalyatjara. The prompts used were roughly around the following open-ended topics.

- Please tell us about life in Wingellina (good things, bad things)?
- How well do you know mining operations?
- What do you know about the plans for the mining operations at Wingellina?
- What do you think about the plans – what will be the good things, and the bad things about the mine starting?
- How do you feel about the shift of the community to a new place?
- If the mine goes ahead, what would you like to see happen?
- If the mine goes ahead, what are you worried about?

Assistance with interpretation in the Wingellina discussions was provided by Chris Reid, Chairperson of the Wingellina Community. The prompts and follow-up discussions were guided by desktop analysis of previous Australian and international studies that have investigated the social and economic impacts of mining on Indigenous communities. Considerable research has been undertaken by, for example, the Centre for Social Responsibility in Mining, at the University of Queensland and with whom URS has an existing association.

The discussions proceeded at the community members' pace, and as people joined and left the discussions. Often there were considerable pauses, or discussion about unrelated matters. Sometimes questions were asked, which the URS team endeavoured to answer based on their knowledge of the Agreement. At other times, separate discussions around the topics of interest were held by the two URS team members present. Items for discussion raised by community members included:

- the payments to be made under the Agreement, and the eligibility to receive these (URS did not raise these matters, or pursue them at all, on the understanding that these are being resolved in a process being undertaken by the NgC);
- the opportunities for training and employment at the mine – people were clearly interested in what might be available, when it might be available, and who will be able to apply;
- the desired level of contact between the mine workers and the community – the question was raised whether community members will be able to access the mine village – community members currently visit the Metals-X camp regularly and the URS observation is that a good relationship has been established (this matter is addressed in the SIMP);

- how the cemetery will be managed and how people will still be able to visit it (this matter is specifically addressed in the Agreement);
- management of traffic and dust – community members are hoping that additional lengths of sealed road will be built close to Kalka, Pip and Wingellina;
- issues around the location and facilities at the 'new' Wingellina (community members are asking about a swimming pool and a new Church) – it was explained that facilities to be provided are set out in the Agreement, and will include a pool; and
- what will remain at the existing Wingellina community after the move and whether people will be able to visit it after relocation (see Section 3.2.2).

Because it was not raised specifically by community members, URS raised the issues of alcohol and drug 'leakage' into the community, but community members did not see this as being a major concern. The point is addressed specifically in the SIMP and in Section 3.

The analysis for the SIA has been supplemented by information gathered during the development of the Wingellina Agreement which also considered (and seeks to address) the social impacts of the proposed mine – as noted above. However, note that as the conversations in the communities and other places where interviews were conducted were free flowing, the prompts will not fully capture the entirety of the conservations that were had. As noted above, the interviews were more in the nature of general discussions, with a focus on what were the key issues to be addressed in the event that the mine proceeds. The community members present were well able to address the prompts from the URS team.

Familiarity of the Wingellina community with mining

The question of the extent to which community members had an understanding of what a functioning mine site entails was one that was foremost in the minds of the URS team during the interviews. The question was specifically (and repeatedly) asked.

Many members of the Wingellina community said they have travelled relatively widely and therefore have a knowledge of mining greater than URS had assumed. The majority of respondents replied that they had seen operating mines in places like Kalgoorlie, Laverton, Leonora, and Coober Pedy. They were confident in these responses in respect of their knowledge of mining and mining communities. Further, some people said they have relatives or friends working at Coober Pedy who are providing experiential knowledge into the communities. Further, there is a reasonable level of enthusiasm for the opportunities for economic benefits to flow from the mine, tempered though by a sense of regret at leaving the existing community site.

It was suggested by URS, during the consultations, that visiting an existing mining operation of similar size would allow the community to better understand what environmental and social changes will occur. It would also provide an opportunity for Aboriginal employees at the site visited to talk about the work that is available and what assistance can be provided to new employees. This suggestion was welcomed although many of those consulted had stated that they had seen enough of other mine sites on their travels to have a reasonable idea of what mining operations entail (see Section 3.2.2). Nevertheless, the recommendation has been retained in the SIMP.

1 Introduction

1.3.5 Consultation with governance and service providers

Consultations with government agencies and service providers located outside of Wingellina have been carried out either by telephone or in face-to-face meetings. These consultation events occurred in April and May 2011.

1.3.6 Consultation done by Metals X

Metals X has undertaken extensive consultation independent of this social impact study which has informed their approach to managing social (and other) impacts. Because the project is located on Aboriginal Lands the company has already negotiated access agreements to cover its exploration and feasibility activities with the relevant Traditional Owners and their representatives. The full agreement required to construct and operate the Wingellina Mine has also been completed, and the people have given their consent for the project to proceed. An extensive period of consultation preceded the creation of the Wingellina Project Agreement, signed between the parties in July 2010. This included a number of public community meetings at Wingellina and discussions with the Wingellina Community Council.

In addition Metals X has met with the Shire of Ngaanyatjarraku, the Ngaanyatjarra Council, the Pitjantjatjarra Homelands Council, and agencies of State and Territory Governments, educational institutions and a range of remote area service providers.

2

The socio-economic environment

This section describes the socio-economic environment of the Wingellina Nickel Project Area.

2.1 The regional context

Wingellina sits within the Mann-Musgrave Block subregion of the Central Ranges Interim Biogeographic Regionalisation for Australia (IBRA) bioregion which is characterised by hot summers where temperatures can exceed 50ºC and variable rainfall.

The region is dominated by rugged ranges and red sandplains. Granite, gneiss and quartzite are the dominant rocks types. At a broad scale, vegetation is generally low open woodlands of either Desert Oak or Mulga over hummock grasslands on sandplains. Vegetation fringing the ranges can be described as low open woodlands of Ironwood and Corkwoods over tussock and hummock grasslands, and on ranges the vegetation consists of mixed wattle scrub or White Cypress woodlands over hummock and tussock grasslands (DOIR, 2008, Clearing Permit Decision Report).

The project area is located on an undulating valley floor and occupies a low rise in the floodplain, rising 3-4 metres above the floodplain. The area is degraded due to disturbance by camel grazing and frequent fires (DOIR, 2008, Clearing Permit Decision Report).

Temperatures in the region range from (median) maximums of 37.3ºC in January to 20ºC in July. Minimum temperatures range from 6.9ºC in the winter months to 23.5ºC in summer. Annual rainfall averages around 285 mm with the wettest months normally being between December and March.

The pattern of past and existing land use across the Ngaanyatjarra Lands (often referred to as 'the Lands') is complex and varied, though traditional practices continue to predominate. There has never been a pastoral industry in the region although the United Aboriginal Mission, established in 1934 at Warburton, managed sheep, cattle, goats and horses until the mid-1980s. In the 1950s and 1960s, Weapons Research patrols actively brought people into settlements while atomic testing was occurring at Maralinga. The only export industries in the Lands have been sandalwood harvest, collection of dingo scalps, and prospecting however, no economic activity of worth other than that undertaken to support the community has been conducted in the vicinity of the project site. The community did have, at one time, a thriving arts economy with a large amount of arts works sold out of the region but this has since declined. It is understood that no significant amount of art is now produced or sold out of Wingellina (although some Wingellina artists may be producing art elsewhere in the region but the economic benefit of this is not necessarily returning to the community). It is likely that the remoteness and general inaccessibility of the region has constrained economic development and activity.

The district has had very little modern exploration. The virtual exclusion from exploration for the 25 year period to the late 1990s (due to the Ngaanyatjarra Land Council restrictions), Apart from small-scale chrysoprase extraction, no mineral exploration has resulted in an operational mine within the Aboriginal lands to date. The Metals X Project, should it proceed will be the first major mineral resource operation in the Lands at the present time.

The remote Musgrave Province is one of Australia's current areas of mineral exploration interest, and about 30 companies hold more than 120 mining tenements in the region.

2.2 Demographic profile

2.2.1 Obtaining demographic data

During consultations there was general agreement that the population of Wingellina ranged from 60 to 100 people – 60 people who are generally permanently resident and an additional 40 people who are occasionally resident in the community. This variation is unsurprising given the movement of people between communities. People from Wingellina frequently travel to and stay at communities to the west and east. There are strong connections with Blackstone and Jamieson in the west, and with Kalka and Pipalyatjarra in the east. (Refer to **Appendix B** for information on nearby communities.)

One source of population data is the General Report filed by the Ngaanyatjarra Council to the Office of the Registrar of Indigenous Corporations (ORIC). This provides a list of members to the Council including their address. In the June 2010 report there were 215 members whose address was listed as Wingellina Community suggesting this number of people call Wingellina home. Whether they are currently residing at the Wingellina settlement or the frequency of their visits to Wingellina is unknown.

Population data from the Australian Bureau of Statistics is available for the Shire of Ngaanyatjarraku as well as the Indigenous Area referred to as Ngaanyatjarraku (S) excluding Warburton which includes the communities of Warakurna, Tjukurla, Blackstone, Warnarn, Jamieson, Patjar, Irrunytju (Wingellina) and Tjirrkarli.

This study primarily refers to data for the Indigenous Area as Ngaanyatjarraku (S) excluding Warburton however it is important to highlight data limitations. The ABS acknowledge that census data, particularly for remote regions, may not fully capture the entire population. There is a suggestion that the Aboriginal population data may be under-reported by between 10-15%. This discrepancy between actual and reported population data can have consequences for the provision of services to remote regions and must be factored in to any service provision planning.

2.2.2 Population

The population of the Shire of Ngaanyatjarraku at the 2006 Census was 1,336 people of which 87% or 1,162 identified as Indigenous. Across the entire population there was a slightly higher proportion of females (52.7%) to males (47.3%) although non-Indigenous male to female ratio was 1:1. The Indigenous population age-sex distribution shows a typical pyramid structure with a higher proportion of very young people in comparison to older people. There were no Aboriginal people identified in the Shire who were aged over 90 years at the time of the 2006 Census.

The Shire of Ngaanyatjarraku has a young population profile with 26.9% aged under 15 years compared to 20.2% for the Western Australian population. About 67.7% of people are aged between 15 and 65 years (equivalent to WA at 67.7%), that is, of working age.

According to ABS the estimated resident population of Ngaanyatjarraku Shire has increased by 5.5% between 2006 and 2009. The Western Australian Department of Planning has forecast population growth of about 3,3% for the Shire to 2031 (WAPC, *WA Tomorrow*) however this does not take account of proposed mineral resource activity in the region.

The population is relatively stable with only 30% of the population residing at a different address in 2006 than they did in 2001. Only 17% of the population had changed addresses in the previous year.

2 The socio-economic environment

Given that a high number of residents of the Shire of Ngaanyatjarraku reside in Warburton it is useful for purposes of analysis to report statistical data excluding Warburton. This data describes the situation for residents of the Lands outside of the major population centre of Warburton which would include the residents of Wingellina.

The ABS provides data for the Indigenous Area (IARE) of Ngaanyatjarra (S) excluding Warburton. These population data are provided in Table 2-1. As is evident with the statistical data for the entire Shire, the population of the IARE of Ngaanyatjarra (S) excluding Warburton is relatively young with a median age of 30 although the median age of Indigenous people is considerably lower (27) than that of non-Indigenous persons (47). Some 29.4% of males and 24.2% of females are aged under 15 years with 65.7% aged between 15 and 65 years (i.e. of working age).

The Indigenous population is relatively stable with 64.3% of the population living at the same address in 2006 as in 2001. On the other hand, the non-Indigenous population is highly mobile with 93.6% of non-Indigenous people living at a different address in 2001 than they were in 2006.

The vast majority of the Indigenous population speak a language other than English, most identifying a 'Western Desert' language as the primary language spoken. This was evident during the consultations for the Social Impact Analysis where many of the local Wingellina community who were consulted spoke a mixture of Pitjantjatjara and English. Very few identified themselves as Ngaanyatjarra, although most people speak both languages.

Table 2-1 Population data in the IARE excluding Warburton

	Indigenous persons/ households with Indigenous persons(a)	Non-Indigenous persons(b)/ other households	Total
Total number of persons	641	110	761*
Percentage of total population	84.2%	14.5%	
Median age of persons	27	47	30
Median individual income ($/weekly)	190	929	214
Median household income ($/weekly)	517	1,122	777
Median housing loan repayment ($/monthly)	0	0	0
Median rent ($/weekly)	13	0	10
Average number of persons per bedroom	1.5	1.1	1.4
Average household size	4.2	1.5	3.3

(a) A household with Indigenous person(s) is any household that had at least one person of any age as a resident at the time of the Census who identified as being of Aboriginal and/or Torres Strait Islander origin.

(b) Includes persons who did not state their Indigenous status.

* Note: 12 not stated (3-male, 9-female)

2.3 Economic activity

Economic activity in the region is dominated by community service provision and infrastructure maintenance. An Indigenous Employment Strategy[3] prepared for the Ngaanyatjarra Council in June 2009 noted that there is

"little structure to the way employment services are delivered, and employers are, generally speaking, too busy to be able to properly supervise and train indigenous employees, many of whom have a limited capacity to perform the work required".

Further, the Centreprise study found that Indigenous people on the Ngaanyatjarra Lands were far from job ready and faced a number of barriers to gaining employment. Similarly, employers face a number of obstacles to engaging Aboriginal people in their workforce. Employers are faced with a number of challenges to employing Aboriginal people as the *Ngaanyatjarra Employment Strategy* identifies, for example:

- many Aboriginal people have other commitments with family, sorry business, cultural business, football carnivals and other matters such that employment takes a lower priority;
- there was no real commitment within the Indigenous community to be employed;
- Many of the jobs are beyond the capacity of Indigenous people owing to their lack of educational attainment;
- Welfare payments and "sit down money" (and other financial compensation) have made employment an option, rather than a necessity;
- There isn't enough time in a day to mentor, supervise, train and develop an Indigenous workforce when core services (e.g. water, power, waste management, maintenance etc) need to be delivered.

The findings reported above suggest that the economic situation for the people of Wingellina is one that is shared by most people on the Ngaanyatjarra Lands.

There are six major employers on the Ngaanyatjarra Lands:

- The Ngaanyatjarra Council;
- The 12 Community Councils (including Community Stores and Roadhouses);
- The Shire of Ngaanyatjarraku;
- The Western Australian Department of Education and Training (Schools);
- The Ngaanyatjarra Health Service; and
- Community Art Centres (separately incorporated from Community Councils).

Statistically, of those 341 people who are in the labour force in the IARE Ngaanyatjarra (S) excluding Warburton, the majority of both Aboriginal and non-Aboriginal employees are employed in the community services sector; being health care (35% of Aboriginal persons and 24% of non-Aboriginal persons), public administration and safety (31% of Aboriginal persons and 23% of non-Aboriginal persons) and education and training (2% of Aboriginal persons and 24% of non-Aboriginal persons). The other major industry of employment for Aboriginal persons is listed as 'other services'. While most people in the workforce stated that they were employed in the private sector, some 80 people were employed by local and state governments.

[3] Centreprise Resource Group, 2009, Making a Better Investment In Indigenous Employment Outcomes: An Indigenous Employment Strategy, Prepared for Ngaanyatjarra Council Aboriginal Corporation, June 2009

2 The socio-economic environment

The unemployment rates indicated in the 2006 census data suggest a low rate of unemployment for Aboriginal people at 3.6%. This low rate is the result of two factors; lower levels of labour force participation (54.5%) and the counting of CDEP as employment in the census data.

Employment data are also prepared by the Department of Education, Employment and Workplace Relations (DEEWR) in their small area labour markets publication. These data, collated at the LGA level, indicates the unemployment rate in the Shire of Ngaanyatjarraku at 21.6% as of December 2010. The small area labour markets data from around the time of the 2006 Census indicates an unemployment rate of 1.8% indicating that unemployment across the LGA has increased substantially in the ensuing 5 years since the 2006 Census[4]. As with the ABS Census Data the DEEWR figures treat CDEP as employment rather than unemployment suggesting that even with CDEP in place unemployment rates have been increasing.

2.3.1 Income

The 2006 Census data shows median weekly income for Aboriginal people in the IARE Ngaanyatjarra (S) excluding Warburton was $190 in comparison to $929 for non-Aboriginal people. The median household income for households with Aboriginal residents was $517 in comparison to $1,122 for other households. In 2006 the median weekly income for an Aboriginal person aged 15 years and over ($254) in Western Australia was approximately half that of a non-Aboriginal person ($507) of the same age group.

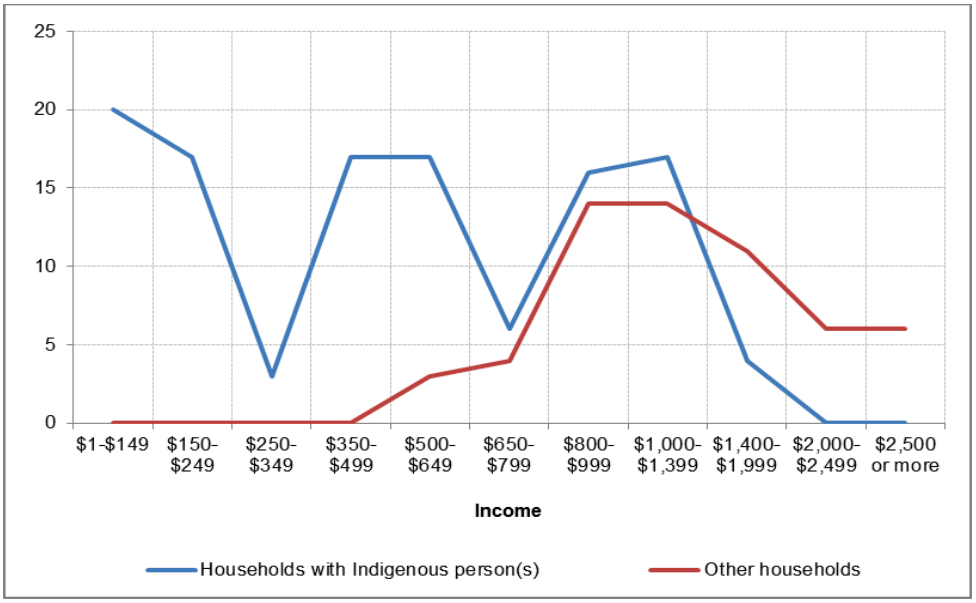
An absolute poverty line was calculated in Australia for the Henderson poverty inquiry in 1973. It was $62.70, which was the disposable income required to support the basic needs of a family of two adults and two dependant children at the time. This poverty line has been updated regularly by the Melbourne Institute according to increases in average incomes; for a single person receiving maximum welfare payments and no other income it was $341.31 per week (including housing costs) in September 2006 (around the time of the last Census). See Figure C-2 in **Appendix C**.

Figure 2-1 shows the number of households in the IARE Ngaanyatjarra (S) excluding Warburton receiving weekly incomes of various amounts. Of note is the larger proportion of households with Aboriginal people who are in receipt of weekly household income of less than $500. The relevance of this becomes even more abundant when considering the chronic overcrowding in Aboriginal households in remote areas (See Section 2.5.3)

[4] Department of Employment and Workplace Relations, 2007, Small Area Labour Markets Australia, March Quarter 2007

2 The socio-economic environment

Figure 2-1 Gross Household Income (Weekly) By Indigenous Status of Household



The main source of income for work-eligible community Aboriginal residents is the Community Development Employment Project (CDEP). Also, some people work in the delivery of services such as education, health, municipal services, construction, infrastructure repairs and maintenance, retailing and community administration. However, in Wingellina, as in other remote Aboriginal communities, the community support roles are predominantly occupied by non-Aboriginal people who have come into the community and stay for a period of time before moving on.

Metals X has provided opportunities for casual employment for a number of people in the area to assist with field work during the exploration and feasibility stage of the project. These work opportunities are providing some skill development for those taking the work and provides an introduction to workforce participation that might not otherwise be available.

2.3.2 Community Development Employment Programs (CDEPs)

Being a typical remote Aboriginal community, Wingellina offers few opportunities for full-time employment. The main provision of employment is the CDEP with 20 participants currently registered. There are limited opportunities for CDEP employment and those who are currently registered provide litter collection, tree pruning and general maintenance tasks (e.g. 'whipper-snippering').

Ngaanyatjarra Council has been funded by the Commonwealth Department of Families, Housing, Community Services and Indigenous Affairs (FaHCSIA) to deliver the Community Development Employment Projects (CDEP) Program to the Ngaanyatjarra Communities through its Training, Employment and Municipal Services (TEAMS) Division. Funding provides for a permanently based Project Officer in Wingellina who provides oversight of the CDEP delivery. Ngaanyatjarra Council has been awarded this contract through to 30 June 2012.

The CDEP comprises two streams: Work Readiness and Community Development. The Training Plan is divided into 2 parts; Short Programs and Long Programs.

The intention of the Short Programs is to provide meaningful engagement opportunities for CDEP participants who don't have the capacity to take up Lands-based employment opportunities in the short to medium term.

The Short Programs on offer largely consist of 1 – 5 day courses and workshops covering, for example, governance, first aid, driver education, cooking and chainsaw operation. Participants engaged in a short program will generally be enrolled in a Certificate 1 in Work Readiness.

The intention of the Long Programs is to provide CDEP participants already engaged in regular activities with a formal training pathway which will lead to fuller employment. The Long Programs on offer are Certificate based courses in areas such as Retail, Hospitality, Business and Community Service.

Ngaanyatjarra Council has a CDEP participant allocation of 630 participants. As of November 2010 there were approximately 500 participants on the Ngaanyatjarra CDEP.

In July 2009, the process of progressively phasing out CDEP in the Ngaanyatjarra Lands commenced. The dismantling of CDEP will continue for two years until the remaining 630 CDEP participants are either receiving Centrelink Benefits or have found employment in the "mainstream economy".

2.4 Governance

2.4.1 Native Title and Aboriginal Reserves

The Metals X Wingellina Nickel Project is located within the boundaries of the Ngaanyatjarra Lands Part A[5] native title area which was the subject of a determination in June 2005. At the same time the native title holders nominated the Yarnangu Ngaanyatjarraku Parna (Aboriginal Corporation) Native Title Representative Body to hold their native title rights and interests on trust on their behalf.

This determination of native title recognised the right of possession, occupation, use and enjoyment to the exclusion of all others of the Lands within the determination area. Exclusive use, possession, occupation and enjoyment native title requires that in most cases entry onto Ngaanyatjarra determination area requires the consent of the Ngaanyatjarra native title holders of which there are 2,921 listed on Native Title documentation.

Access to Aboriginal Reserves is gained through an entry permit under the *Aboriginal Affairs Planning Authority Act 1972* requiring the consent of the Ngaanyatjarra native title holders.

There are portions of the Ngaanyatjarra Lands determination area that are subject to either 99 or 50-year leases held by the Ngaanyatjarra Lands Council from the Western Australian Government. Entry to land that is subject to these leases will require the additional consent of the Ngaanyatjarra Land Council (from http://www.centraldesert.org.au/what-we-do/by-claim-determination-area/ngaanyatjarra-lands/)

[5] The Ngaanyatjarra Lands Part A determination left a small sliver of land to be determined for another day following the resolution of native title claim overlaps with two other claims. The overlaps were resolved in early 2008 and the determination of the Ngaanyatjarra Lands Part B native title claim followed in June 2008 to finally resolve the entirety of the Ngaanyatjarra Lands claim area.

2.4.2 State and Federal Government services

The scope of the project's impacts will affect three jurisdictions – the mine site itself is within Western Australian while the transport routes are likely to transect South Australia and the Northern Territory, and natural gas will be supplied from the Northern Territory. This social impacts study has only considered those impacts occurring as a result of activities in Western Australia.

The State Government has responsibility for the delivery of normal health, education, policing and community services. In recent years, additional approaches to serving regional and remote communities have emerged. In Western Australia the government has implemented the Royalties for Regions program under which the equivalent of 25% of mining royalties are returned to regional areas through investment in projects, infrastructure and community services. The Royalties for Regions program is administered by the Department of Regional Development and Lands and operates three funds covering Local Government, Regional Community Services and Regional Infrastructure and Headworks.

The Federal Government is investing in initiatives and programs aimed at 'closing the gap' between life outcomes of Indigenous and non-Indigenous people in Australia. The program aims to reduce Indigenous disadvantage with respect to life expectancy, child mortality, access to early childhood education, educational achievement and employment outcomes.

The Federal Government is also responsible for the Community Development Employment Program (CDEP) concentrating on work readiness in remote areas and the Indigenous Employment Program (IEP) which has been expanded to include more support for employers, especially small and medium businesses, including pre-employment training and mentoring. In practice, in many remote Aboriginal communities, the CDEP has tended to have become a 'part-time employer of last resort', focusing on low skill local services, rather than its intended function of providing a path to full-time employment in the 'mainstream economy'. The situation is Wingellina would seem to fit this description.

It is understood that Metals X has been in discussion with a range of government agencies to encourage investment and involvement in the Ngaanyatjarra Lands by those agencies to enhance economic opportunities.

2.4.3 The Shire of Ngaanyatjarraku

The Shire of Ngaanyatjarraku was established in 1993 with its administrative centre located in Warburton, about 250 km to the west of Wingellina and 1,500km from Perth. The Shire encompasses an area of 160,000 square kilometres and at the 2006 Census had a population of about 1,300 people, with all but 200 being Aboriginal people from a range of language groups.

The Shire is responsible for the provision of 'mainstream' local government and delivery of services to the communities within its boundaries. The fourteen main community settlements in the Shire are:

1. Coonana
2. Cosmo Newberry
3. Irrunytju (Wingellina)
4. Karilywara (Patjarr)
5. Kiwirrkurra
6. Mantamaru (Jameson)
7. Papulankutja (Blackstone)
8. Pira-Kata (Kanpa)

9. Tjirrkarli
10. Tjukurla
11. Tjuntjuntjara
12. Wanarn
13. Warakurna
14. Warburton

Of these fourteen, the following 12 are members of the Ngaanyatjarra Council (see below):

1. Cosmo Newberry (Aboriginal Corporation)
2. Irrunytju Community Incorporated (Wingellina Community)
3. Kiwirrkurra Council (Aboriginal Corporation)
4. Mantamaru Community Incorporated (Jameson Community)
5. Papulankutja Community Incorporated (Blackstone Range Community)
6. Patjarr Aboriginal Corporation
7. Pira-Kata (Aboriginal Corporation) (Kanpa Community)
8. Tjirrkarli (Aboriginal Corporation)
9. Tjukurla Community Incorporated (Aboriginal Corporation)
10. Wanarn Community (Aboriginal Corporation)
11. Warakurna Community Incorporated (Aboriginal Corporation)
12. Warburton Community Incorporated

The Shire currently provides and maintains the access road into the community and maintains all internal community roads (7km); is responsible for environmental health and building inspection and regulation (e.g. food safety in the community store); provides an allowance for street lighting (to the regional services provider); provides waste management functions including provision and maintenance of the community rubbish site (rubbish collection is generally carried out as part of the CDEP role) and provision of sewage/effluent disposal systems; dog control (the Shire contracts a vet to undertake dog sterilisation and euthanasia within the area) and supports the provision of some recreational facilities. The Shire also funds two part-time Transitional Employment Positions and funding towards the cost of providing broadcast facilities through the Ngaanyatjarra Media Centre. The Shire has contributed to costs associated with the provision of fibre optics and other broadband communications upgrades in the Wingellina community.

At present there is no community youth worker located at Wingellina although a visiting service is provided. Youth services are typically the responsibility of local government s in Western Australia.

2.4.4 Ngaanyatjarra Council

The Ngaanyatjarra Council is the principal organisation of governance in the Ngaanyatjarra Lands. Incorporated under the *Aboriginal Councils and Associations Act* in 1981, the Council's main responsibility is to provide support for the development of its members (in regard to health, education, housing, law and justice matters, finance) and through a variety of commercial enterprises.

The Council's Governing Committee, a Board of Directors meets on a monthly basis in the communities on a rotational basis to discuss issues affecting Ngaanyatjarra people and to make decisions on matters affecting the operation of the Ngaanyatjarra Council and the enterprises or work units (such as the Council's Land and Culture Unit, the Ngaanyatjarra College in Warburton and the Ngaanyatjarra, Pitjantjatjara, Yankunytjatjara Women's Council) that report to the Council.

2 The socio-economic environment

Membership of the Board of Directors is decided by the members rather than by a formal constitution and comprises the chairs of each of the Ngaanyatjarra settlements. Directors of the Ngaanyatjarra Council as at June 2010 are listed in **Appendix D**.

The Council headquarters is based in Alice Springs while the chairman, members and supporting staff reside in the communities. Ngaanyatjarra Council is the parent and ultimate holding company of the Ngaanyatjarra Corporate Group which includes the following entities:

- Ngaanyatjarra Services (Aboriginal Corporation)
- Ngaanyatjarra Health Service (Aboriginal Corporation)
- Indervon Pty Ltd (Caltex Alice Springs)
- NATS (Ngaanyatjarra Agency and Transport Service)

Under incorporation the Ngaanyatjarra Council has been constituted to undertake functions that would generally be the responsibility of local government such as essential services and the provision of community amenities.

Ngaanyatjarra Services provides services to the Wingellina Community including:

- A building and construction supervision service;
- Essential Services Maintenance to community power, water and wastewater systems; and
- Management of the Community Store, on behalf of the Irrunytju Community Incorporated.

The Ngaanyatjarra Health Service (NHS) is an independent body under the direction of the Ngaanyatjarra Council. Community-based staff employed by the NHS provide full-time primary and preventative health care to the community health clinics in the Ngaanyatjarra Lands.

2.4.5 The Ngaanyatjarra Land Council

The Ngaanyatjarra Land Council was incorporated separately from the Ngaanyatjarra Council for the purpose of holding the leases over the reserve lands. The board of the Ngaanyatjarra Land Council and the Ngaanyatjarra Council is the same and they meet simultaneously. Ngaanyatjarra Council also has a management agreement as agent for the body prescribed by the Native Title Act 1993 to hold native title, the Yarnangu Ngaanyatjarraku Parnu Aboriginal Corporation, which is required by the Regulations to the NTA to be separately incorporated under the Australian Government Corporations (Aboriginal and Torres Strait Islanders) Act 2006.

Most Aboriginal communities are located on an undivided parcel of Crown land which forms part of the Aboriginal Lands Trust (ALT) estate. The ALT, established under the *Aboriginal Affairs Planning Authority Act 1972*, is empowered to acquire and hold land. It must use and manage that land for the benefit of people of Aboriginal descent and, as far as practicable, in accordance with the wishes of the Aboriginal inhabitants of the area.

Wingellina is located on Aboriginal Reserve A17614 which has been on-leased to Ngaanyatjarra Land Council. The Ngaanyatjarra land Council is incorporated under the *Corporations (Aboriginal and Torres Strait Islander) Act 2006* (Cth) and is the lessee of land within the land the subject of the Ngaanyatjarra Lands Determination which are proclaimed under Part III of the *Aboriginal Affairs Planning Authority Act 1972* (WA), including Reserve 17614.

One consequence of this form of undivided land tenure is that the houses in the communities are owned by the State, and are not available for purchase by individuals.

2.4.6 Irrunytju Community Incorporated

Irrunytju was established as a community in 1975 and incorporated in 1976.

A Community Council has been established which is currently chaired by Mr Christopher Reid. Members of the Community Council were reported as:

- Christopher Reid (Chair);
- Tjawina Roberts (Deputy Chair);
- Linda Eddy;
- Hinerangi Tukere;
- Belle Davidson;
- Elizabeth Dawson;
- Joshua Dawson;
- Carlo Martin; and
- Stanley Mervyn.

The role of the Community Committee is to make decisions for the good of the community on community specific matters. This includes such decisions as the opening hours for the community store, distribution of profits from various profit making organisations (e.g. Ngaanyatjarra Agency and Transport Services), the types of goods to be stocked by the store or a say in who manages the store. The Council is also the primary point of contact between the community and the Ngaanyatjarra Council. According to the Ngaanyatjarra Council the Wingellina Community Council is well-led and is a frequent contributor to discussions at the Ngaanyatjarra Council meetings.

2.5 Infrastructure

Aside from the recently constructed Media Centre and Wingellina School most other infrastructure at Wingellina is reasonably old and/or in poor condition.

The Remote Area Essential Services Program (RAESP) provides essential repairs and maintenance services to remote Indigenous communities in WA. The program covers the Kimberley, Pilbara/Gascoyne and Western Desert including Wingellina, with service providers for each of these regions. Parsons Brinckerhoff manages RAESP on behalf of the WA Department of Housing and Works (DHW).

In the program management role Parsons Brinckerhoff is contracted to provide technical support and advice to regional service providers (RSPs) being commercial operators contracted directly to DHW, to carry out necessary maintenance and monitoring to keep essential services operating safely and efficiently in Aboriginal communities. RSP staff are required to regularly visit each community to monitor drinking water quality, and to check and service power and sewerage systems. Communities can call RSPs about problems affecting essential services, but are expected to manage day-to-day tasks themselves (e.g. cleaning solar panels, taking meter readings, checking fuel levels, mowing and weeding around wastewater ponds, checking fences and locks etc).

Infrastructure and the quality and availability of water at the existing Wingellina community site were raised during consultations with the Shire of Ngaanyatjarraku. Specifically four issues were highlighted:

1. the existing water supply is problematic;

2. water reticulation infrastructure did not meet current standards, specifically environmental health standards;
3. inefficient effluent disposal; and
4. poor quality of major infrastructure largely through neglect.

The primary difficulty in installing adequate sewerage and water reticulation is the siting of the community on very hard calcrete which makes excavation challenging. For the reasons noted above the Shire supports a relocation of the community would provide great benefit to the community. The Shire did acknowledge that responsibility for the provision and maintenance of quality infrastructure rested with the State and Federal Governments.

2.5.1 Public infrastructure

There are no sealed roads within or outside the settlement. At the time of the consultations (April 2011), roads were in fair condition although recent flooding in the area had left many of the main arterial roads in need of maintenance. Within the settlement, the lack of sealed roads contrasts with the situation in the nearby communities of Blackstone and Pipalyatjara, which have sealed roads in most of the community.

The community power station consists of four diesel generators with a capacity of 400kw which was described by Ngaanyatjarra Services as being more than adequate. The power station is located approximately 150 m south of the community and is maintained and monitored by the CDEP Project Officer.

Water is supplied from three bores although one is currently being treated following contamination and is not able to be used. Water is pumped via mains to an elevated storage tank on a 12 metre stand. Wastewater disposal is by on-site means consisting of septic tanks and leach drains. There is no known regular pump-out program.

A rubbish tip is operated some 1,000 m north-east of the community. There is no capacity issue.

An unsealed, well compacted airstrip is located immediately adjacent to and north of the community. Fencing contractors were installing camel-proof fencing at the time of the consultations (April 2011) and maintenance to the strip was being conducted. The airstrip does not operate for night-time take-off and landing.

The community is connected to the fibre-optic telecommunications network. In 2007, Wingellina became the first remote desert community in Western Australia to gain access to broadband services, under a $4 million telecommunications project.

2.5.2 Community facilities

Health Clinic

The facility is in reasonable condition. Funding for the clinic and the resident nurse is provided by the Ngaanyatjarra Health Service. At the time of the visit for consultations (April 2011), the community did not have a resident nurse on either a part-time or full-time basis. Ngaanyatjarra Health Services also provide one house for Health Clinic staff and will rent additional housing accommodation from the community store.

The Health Clinic contains all of the medical equipment required under legislation to provide comprehensive primary health care in the community. Additional support may be brought in on an as needed basis.

The nearest health clinic to Wingellina is located in the community of Pipalyatjara in South Australia. This has two nurses in attendance and is visited regularly by a doctor from Fregon. The Pipalyatjara Health Clinic is part of the Nganampa Health Council. There is a 4WD Ambulance that is used to pick up or drop off patients and can also be used to transport patients to Alice Springs if the situation is not life threatening. Otherwise the Royal Flying Doctor Service is available.

Community Office

A Community Office is located in the centre of the settlement adjacent to the school. It is a concrete and iron structure containing several rooms used by the Community Development Advisor and CDEP Project Officer. Rooms are available for individual consultations with community members. Private kitchen and toilet facilities are provided for.

Store

The community operates a relatively large store constructed from concrete block and iron in the middle of the settlement. The store has a cool room and frozen food storage, and is also the point of sale for opal petrol, diesel and gas bottles. The store also stocks a limited range of clothing, household goods and appliances and offers a service that enables residents to request delivery on larger items such as televisions, washing machines, etc. The store houses an ATM allowing community members to access bank accounts.

2 The socio-economic environment

All supplies are provided from Perth by the Ngaanyatjarra Agency and Transport Service (NATS). Despite NATS only charging cost price for freight, the costs and distances associated with transport mean that prices within the store are high and the quality of fresh produce diminished[6].

A store manager is contracted by the Ngaanyatjarra Council to manage the operation of the community store. Profits from the store are returned to the community.

School

The school is part of the Ngaanyatjarra Lands School Federation. The Wingellina complex is in good condition with a well-maintained grassed area which is fenced and secure. The school is funded and managed by the WA Department of Education and provides education services from Kindergarten to Year 10.

Students wishing to continue their secondary education need to leave the community and enrol in boarding facilities away from the Lands. Some students are currently attending schools in Adelaide and Kalgoorlie. In the consultations with the Wingellina community residents only one parent stated that their child was currently attending secondary schooling in Adelaide. The exact number is unknown.

Ngaanyatjarra Media Centre

Ngaanyatjarra Media Aboriginal Corporation (NG Media) has been operating for 16 years and has its central hub at the media centre in Wingellina. The centre is staffed by four full-time employees and provides professional equipment and training in TV broadcasting, radio broadcasting, video, IT, music and archiving. For the Wingellina community, it also provides a telecentre as well as providing video conferencing services used regularly for family visits to prison inmates or hospital patients.

The design of the building housing the media centre was developed in collaboration with the community and is the source of 'great community pride'.

The internet-connected computers are well utilised by the community, particularly the young people. There is also regular radio broadcasting from the centre which goes out to the communities in the Ngaanyatjarra and APY Lands. Wingellina also supports two music bands and they have recorded music albums in the facilities of the media centre.

Ngaanyatjarra Pitjantjatjara Yankunytjatjara (NPY) Women's Council Centre

Located near the clinic and aged person's units, the women centre is open 5 days a week and is reportedly well used.

[6] See Patrick Sullivan, 2010, *Government processes and the effective delivery of services: the Ngaanyatjarra Council and its Regional Partnership Agreement*, DKCRC Working Paper 71, Desert Knowledge CRC, Alice Springs

Workshop

At the time of the consultations for this study (April 2011) the workshop buildings were not being utilised. One of the large sheds is currently being used to store some equipment.

Community Hall

The community hall shares the central area with the other community buildings. The community hall had been used for indoor sports and events during the 1990's but has since fallen into disrepair and is now predominantly utilised for storage. In its current condition it would not be suitable for use as a recreation centre.

Arts Centre

It is understood that an Arts Centre is soon to be re-established. Wingellina previously had a thriving arts program but due to internal divisions and the migration of some of the main artists several years ago it floundered.

Football Oval

A full size non-grassed football oval is located to the west of the settlement. It is overgrown and has not been used in recent years.

Community Church

A small iron clad structure on a concrete footing provides the community church function. It is essentially an empty shell with a small raised area to one end.

Aged Person's Units

Four aged person's units are included on the Wingellina Community Layout Plan although their condition or current use is unknown. Aged care services in the form of meals and personal care are provided by members of the community as part of the HACC program.

2.5.3 Housing

Permanent housing

During the consultations conducted in 2011 48 structures were counted within Wingellina within an area approximately 0.5 square km[7]. On observation it appeared that not all of the structures were inhabited and the Wingellina Project Agreement refers to 34 residential houses in the new community (p.86).The majority of the houses were built in the 1980s and 1990s and are in a poor state of repair, some with broken doors and windows and cracked walls.

The Aboriginal Lands Trust owns 35 dwellings in Wingellina which are leased to the WA Department of Housing for public housing. The Department in turn contracts Ngaanyatjarra Council (Housing Services) to maintain and manage the public housing in the community. These dwellings are currently rented at $21 per person per week.

[7] Note: the Wingellina Project Agreement refers to 34 residential houses in the new community (Schedule 4, Clause 8(a)(ii)). The Scoping Document for the SIA refers to 29 community houses and 8 staff houses.

The housing stock is predominantly of cement block construction on a concrete foundation with iron roof. The design of the houses is simple – typically three bedrooms, kitchen, bathroom and living room. Most have a verandah to the front and/or side of the property.

The majority of the houses appear to have evaporative air conditioning installed although it was apparent during the site visit that some units were inoperative.

It is understood that houses have been fitted with 'pay as you use' electricity meters. Consultation revealed that a $20 credit would typically last three days. It was not uncommon for some households to be without power for several days particularly immediately prior to Centrelink payments being received by residents.

The Department of Housing has provided four Government Regional Officers Housing (GROH) in Wingellina. Two 2-bedroom and two 3-bedroom properties are currently being used by Department of Education staff (teachers) at the Wingellina School.

Aside from the GROH dwellings all other dwellings are owned by the community through the Ngaanyatjarra Council with maintenance provided by Ngaanyatjarra Services based in Perth.

Temporary Housing

Sorry Camps occur from time to time. These present some concern as there is generally a large influx of people into the community for an extended period of time, sometimes for periods of up to three weeks. The increased population can result in stresses to accommodation, sanitation, potable water supply and waste disposal. At the time of the consultations there was no accommodation available for temporary workers or visitors to the community. Metals X has been offering accommodation to contractors and service providers to Wingellina at the exploration camp site and this service is an important one for service providers who would otherwise find it difficult to visit the community. At the time of the consultation a temporary structure was being constructed. Provided by the Ngaanyatjarra Council, this was to provide 2 bedroom visitors accommodation. The Council has signed a Memorandum of Understanding with the Wingellina CDA who will be responsible for managing the bookings and payments associated with the dwelling.

2.6 Social and cultural services

Cultural activities touch the lives of the Wingellina community regularly. Hunting, gathering bush products, hosting people from other communities, travelling on culture and lore business and participating in ceremonies are cultural activities of significance to the people of the Wingellina community.

In terms of service provision Wingellina is on a par with other communities in remote Australia. To a large extent its location determines the level of service provision from Western Australian service providers. However, its proximity to the communities of Pipalyatjara and Kalka in South Australia do provide access to arguably higher levels of goods and services. The following discussion describes the level of social and cultural services being provided into the community.

2.6.1 Education

The Ngaanyatjarra School is a remote multi-campus school based in the Goldfields Education District comprised of the following campuses – Blackstone, Cosmo-Newberry, Jameson, Kiwirrkurra, Tjirrkarli, Tjukurla, Wanarn, Warakurna, Warburton and Wingellina.

The Wingellina campus caters to students from kindergarten to year 10. The secondary school years 8 to 10 provide a general 'high school education' focusing on literacy and numeracy rather than offering standard Department of Education curriculum.

The staff at Wingellina comprises 3 teachers (including Teacher-Principal) and an education assistant. Student distribution is as follows:

- Kindergarten to Year 3 – 14 students.
- Year 4 to Year 7 – 8 students.
- Year 8 to Year 10 – 4 students.

Across the Ngaanyatjarra Lands school attendance is generally poor. Table 2-2 outlines the attendance rates at the Ngaanyatjarra Lands School (i.e. all 10 campuses) in comparison to whole of state attendance. While primary school attendance for Aboriginal students is above 50% and has improved, attendance for secondary school Aboriginal students has been consistently below 50% for the three years to 2009. The Department of Education recognise the various factors that contribute to low attendance including cultural and family obligations, the transient nature of the families and the rostering of Football Carnivals on school days.

Key challenges for teachers in the Lands include the high proportion of students with English as a second language, the Ngaanyatjarra language not being accessible in the written form and a general lack of readiness for students to school[8].

Table 2-2 School Attendance Rates (Ngaanyatjarra Lands School) 2007 - 2009

	Primary School					
	Non-Aboriginal		Aboriginal		Total	
	School	*State*	*School*	*State*	*School*	*State*
2007	65.5%	94.1%	56.2%	81.2%	56.3%	93.1%
2008	58.2%	93.6%	55.9%	80.7%	55.9%	92.6%
2009	79.8%	93.9%	66.7%	81.1%	68.0%	92.9%

	Secondary School					
	Non-Aboriginal		Aboriginal		Total	
	School	*State*	*School*	*State*	*School*	*State*
2007	92.5%	89.9%	50.0%	69.4%	50.5%	88.4%
2008	73.8%	89.1%	43.1%	67.4%	43.8%	87.6%
2009	85.8%	89.3%	48.7%	66.9%	49.3%	87.7%

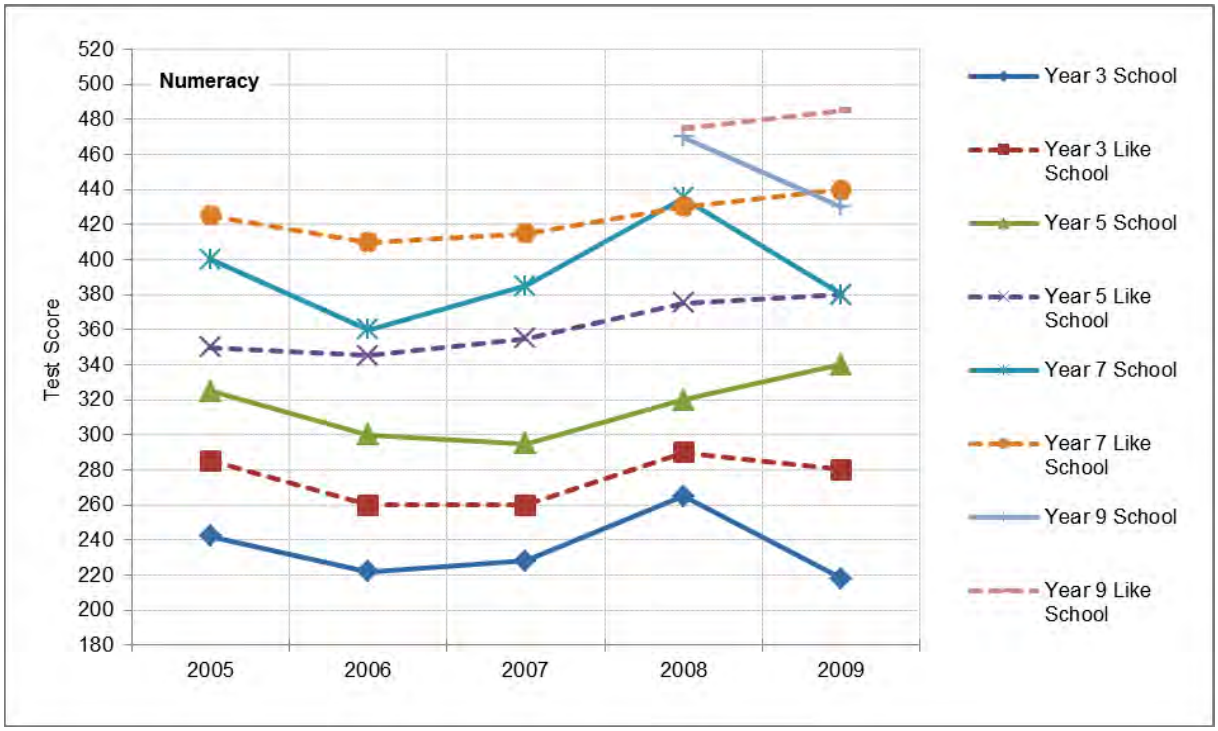
[8] See Ngaanyatjarra School Annual Report, 2009

2 The socio-economic environment

Educational levels on the Lands are low. The outcomes from literacy and numeracy testing are consistently below national minimum standards. Test outcomes for Ngaanyatjarra Lands School students have been below 'like schools' over the 5 years of testing as shown in Figure 2-2 and Figure 2-3 below. Of note are the poorer outcomes in 2009 than 2008 for each school year aside from year 5.

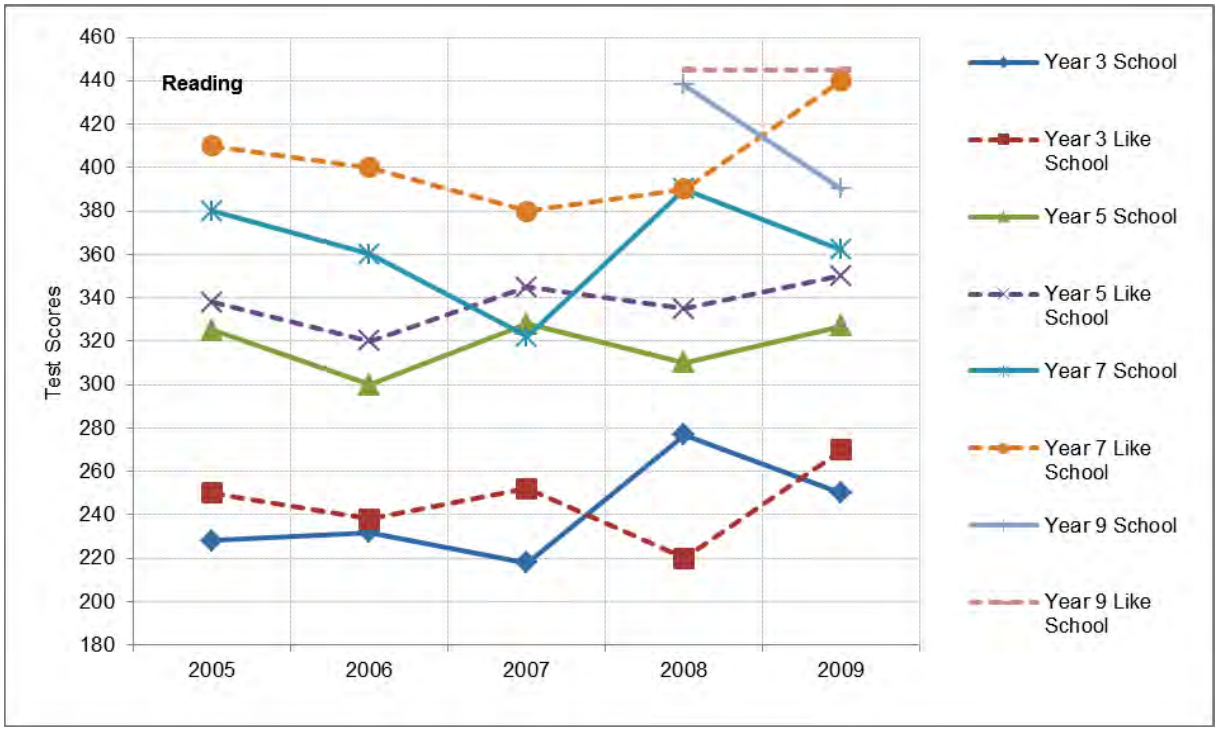
It is thought that many Aboriginal job seekers in the Lands have an education equivalent to somewhere between Year 5 and Year 9.

Figure 2-2 Numeracy Outcomes (Ngaanyatjarra Lands School)



2 The socio-economic environment

Figure 2-3 Reading Outcomes (Ngaanyatjarra Lands School)



2.6.2 Child care

There is currently no child care facility in the community.

2.6.3 Registered Training

Resources available for accredited training on the Lands are limited with no TAFE provider actively servicing the region. . In Western Australia, Warburton was the nearest centre delivering the types of training necessary to assist Ngaanyatjarra Lands people into employment. The Ngaanyatjarra Community College based in Warburton had previously offered a range of courses but the College is not currently operational (*pers. comm* Clint Shaw Ngaanyatjarra Training, Employment and Municipal Services). This means that Ngaanyatjarra residents are primarily reliant on the training resources available through the CDEP provider (NG Council) and the Jobs Services Australia (JSA) providers (Max Employment and Skill Hire).

Registered Training Organisations (RTO) currently engaged by Ngaanyatjarra Council to deliver Certificate based training on the Lands include:

- Certificate I Business (RITE)
- Certificate II Community Service (Drug and Alcohol and Henge Training – 2 separate programs)
- Certificate I Hospitality (Kimberly TAFE)
- Certificate I Work Readiness (RITE)
- Certificate I Work Readiness (Kitchen Operations) (Kimberly TAFE)
- Certificate I Visual Arts and Contemporary Craft (Kimberly TAFE)

In the past training has been delivered in the community by Rural Industry Training and Extension Limited (RITE). RITE specialises in delivering nationally recognised training, focussing on rural and remote communities. This training is enhanced by RITE's status as both a Group Training Organisation (GTO) and Registered Training Organisation (RTO) enabling qualifications to be achieved.

Available training options include traineeships, skill sets training and recognised prior learning (RPL) assessment services. All training is tailored to suit individual client requirements. It is understood that modules associated with the Certificate I in Work Readiness have been delivered but as yet no students have completed all required modules. Other courses have been delivered in First Aid and Hospitality.

Delivery of the training is challenging in the Lands due to a number of factors including a lack of visitor accommodation in the community for training providers as well as the barriers to education and training faced by people on the Lands (including lack of child care facilities, distances to travel, cultural obligations and English language proficiency amongst others).

The Ngaanyatjarra Council has reported the development of their Young Mining Leaders program and has formed the Ngaanyatjarra Labour Hire service to aid work readiness. It reports having gained the voluntary support of some mineral explorers in the region who are tyring to assist Ngaanyatjarra peoples capacity to gain employment in the mining industries.

2.6.4 Health

Health services are provided to the community through the Health Clinic operated by Ngaanyatjarra Health Services. The Clinic is staffed by one permanently placed nurse with relief nursing providing out of Blackstone.

Ngaanyatjarra Health Service has a staff of 86, including support staff needed to manage clinicians, general practitioners, allied health workers and nurses. Those 86 people deliver services to approximately 2,000 indigenous people, a population that is highly mobile and needs to access health services from different locations at different times.

An interview was conducted with the Manager of Ngaanyatjarra Health Services who advised that the primary health conditions treated at the Wingellina Health Clinic were chronic diseases – diabetes, chronic renal (kidney) disease, cardiovascular disease, and respiratory diseases. Mental health issues were also identified as a problem in Wingellina.

Poor nutrition, inactivity and high rates of smoking were seen to be the main contributing factors in the chronic disease conditions seen in Wingellina. Respiratory disease is also worsened by the lack of sealed roads through most communities.

The Clinic also handles one-off presentations often related to accidental injuries such as cuts and abrasions. Serious injuries or medical conditions may require the evacuation of patients by Royal Flying Doctor Service to Kalgoorlie. There is no tri-state agreement in place that would allow evacuation to NT or SA medical facilities.

The nurse has access to a 4WD Landcruiser Troopcarrier vehicle which acts as the community ambulance.

The Clinic can see between 90 and 200 presentations per month.

2 The socio-economic environment

Aside from the primary health care provided by the community nurse other medical/health services are delivered on a 'hub and spoke' model of service provision. The Division of General Practice in Kalgoorlie coordinate visits to the community by a GP and this typically occurs on a 6-monthly basis. The Division also provides mental health services are provided into the community on an outreach basis every 6 months.

At present there is no visiting dental health service although it is understood that one has been commenced in Warakurna and may be extended to Wingellina. Other health services not currently provided but required include podiatry (diabetes-related foot complications), audiology (particularly amongst children and to address associated child development issues), additional mental health services, particularly for youth, and diversional therapy options).

One issue that many health clinics struggle with throughout the Lands is encouraging men to access health services. In other parts of regional Australia the establishment of "men's sheds" has assisted as it provides a space for men to come together and talk about their mental and physical health issues in a safe and non-confronting environment.

2.6.5 Policing

The WA Police Service has a new Police Station in Blackstone as a centre for providing policing services in Blackstone, Jameson and Wingellina. The Station is staffed by two sworn officers, who have difficulty in providing an adequate presence across this large area (see comments in Section 3.2.2). A current focus of the Police is ensuring everyone has a current Driver's Licence, which has been a significant task. The Police are putting forward suggestions through their own networks for programs in skill development/ employment programs for the Lands and would welcome the opportunity to partner with mining companies active in the area – such as Metals-X and BHP Billiton.

2.6.6 Other services

Religion

The community has a simple structure church which is reportedly well-utilised by the mainly Christian population. The congregation organises and runs its own services.

Aged Care

The Community Layout Plan identifies aged persons units located adjacent to the Health Clinic in the centre of the settlement. One of the community residents is currently employed in the role of Home and Community Care and provides a service to those in need of care in the community. Management of the Home and Community Care program is coordinated out of Blackstone. The nearest age care specialist services are located 190 km away in Warnarn.

2 The socio-economic environment

While exact numbers of elderly residents is unknown the community visit conducted for this study did identify a number of residents who seemingly would qualify for aged care services.

Community Office

The Community Office serves many of the functions of government and non-government agencies in mainstream regional communities. It assists people with their banking, benefits (e.g. as Centrelink agent), contacting relatives, obtaining and storing necessary identity and other personal documentation, emergency financial assistance (e.g. through the use of Purchase Orders), liaising with justice or other government agencies, and community governance. It also provides the central location for many government parties seeking to consult with community members[9]. Alongside the Community Store and Health Clinic, the Community Office is the pivotal service provider in the community.

Ngaanyatjarra Pitjantjatjara Yankunytjatjara (NPY) Women's Council

Ngaanyatjarra Pitjantjatjara Yankunytjatjara (NPY) Women's Council acts as an advocacy group and voice for women's concerns on their own Lands and with government bodies and other Aboriginal organisations. They assist individual women in undertaking further training and education with the aim of finding employment. The Council also establishes, provides and/or promotes services to improve the health and safety, education and general wellbeing of people in the Ngaanyatjarra, Pitjantjatjara and Yankunytjatjara region.

The NPY Women's Council have a centre in Wingellina and one permanent staff member who performs a variety of tasks across several communities related to the core aims of the Council.

[9] Ngaanyatjarra and Ngaanyatjarraku Shire Submission (2007) Response to Western Australia Legislative Assembly Education and Health Standing Committee Discussion Paper on Remote Aboriginal Communities, page 9-10

3

Social and economic impacts

This section details the outcomes from consultation and describes the identified potential social impacts of the Wingellina Nickel Project. Section 4 outlines the management measures that can be put in place to mitigate against negative social impacts and enhance opportunities for potential positive impacts.

3.1 The Wingellina Nickel Project

The Wingellina Project Agreement makes provision for the construction of a new community at Clause 8. Metals X and the community (through Ngaanyatjarra Council) are working to attract government support for the relocation of the existing community and the construction of a new community at an agreed location. Metals X is pursuing a staged approach to attracting government support and funding and is currently working towards establishing the necessary approvals. These efforts, which are ongoing, aim to have all necessary planning approvals in place to facilitate the construction stage.

Construction of the mine infrastructure will commence once a decision to proceed is taken and there is expected to be a ramp-up period of up to four years with production peaking at 4.3 Mtpa within four years of commencement of the operation.

Employment is expected to peak at 1,500 workers in the construction period with an operational workforce of 450 personnel. An additional 500 positions may be evident during periods of maintenance shutdown.

In the Wingellina Project Agreement, Metals X acknowledge that the Ngaanyatjarra Lands People want improvements in their education, training, employment and social circumstances as a result of any mining operations. As such the company has made a number of specific undertakings in relation to employment and training. These commitments have been incorporated into the Social Impact Management Plan at Section 4 of this report. While Metals X will attempt to source employees from the Ngaanyatjarra Lands area, with a particular focus on Wingellina itself, it is probable that most employees for the project will be sourced from outside the area because of the currently low numbers of job-ready individuals in the local and regional area, and the requirement for specialist roles in the processing plant.

Depending upon the level of local employment some employees and contractors may reside permanently in Wingellina or other nearby communities. The remainder of employees and contractors will undertake their employment on a fly-in fly-out (FIFO) basis and will be housed in a workers village whilst on-site.

3.2 Stakeholder consultation outcomes

This section provides a summary of the feedback received from the consultation process undertaken for the proposed Metals X Wingellina Nickel Project. The majority of stakeholder feedback was received through discussions held as part of the social impact study and as such, the recording and documentation of these discussions has formed a core component of the stakeholder consultation reporting.

Face to face consultations with community members and service providers in Wingellina, Blackstone and Pipalyatjara occurred between 14 and 21 April 2011. Additional interviews were conducted with other key stakeholders by telephone including representatives from government agencies, local government and other service providers. A meeting was held with Ngaanyatjarra Council representatives providing housing and essential services into the community in April 2011. The

consultations focused upon current conditions at Wingellina and on the potential social impacts that may result from the commencement of mining and the relocation of the settlement. The methodology has been described elsewhere (Section 1.3) and a list of those consulted can be found in Table 5-1.

3.2.1 Community objectives and expectations

Emerging from the consultation with the community has been a list of concerns and opportunities and this has helped to inform the development of the *Social Impact Management Plan*.

In terms of social impact management the community's objectives, and expectations can be summarised as follows (ranked in order of importance to community members):

- Ensuring that Aboriginal heritage and culture is respected and protected and remains accessible;
- Ensuring the environment is suitably protected and maintained (rehabilitated);
- Implementation of a training program to get people job-ready;
- Identification of, and assistance with business development;
- Enhancing opportunities for employment;
- Maximising the potential for new businesses to emerge that support the mine operation but will be sustainable in the long term;
- Ensuring the location, style and design of the new community fits the community's needs and aspirations;
- Enhancing positive interactions between the mine and the community; and
- Ensuring safety on the roads as a result of increased traffic movements

3.2.2 The current situation and future prospects

While the study has found that the standard of living for people in Wingellina is low in comparison to less remote communities, the community members of Wingellina expressed a strong affection for their community and satisfaction with their way of life. Connection to traditional ways of living are still strong and hunting for native animals (e.g. bush turkey, lizard, kangaroo, honey ants) or searching for bush fruits is a regular (and necessary) activity. At the same time, however, there is an acknowledgement that infrastructure is poorly maintained, incomes are low, services are inadequate and economic opportunities limited.

Many of the people of Wingellina are well-travelled and have seen other communities, larger regional centres, some mining activities (e.g. Kalgoorlie, Coober Pedy) and urban capital centres. They are acutely aware of what is lacking in Wingellina although there is no expectation that Wingellina will ever provide the level of services and amenities that larger centres provide. However, there is an expectation that basic amenities and services should be available consistent with the size and location of the community.

These expectations have been heightened with the increased activity around the Wingellina Nickel Project and with the signing of the Agreement, and the community appeared to be supportive of mining development in the area. Metals X consulted extensively with the community in the preparation of the Agreement commitments and through this process has developed a good understanding of community desires and wants. The company understands that the community members are keen to reap the potential benefits that come with the mining operations. At the same time they recognise that the capacity of many community members to take advantage of future opportunities is yet to be built.

3 Social and economic impacts

Some of the issues and expectations raised during community consultation for this Social Impact Analysis are outlined below.

Relocation of the community

Metals X has been working with the community to identify a number of preferred locations to which the community can be relocated. As described in Schedule 4 of the Wingellina Project Agreement, the new community will be located a minimum of 10 kilometres and a maximum of 50 kilometres from the existing settlement.

The Agreement describes the process by which the new site will be selected and outlines the commitments of Metals X in relation to what construction will proceed following a Final Investment Decision. These commitments have been communicated to the community.

Most people seem to accept the relocation of the community and, while they have expressed 'sadness' about leaving their homes, acknowledge that they will be moving into new dwellings with new fixtures and fittings. Current dwellings are in poor repair and little maintenance has been done in recent years. The Shire of Ngaanyatjarraku noted that the community had been neglected by state and federal government authorities for several years.

While the Agreement states that buildings and community infrastructure will be 'replicated' the community have an interest in providing input to the design of buildings and community layout so that the end product better suits their needs and contributes to community well-being.

One of the community assets identified as 'missing' in the current town is a dedicated youth centre. At present there is little for youth to engage in. They are not attending high school and recreation facilities are lacking. The outdoor basketball court is in poor condition and is not covered; the football oval is some distance from the town and is overgrown; and the community hall, once a venue for indoor sports and games, is out of service. Wingellina also does not have a youth worker as is common in other small communities however a youth worker, employed by the Shire of Ngaanyatjarraku, is located in Blackstone and may provide outreach services to Wingellina.

Many people mentioned the lack of swimming pool, although they do have some access to the excellent pool facility at Pipalyatjara. The Wingellina Project Agreement does provide for the construction of a swimming pool and this has been communicated to the community as part of Agreement consultations and negotiations.

Given the sometimes irregular provision of building maintenance services to the current community some community members expressed an interest in developing the skills necessary to undertake minor building repairs. They saw the period during the construction of the new settlement as an ideal opportunity to implement some form of Building Training Program (or similar) to provide basic building maintenance skills to local people that will assist them in on-going maintenance and upkeep.

Other community assets and features that were mentioned by one or more people during consultations as being of benefit in the new settlement included:

- Sealed roads in the community;
- Wide verandahs on housing to provide a shaded outdoor space to live;
- Women's centre and refuge;
- Grassed and shaded recreational space with playground equipment;
- Church;

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- Additional housing to accommodate temporary service providers to allow for 1-2 week stays;
- Provision for additional accommodations for potential influx of job seekers (may be small sleeping blocks with communal ablutions and kitchen blocks);
- Timed switches to conserve energy consumption;
- Consider distance between dwellings to manage noise;
- Security of dwellings; and
- Creating a marker/memorial of the town at the current location if the structures themselves are removed and providing access to same.

The Wingellina Project Agreement makes specific commitments with regard the provision of community infrastructure and assets in the relocation of the community. The Agreement provides for the construction or procurement of construction of the same number, type and scale of buildings and community infrastructure as currently exist (for the same purposes); sealed roads within the community; public swimming pool (25 metres); lighting for outdoor multi-purpose sports court and underground sewerage (and associated sewerage treatment facilities). The community might consider utilising the financial compensation that accompanies the Agreement to construct additional community assets to that provided by Metals X.

The Agreement notes that Metals X will seek to encourage State and Federal authorities to make funding available to the community and the Ngaanyatjarra Council for the construction of community facilities. This acknowledges that both the State and Federal governments, and on other matters the local government authority, have responsibilities to provide infrastructure and services into communities such as Wingellina.

Remoteness and high cost of living

Wingellina is one of the more remote Aboriginal communities in Australia. The effect of this remoteness is felt in a number of areas.

It is difficult to attract and retain staff in health and education. At the time of the consultations there was no community nurse and people were required to travel to either Blackstone or Pipalyatjara for their health needs.

The community is essentially at ‘the end of the line’ for other services. For example, road maintenance is provided by the Shire of Ngaanyatjarraku. With the recent heavy rainfall in Central Australia many of the roads remain ungraded and unrepaired as the Shire works its way east. There was some frustration expressed by Wingellina residents that they were being overlooked in the delivery of services. Some of those consulted suggested that service delivery by government had become worse since the announcement that the nickel mine was potentially going to proceed and this was confirmed in discussions with the local government authority. However, it may also be a result of higher community expectations about service delivery.

Wingellina’s remoteness also affects other services. It was reported that police infrequently visit the settlement unless there is a serious offence to investigate. To some extent this was confirmed in discussions with WA Police in Blackstone who reported they had not attended at Wingellina for some 6 weeks although they do try to spend 1 – 2 nights a week in the community. The recent lack of contact with Wingellina is a result of under-resourcing with two officers having to police a large area from Jamieson to Wingellina. There had also been a funeral and sorry camp at nearby Jamieson requiring the Police to redirect their resources to manage the influx of people into the town.

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Transport of goods to the settlement is costly. Currently the store is replenished with goods delivered from Perth some 1,500 km away by the Ngaanyatjarra Agency and Transport Service (NATS). The freight distances mean that items sold in the local store are expensive[10] and often not fresh. Transport from Perth is also an issue when there have been rains and the roads become impassable, as was the case in early 2011.

The remoteness of the community also presents issues for personal travel. There is no transport service available to community members (e.g. bus services to other communities, air service to major centres) and people are reliant on travel by personal vehicle to move about the Lands.

Centre Bush Bus provide a bus service between Docker River and Alice Springs twice weekly and between Pipalyatjarra and Alice Springs, servicing Mt Ebenezer, Amata, Nyapari, Kanpi and Kalka on a weekly basis.

Residents do have access to air travel on the mail plane and this has been utilised for transferring medical patients out of Wingellina to Alice Springs.

This has impacts on many aspects of life – it limits attendance at training or work opportunities outside of the community as well as access to health care services not available in the community.

Employment and Training

Aside from the CDEP opportunities there is essentially no other employment available to local residents and any employment (i.e. in community services) that is potentially available is predominantly going to people from outside the community. As a consequence, by normal standards, Wingellina people are financially poor. Although it is apparent that they are able in most cases to 'make do' with their Centrelink and other payments (including CDEP), there were examples of families having to go without food from time to time, and the Metals X camp is regularly visited by local people requesting extra food and fuel. In short, members of the community would welcome an improvement in their financial situation.

Hence the consultation found an eagerness and enthusiasm for the employment and business opportunities that a new mining operation might bring, although the level of real understanding about what this might entail may be limited and there was recognition that there were existing barriers to employment including low levels of literacy and numeracy and a general lack of work-readiness.

Opportunities for girls and young women to enter employment are perhaps even more limited than for males. It is not uncommon for girls to become mothers at a very young age and therefore have parenting responsibilities that keep them out of the labour force. Even if young women were in a position to find employment few jobs are available outside of the caring profession. Engaging young women in the mining sector will be challenging but there appears to be interest in developing business opportunities for such tasks as cleaning and maintenance, hospitality services and in transport (e.g. bus driving). Opening up opportunities for people with parenting responsibilities will benefit from the provision of child care facilities in the settlement.

One factor considered to have the potential to deter employment was the heightened sense of familial responsibility common in close-knit Aboriginal communities. Many Aboriginal employees feel obligated to share their resources including income with family members. As reported in a 2006 study, the circulation of income within Aboriginal society can be a complex phenomenon. The use of mine

[10] Relative to incomes in Wingellina

wages to support immediate and extended family members can have several consequences. Employees may become more valued members and increase their status in family networks. This in turn can spur interest amongst other family members to become miners as well. However, in those cases where few Aboriginal people are employed, greater pressure to share their wages could also be exerted.[11] This pressure to share resources can result in a reluctance to enter employment in the first place.

Providing opportunities for employment will only lead to actual employment if these other cultural issues are addressed.

Business Development

As stated previously, the majority of people consulted were enthusiastic about the potential business opportunities that might come as a result of the mine but there is little capacity currently in the community to establish business ventures. Metals X could assist by identifying existing Indigenous businesses, particularly in the Lands, that might provide a service to the mine (Carey Mining Services of Kalgoorlie or Ngarda Civil and Mining in the Pilbara provide a useful model). There may be opportunities for individuals in Wingellina to support such activities as:

- Capping drill holes;
- Fencing;
- Supervision of heritage sites;
- Rubbish collection;
- Camp maintenance and cleaning services;
- Seed collection and rehabilitation works;
- Transport (goods and people).

One factor that will need to be considered prior to the establishment of any business venture is the issue of its sustainability long-term. The activities noted above may, in fact, be infrequent or one-off requirements (e.g. fencing) and so would not support a business entity.

Given that the Ngaanyatjarra Council has established business entities there may be an opportunity for the Council to support the development of business ventures in Wingellina or to provide advice and direction to those interested in establishing a business.

Direct Economic Impacts

The Wingellina Project Agreement provides for the payment of financial compensation to the beneficiaries of the Agreement (i.e. Ngaanyatjarra Native Title holders). The Agreement sets out conditions and schedule of payments aligned with the Project's development. The Ngaanyatjarra Council is currently working towards establishing trust structures that will receive, manage and distribute compensation payments.

Cultural Heritage and Environment

The people of Wingellina have a strong attachment to their country. There are several important Tjukurrpa (dreaming stories) that pass through the area. These include Papa Tjukurrpa (Dingo

[11] Tanuja Barker, 2006, Employment outcomes for Aboriginal People: An exploration of experiences and challenges in the Australian minerals industry, Research Paper No. 6, October 2006, Centre for Social Responsibility in Mining, Sustainable Minerals Institute University of Queensland, Australia

dreaming), the Ngintaka (Perentie) Tjukurrpa and the Minyma Kutjara Tjukurrpa (Two Sisters Story) which begins near the Nullarbor passes through the community on its journey north.

A search of the Aboriginal Heritage Inquiry System identified 16 registered sites and 36 other sites defined in a survey commissioned by Metals X within tenement EL69/535. Metals X currently operates under an access agreement which requires that all proposed work areas be subject to heritage protection surveys prior to any work commencing. Surveys undertaken by Traditional Owners to date have identified a number of culturally significant areas that now form part of the exclusion zones around the project site. Ten heritage exclusion zones have been established and these have been identified in the Wingellina Project Agreement (see also Figure E-5). All company personnel are made aware that these areas cannot be accessed.

When asked during consultations how it would feel to leave the community and relocate elsewhere several people tapped their chests and spoke of “sadness” but when asked what they were sad to be leaving behind most mentioned the “hills” and the “land”. While the Wingellina settlement holds many memories for residents the primary attachment is to the land which encompasses the wider area around the dwellings and structures.

Access to the land for cultural purposes is important. Hunting is an important activity and continues to provide a necessary supplementary food source for the community. Maintaining access will be essential should the mine become operational. Particularly important is the cemetery. Many of those consulted referred to the cemetery without prompting, including people consulted in Pipalyatjara. These areas within the exclusion zones have high cultural value and continued access to the cemetery is expected. In order to keep faith with the local people, very careful management of these heritage places needs to have the highest priority during construction and operations. Protocols governing access can be articulated and managed in the development of the Cultural Heritage Management Plan which Metals X has committed to implement as part of the Wingellina Project Agreement.

Traffic

Concerns were raised in Pipalyatjara regarding the potential for increased traffic movements as the product from the mine is transported for export. Metals X expects approximately 15 trucks per day will be travelling on the roads in the transport of product out and goods in. Residents of communities in the Project area are very mobile, travelling between towns frequently and at all hours of the day and night. The movement of large trucks on the roads potentially increases the risk of accidents with other road users.

Also, given that all roads in the Project area are unsealed there is concern that levels of dust will create both health and environmental (flora and fauna) risks, and community members would be looking to have roads sealed for some distance either side of a community.

On a positive note, increased traffic on remote roads provides increased surveillance and reporting of vehicle breakdowns and strandings.

According to the WA Police, most people of Wingellina who drive have driver’s licenses. The greater concern for Police is the number of unlicensed and unsafe vehicles that are being used, although this is difficult to administer over such a large area and given frequent turnover in vehicles. The safety of road users is a primary concern.

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Health

While community members did not specifically refer to health services in relation to the mining operation or settlement relocation it was mentioned by other stakeholders. Three main points were raised.

The first questioned the potential for the introduction of alcohol and other drugs through a fly in-fly out workforce. Wingellina, as all communities are on the Ngaanyatjarra Lands, is 'dry' – no alcohol is permitted. Discussions with Police indicated that little alcohol is coming into the Lands and incidents of "grog running" are decreasing. There is, however, widespread marijuana use with drug dealers "doing regular runs". An increase in traffic through the region opens up the possibility for more alcohol or other drugs to enter the community and this will need to be carefully managed. The Wingellina Project Agreement recognises the company's responsibility to manage liquor and harmful substances and commits to using its best endeavours to ensure company personnel do not commit an breach regulations governing access to the 99 year lease area.

A second concern was the potential public health impacts that might come as a result of more money flowing through the area, as a result of payments from the Agreement and through employment income. Specifically, there was a concern that access to more money might lead to poorer nutrition as people accessed more highly processed foods rather than consuming traditional diets. It may necessitate a public health campaign or other workforce healthy eating education being implemented, as well as some programs in money management (as referred to above). While public health promotion is the responsibility of government authorities Metals X may consider extending any internal 'good nutrition' messages into the community.

Supporting youth

One of the key issues raised during consultation was the lack of facilities and support for youth which are typically provided through the local and state government authorities. The settlement has an uncovered basketball court, an un-grassed football oval that was overgrown and untended and a community hall that was in a state of disrepair and hadn't been utilised for some time. The only outlet for youth was the media centre where they could access the internet, play computer games and sometimes use recording studios. These latter activities are proving to be very beneficial, not the least in assisting with literacy. The swimming pool at Pipalyatjara was available for use for Wingellina residents but was not easily accessed given the distance. Wingellina is also not supported by a youth development officer as are other towns in the Shire of Ngaanyatjarraku.

It is noted that the Wingellina Nickel Agreement provides for the construction of a public swimming pool of 25 metres length and including changing facilities. This will be welcomed, particularly the younger members of the community. Additionally, lighting will be provided for an outdoor multi-purpose sports court enabling night-time use.

There will also be opportunities for Metals X to support youth development through a number of mechanisms. For example, encouraging employees to volunteer their time and expertise as coaches and mentors to community, hosting events such as film nights or sporting carnivals, or through the simple provision of equipment (e.g. table tennis tables, sports equipment, game consoles etc).

The Shire of Ngaanyatjarraku have advised that they provide a youth development officer position in nearby Blackstone who may provide outreach services into Wingellina in the future.

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Communication

There is a sense that communication between organisations responsible for governance in the region (i.e. State Government agencies, Shire of Ngaanyatjarraku and Ngaanyatjarra Council) and the community is less than ideal although it is not clear where the blockages are occurring.

Communications between Metals X and the community are currently good and there is a strong relationship of mutual respect established between on-site personnel and the community, and the employment of a Community Liaison Officer. This extends to the relationship with the people at Pipalyatjara who will become involved in the Project through extraction of calcrete in the area.

Metals X has adopted an open approach to communications with the community and if there is to be a transition from these less structured arrangements to a more formal and structured approach it will be very important that the trust that has been created to date is maintained and continued with whoever it is that takes on the company liaison role. Given the communities' limited previous involvement with external parties coming into their land, maintenance and strengthening of the relationships will need to receive priority.

Although the community members have indicated that they understand the scope and size of the operations, there does not appear to be a complete or satisfactory comprehension of the changes to landforms that will come as a result of the mine. It was suggested, during the consultations, that visiting an existing mining operation of similar size would allow the community to better understand what environmental changes will occur. It also provides an opportunity for Aboriginal employees at the site visited to talk about the work that is available and what assistance can be provided to new employees. This suggestion was welcomed although many of those consulted had stated that they had seen other mine sites on their travels. Metals X may consider arranging visits to other sites for Wingellina people who gain employment with the company.

Metals X has produced 3D animations of the operations and other visual representations which have been shared with the community. To further extend the accessibility of these existing publications the company may consider translation of written materials into language (Pitjantjatjara and Ngaanyatjarra).

On the same theme a model of the mine site could be constructed so that people could see how the mine operation sits within the landscape and what its relationship is to points of cultural significance (e.g. cemetery, "big hill", etc).

Relationship between mine and community

Community members wondered about what level of interaction they would have with the mine once it becomes operational. To a large extent this will be determined by the location of the new settlement. One that is closer is likely to have more interaction than one that is positioned further away. At present community members will often drive to the exploration camp for social and work purposes. There is unrestricted access, and a good relationship has developed.

With the increase in workforce associated with the construction and operation phases of the project comes an increased risk of current good relations deteriorating, if interactions are not managed properly or workforce strategies enacted to manage the behaviour of personnel on site.

The approach to managing interaction will be developed through the creation of Workforce Management Plans and other internal policy to guide operations. Managing interaction between mine

and community is an important task for the Company and will be further defined after Financial Investment Decision (FID). The Company aims to ensure that contact is positive for both parties, and to achieve this will negotiate a nature and frequency of contact between mine and community that the community is comfortable with. In this sense the community will be the arbiter on the level of desired contact, and the Company will respect the community's wishes in this matter. Further risk management to ensure that illegal transfers of alcohol and drug do not occur will be a primary concern in negotiating these arrangements. The Company's policy on this is strict with transgressors subject to immediate cessation of employment (as shown in the SIMP).

In summary, Metals X will need to consider and make a decision about the level of future interaction between the mine, its workforce and the community and how this impacts upon relationships of trust. It may be that interaction is limited to organised events such as film nights or sporting competitions.

Structures

On paper the existing community has a range of community infrastructure but in reality most are run-down, poorly maintained or not in use. The condition of housing was also raised during the consultations. In many houses the air conditioning is not working, windows and doors are broken, and wiring and plumbing is damaged. Maintenance is delivered out of Perth through Ngaanyatjarra Services and has been infrequent or difficult to procure according to those consulted. There is no program in place for the repairs to be delivered locally by the CDEP employees. While the Project Officer attempts to undertake some minor maintenance the extent of the problems is such that his efforts have little impact.

Several people who were consulted expressed an interest in learning the skills necessary to maintain some of the infrastructure in the community. This is, however, a Ngaanyatjarra Council (and to some extent a Department of Housing) responsibility but there may be an opportunity for these organisations to devolve some of the responsibility to the community such that they can maintain their own premises and not have to rely on external service providers. If this does proceed then some consideration will need to be given to providing the tools necessary to undertake this work.

4

Social Impact Management Plan

4.1 Social and economic impacts of the Project

The key socio-economic impacts and opportunities identified by the community and other stakeholders associated with the construction and operation of the Metals X Wingellina Nickel Project are outlined in the previous section and have been summarised in the Tables on the following pages.

Due to the emergent nature further social impacts and opportunities for the community will need to be continually monitored by Metals X and the community on an ongoing basis. Processes to allow this to happen are captured in the **Social Impact Management Plan**.

Social impacts and opportunities were analysed with consideration given to the local and regional effects in the following areas:

- Relocation of the community;
- Education and employment opportunities;
- Business development opportunities;
- Aboriginal heritage and culture;
- Environmental management;
- Interaction between the mine and the community; and
- Traffic and transport.

Table 4-1 below provides a summary of:

- the identified social impacts;
- the level of impact likely;
- the risks and opportunities to the community;
- indicators that can be used to determine the effect of the impact (and how it can be measured);
- who has a stake in the impact effect;
- what outcome the community wants to achieve with relation to the risk; and
- what action should be taken to address the impact.

The level of detail contained in the accompanying SIMP is likely to increase once a decision has been taken regarding the mine proceeding to operation (i.e. following Financial Investment Decision). At this early stage targets have been identified at a general level only.

Table 4-2 following, shows how the social impact management strategies listed in Table 4-1 will be implemented. It details what work needs to be done and when and shows, where relevant, actions that have been committed to and may already be in train.

Table 4-1 Key social impacts and management strategies

Impacts and rating	Impact Phase and probability	Risk to community Opportunity for community	Indicator	Measure	Stakeholder Group	Objective and Target	Social Impact Management Strategy
Relocation of Wingellina community **Rating**: High	Following Financial Investment Decision **Probability**: High	**Risk**: Sadness at moving and personal stress; loss of access to childhood places; loss of local history; access to important heritage sites more difficult; community members may remain in existing community without service provision; Shire, State Government and Ngaanyatjarra Council 'leave all the work' to Metals-X, continued reliance on external governance and maintenance **Opportunities**: new community provides improved living conditions; health and safety improves; community amenities extended (e.g. swimming pool, community hall); social capital improves with community capital; Shire, State Government and Ngaanyatjarra Council can augment facilities provided by Metals-X, increased commitment to community self-governance and self-maintenance.	Community satisfaction Participation in sport and recreation Investment in facilities by other parties – as above No .and % of Wingellina people employed in community construction and management Continued access to heritage sites	Community Survey Entry numbers to pool Survey of service providers (e.g. Government, NgC) Number of sporting events held in the community	Wingellina community members Wingellina service providers Shire of Ngaanyatjarraku Ngaanyatjarra Council Contractors building the community	To be determined by community Increased community self-reliance as result of involvement in building new community	• Establish and support an Implementation and Review Committee to act as a forum to consult with Ngaanyatjarra Lands People on community and cultural heritage concerns and other matters as described in the Wingellina Project Agreement • Opportunity for community residents to have input into the design of the new community including input to building design. Consideration towards the placement of dwellings to minimise disturbance. • Investigate potential for the construction of additional social infrastructure and other buildings in the new community (e.g. Women's Refuge, dedicated art centre, additional visitor accommodation, church) • Support the community to work with local and state government tin the provision of additional services not currently available in the community (e.g. youth worker, child development centre) • Maintain protection from disturbance and community accessibility of cemetery and other identified heritage sites • Install a memorial or marker in existing community site to signify its importance to the people of Wingellina • Work with training service providers to deliver (or provide access to) Building Training Program including Building Maintenance • Provide opportunities for interested Wingellina residents to gain employment and/or training during construction of new community and in on-going management and maintenance
Employment and Training Opportunities **Rating**: High	Following Financial Investment Decision **Probability**: High	**Risk:** Ngaanyatjarra Lands People miss opportunities to increase workforce skills and gain meaningful employment; relationship between Metals X and Ngaanyatjarra Lands People is diminished **Opportunities**: Training and employment opportunities for Ngaanyatjarra Lands People	Participation in workforce % of Metals X workforce who are Ngaanyatjarra Lands People	Ngaanyatjarra Lands Unemployment rate Metals-X records Community Survey # Traineeships established # Traineeships completed # People assisted into training #/% Employees from Ng Lands	Ngaanyatjarra Lands People Ngaanyatjarra Council (and affiliated services) Ngaanyatjarra Community College Other mining operations with interests on Ngaanyatjarra Lands Aboriginal Workforce Development Centre (Kalgoorlie) Registered Training Organisations Other organisations with an interest in fostering employment in the Lands (e.g. BHP Billiton, Police)	Support community capacity building through contributing to local employment, education and training opportunities	• Prepare and implement a Communications Strategy that provides information to Ngaanyatjarra Lands People about job entry requirements, training opportunities, drug and alcohol requirements for employees, and services requirements for the operation of the mine • Employ suitably qualified Ngaanyatjarra Lands People • Cooperate with relevant government agencies, schools, colleges and training providers to encourage participation by local job-seekers in training and employment opportunities generated by the Project • Prepare and implement Aboriginal Employment Strategy • Identify entry level positions that might be available to lower skilled workers. This might include such activities as seed collection, fencing, labouring • Consult with Ngaanyatjarra Lands People to identify flexible work practices that will encourage Aboriginal participation in the workforce (e.g. shift rostering, recognition of cultural practices) • Implement Mentoring Program for Ngaanyatjarra employees • Provide traineeships for local youth • Investigate opportunities to link with other mining operations entering the Ngaanyatjarra Lands on developing a coordinated training package and joint scholarships • Identify and support students in primary and secondary schools who demonstrate a desire for learning through mentoring

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Impacts and rating	Impact Phase and probability	Risk to community Opportunity for community	Indicator	Measure	Stakeholder Group	Objective and Target	Social Impact Management Strategy
							• Provide scholarships for 2 Wingellina community residents to enrol and attend the Young Mining Leaders program offered by Ngaanyatjarra Council • Work with Ngaanyatjarra Councils TEAMS ((Training, Employment & Municipal Services) Unit to develop employment capacity of local workforce • Provide assistance for community members to attend vocational education and training at Ngaanyatjarra Community College in Warburton • Work with state and federal government agencies and registered training organisations to procure funding for the provision of training and employment programs for the Ngaanyatjarra Lands People to become work-ready and obtain jobs with Metals X • Prepare and implement a Contracting and Procurement Strategy and work with Ngaanyatjarra Lands businesses to assist entry to procurement and contracting opportunities • Implement Aboriginal Cultural Awareness training to Metals X employees to increase workforce cultural sensitivities • Arrange site visits for Ngaanyatjarra Lands People who are interested in employment at Metals X to similar seized mining operation so that they can meet Aboriginal employees in the mining sector and learn about mining employment • Establish and support an Implementation and Review Committee to act as a forum to identify and review economic opportunities for the Ngaanyatjarra Lands People and other matters as described in the Wingellina Project Agreement • Employ an Indigenous Liaison Officer to provide mentoring and support to Aboriginal employees of Metals X Wingellina Project
Business Development Opportunities **Rating**: Medium-High	Pre-construction **Probability**: Likely	**Risk:** Ngaanyatjarra Lands People miss opportunities to identify and establish business opportunities emerging from the Metals X Wingellina Project; Metals X reliant upon 'importing' all additional services from outside of the Ngaanyatjarra Lands; relationship between Metals X and Ngaanyatjarra Lands People is diminished **Opportunities**: Business development opportunities for Ngaanyatjarra Lands People are enhanced	Number , total turnover and viability of local businesses	Local business turnover and profitability Local business survey	Ngaanyatjarra Lands People and businesses Ngaanyatjarra Council	Maximise opportunities for local businesses and business development with the Wingellina Nickel Project	• Prepare and implement a Contracting and Procurement Strategy and work with Ngaanyatjarra Lands businesses to assist entry to procurement and contracting opportunities • Establish and support an Implementation and Review Committee to act as a forum to identify and review economic opportunities including business development opportunities for the Ngaanyatjarra Lands People as described in the Wingellina Project Agreement • Prepare and implement a Communications Strategy that provides information to Ngaanyatjarra Lands People about business opportunities related to the operation of the mine • Notify Ngaanyatjarra Lands businesses when calling for tenders or procuring the supply of goods • Provide opportunity for people interested in business development to visit Indigenous businesses providing services to the mining industry in WA, NT and SA.
Protection of Aboriginal Heritage and Culture **Rating**: High	Pre-construction Construction Operation Post-closure	**Risk**: Aboriginal heritage sites are inaccessible to Ngaanyatjarra Lands People; Aboriginal Heritage sites are damaged; Aboriginal culture is not respected, serious loss of trust between Metals-X and community **Opportunities**: Aboriginal cultural awareness of the Metals X workforce is increased; good relations between Metals X workforce and Aboriginal people; Aboriginal heritage sites are protected and able to be accessed by Aboriginal people	Ngaanyatjarra Lands People feel their culture and heritage is respected and protected Metals X employees have greater cultural awareness	Community survey – every three years? Number of training courses delivered in Cultural Awareness Number and % of MetalsX staff who complete cultural awareness courses	Ngaanyatjarra Lands People Department of Indigenous Affairs Metals X management and employees		• Prepare and implement a Cultural Awareness training program to be delivered by senior Ngaanyatjarra Lands People • Prepare and implement a Cultural Heritage Management Plan in consultation with Traditional Owners that identifies how heritage sites will be protected and maintained during construction and operation • Prepare and implement a Mine Closure Plan that details how heritage sites will be protected and maintained following mine closure • Prepare and implement a Contracting and Procurement Policy that requires consideration of the cultural concerns

4 Social Impact Management Plan

Impacts and rating	Impact Phase and probability	Risk to community Opportunity for community	Indicator	Measure	Stakeholder Group	Objective and Target	Social Impact Management Strategy
		of the area					of the Ngaanyatjarra Lands People in the delivery of goods and services to the Wingellina Nickel Project. • Engage a panel of up to 6 members of the Ngaanyatjarra Lands People to act as heritage monitors during any ground disturbing work carried out by Metals X for the Wingellina Nickel Project
Environmental Management Rating: High	Pre-construction Construction Operation Post-closure	**Risk:** Community feel uninformed about environmental management initiatives and unsure whether adequate steps are being taken to protect the local environment and community health **Opportunity**: Community members able to participate in environmental management activities	Complaints about environmental impacts Requests for information about environmental monitoring and reporting	Community survey Number of enquiries related to environmental management	Ngaanyatjarra Lands People Environment agencies Media	Wingellina community supportive of the Project	• Prepare and implement an Environmental Management System as per the requirements of the EPA • Establish and support an Implementation and Review Committee to act as a forum to consult with Ngaanyatjarra Lands People on environmental management concerns and other matters as described in the Wingellina Project Agreement • Prepare and implement a Communications Strategy that provides information to Ngaanyatjarra Lands People about environmental management and monitoring related to the operation of the mine • Develop 3D computer graphics, and topographic models to demonstrate mining activity) • Establish a 'hot line' to allow concerned parties to report concerns or complaints related to environmental impacts • Establish mine tours during operations to allow interested community members to tour the operation and witness the monitoring activities that take place
Interaction between the mine and the community (Communications) **Rating:** Low	Construction Operation	**Risk:** Anti-social behaviour leads to conflict between mining workforce and community members; alcohol and other drugs enter the community **Opportunities:** Shared resources; economic contribution to the community by the mine workforce; social and sporting occasions between mine workforce and community	Community involvement by staff in local events Drug and alcohol testing MLX personnel	Number of events sponsored by the company Positive results from testing No. of AOD related infringements	Wingellina community Ngaanyatjarra Lands People Mine workforce (including contractors)	Encourage constructive engagement between the community and mine workforce Support community events / activities that promote and enhance community connectedness	• Prepare and implement a Workforce Management Plan that includes clear protocols for employees to guide their interaction with local community members and stipulate consequences if protocols are not followed • Develop a Community-Employee Engagement Program in collaboration with the Wingellina community
Traffic and transport **Rating: Low/Medium**	Construction Operation	**Risk:** increased number of vehicle accidents due to volume of traffic; increased environmental and public health impacts Deterioration of road conditions due to increase in heavy vehicle use **Opportunities:** notification of stranded motorists, roads being sealed and/or better maintained	Incidents on the roads Extent of road improvement	Number of reported accidents Reporting of incidents of vehicle breakdowns Kms of road improved	Shire of Ngaanyatjarraku Main Roads WA Ngaanyatjarra Services WA Police	Reduced traffic incidents along transport routes	• Prepare and implement a Traffic Management Plan • Prepare and implement Environmental Management System and Plans to manage dust and noise from traffic movements • Liaison with state and federal government agencies responsible for road maintenance to ensure roads are in good repair

Social Impact Management Actions

Table 4-2 shows how the social impact management strategies listed in Table 4-1 will be implemented. It details what work needs to be done and when. The actions detailed below should be read in conjunction with the Wingellina Project Agreement which further describes actions that have been agreed between the Company and the beneficiaries to the Agreement.

Table 4-2 Social Impact Management Actions

	Social Impact Management Strategy items	Action	Timing	Existing Commitments and other supporting comments	Project Agreement Clause (where applicable)	Responsibility
1	Establish and support an Implementation and Review Committee to act as a forum to consult with Ngaanyatjarra Lands People on community and cultural heritage concerns and other matters as described in the Wingellina Project Agreement	• Establish Implementation and Review Committee whose role is described in the Wingellina Project Agreement • Membership to include between 3 and 5 appointments determined by Ngaanyatjarra Lands People and Ngaanyatjarra Council and to include the Manager of the Land and Culture Unit; Metals X will appoint between 3 and 5 members one of whom is to be the Manager of mining operations at Wingellina • Schedule meetings to occur once every three months during construction and not less than 6 months during operations and before FID. Implementation Committee to determine frequency of meetings following FID • Prepare a meeting agenda in collaboration with all members and document discussions and outcomes of all meetings • Metals X to pay the reasonable costs of the Traditional Owner representatives attending Committee meetings capped at $500 per member per day *pro rata* and reasonable travel costs • Metals X will provide secretariat services	Current and ongoing	• Implementation Committee has been established and has met once to agree on structure and role • Current membership includes Beneficiaries Representatives, CEO Ngaanyatjarra Council, Manager Land and Culture Unit, Traditional Owners and Wingellina Community Council members • Representatives of Metals X • Ngaanyatjarra Council Indigenous Liaison Officer)	Clause 10	Metals X
2	Opportunity for community residents to have input into the design of the new community including input to building design. Consideration towards the placement of dwellings to minimise disturbance.	• Work with the Wingellina Community Council to facilitate access for community members into the planning process for the new community • Engage the services of suitably qualified town planner to work in consultation with the community in the preparation of a community layout plan that meets community requirements • Engage the services of a suitably qualified architect/draftsperson to work in consultation with the community to design individual dwellings that suit the environment and meet the requirements of the residents. • Consider allowing the residents to submit ideas/drawings of their preferred community and residence design as part of a competition	Current	• Certain elements in the design and construction of the new community are determined by the content of the Wingellina Project Agreement. • The Agreement notes that the Company and Beneficiaries will negotiate in good faith to agree the new site and specifications for the community. • Specifications for the new community will need to take account of planning, environmental and other approvals.	Clause 8 Schedule 4	Metals X
3	Investigate potential for the construction of additional social infrastructure and other buildings in the new community (e.g. Women's Refuge, dedicated art centre, additional visitor accommodation, church)	• Establish working relationships with; — Shire of Ngaanyatjarraku — WA Departments of Housing; Planning; Culture and the Arts; Communities • Work with state government agencies and the Shire of Ngaanyatjarraku to investigate opportunities for funding to construct additional social infrastructure and other buildings not currently in the existing Wingellina community	Following FID	• The Agreement stipulates those aspects of the community for which Metals X is responsible to provide. The Agreement specifies that Metals X will seek government funding assistance for the construction of the new community. • Metals X has commenced communications with state and local government authorities and with Ngaanyatjarra Council with regard their service/infrastructure provision responsibilities and will continue to do so	Clause 8 Schedule 4	Metals X to assist NgC in providing funds as required

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	Social Impact Management Strategy items	Action	Timing	Existing Commitments and other supporting comments	Project Agreement Clause (where applicable)	Responsibility
4	Support the community to work with local and state government in the provision of additional services not currently available in the community (e.g. youth worker, child development centre)	• Establish working relationships with; — Shire of Ngaanyatjarraku — WA Departments of Housing; Planning; Culture and the Arts; Communities • Assist and co-sponsor the community in making funding submissions and grant applications • Assist the community in lobbying government for additional services	Following FID	• As per the above Metals X is building good relationships with state and local government authorities. Metals X may provide assistance to representatives of the Wingellina Community Council in accessing government agencies if required.	Clause 8 Schedule 4	Metals X to assist NgC as required
5	Maintain accessibility of cemetery and other identified heritage sites	• As part of the Cultural Heritage Management Plans ensure that access to the cemetery and other places of cultural significance is not hindered	Following FID	• The Company has committed to the development of a Cultural Heritage Management Plan prior to commencing construction of the project. This Plan will outline management approaches to the protection of cultural heritage sites and should describe access rights to each site	Clause 13 Schedule 4, §14, §15, §16	Metals X
6	Install a memorial or marker in existing community site to signify its importance to the people of Wingellina	• Ensure that the existing settlement is remembered by marking its location with a special memorial marker • Work with the community in the design of the marker	Following construction of new community			Metals X
7	Work with training service providers to deliver (or provide access to) Building Training Program including Building Maintenance	• Identify appropriate training delivery organisation to deliver entry level training to support community members in building services and maintenance • Provide support to Ngaanyatjarra Council to assist people interested in training into a relevant program	Pre-construction			Ngaanyatjarra Council
8	Provide opportunities for interested Wingellina residents to gain employment and/or training during construction of new community and in-on-going management and maintenance	• Incorporate training provision within tender process for the construction of the new community such that the successful bid provides training for at least two interested and suitably ready community members • In collaboration with construction company responsible for development of new community identify opportunities where unskilled workers could assist in building and construction • Work with Ngaanyatjarra Council in supporting people who have worked on construction to take on roles within community governance and maintenance	Following FID	• Construction of the new community will be the responsibility of the State Government with funding, to the extent provided for in the Project Agreement, provided by Metals X • The Company will work with NgC and the State Government to facilitate the use of Ng Lands people in the development and construction of the new community • The Company has committed to identifying and making reasonable endeavours to procure funding form government programs for training and employment programs for Ngaanyatjarra Lands People.		Metals X State Government NgC
9	Prepare and implement a *Communications Strategy* that provides information to Ngaanyatjarra Lands People about job entry requirements, training opportunities, drug and alcohol requirements for employees, and services requirements for the operation of the mine	• Summarise likely/potential job opportunities according to job requirements (i.e. low skill, license requirements, etc) • Prepare Drug and Alcohol Policy and testing regime • Prepare document summarising expectation of Metals X for employee behaviour (simplified version of Workforce Management Plan) • Develop *Communications Strategy* identifying approach to information dissemination • Work with Ngaanyatjarra Council to define communications approach • Disseminate information to Ngaanyatjarra Lands People through the medium of the Implementation and Review Committee	Following FID	• The Company has made commitments in the Agreement to provide information to the Beneficiaries on potential employment, contracting and business development opportunities	Clause 10 Clause 12.1	Metals X
10	Employ suitably qualified Ngaanyatjarra Lands People	• Cooperate with government agencies, job service agencies, local schools and training providers to encourage participation by local Ngaanyatjarra Lands People in employment opportunities generated by the Project	Following FID	• As per commitments made in the Agreement	Clause 12	Metals X

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	Social Impact Management Strategy items	Action	Timing	Existing Commitments and other supporting comments	Project Agreement Clause (where applicable)	Responsibility
11	Cooperate with relevant government agencies, schools, colleges and training providers to encourage participation by local job-seekers in training and employment opportunities generated by the Project	• Develop working relationships with government agencies, job service agencies, local schools and training providers • Link with the Aboriginal Workforce Development Office to maximise reach of Metals X to potential job seekers • Attend training institutions to promote benefits of employment at Wingellina project	Following FID	• The Agreement provides for the payment of funds to education or training providers for the purposes of assisting the education and/or training of Ngaanyatjarra Lands People by the Beneficiaries (or through the Trusts)	Clause 12	Metals X Beneficiaries
12	Prepare and implement *Aboriginal Employment Strategy*	• Work with the Implementation and Review Committee to identify objectives for the Employment Strategy • Develop key Aboriginal employment growth targets • Embed the commitment to Aboriginal employment at the highest level • Identify Metals X business needs • Identify the initiatives that will increase Aboriginal recruitment outcomes • Outline career development goals and strategies • Implement the Aboriginal Employment Strategy	Ongoing for completion by FID	• *Aboriginal Employment Strategy* is being prepared to guide Metals X operations at Wingellina • The Company has committed, through the Agreement, to provide a minimum of 4 traineeships at any one time for Ngaanyatjarra Lands People subject to conditions. • The Company has committed to the provision of a minimum of 10 FTE positions at any one time for suitably ready, willing and able Ngaanyatjarra Lands People. • The Company has committed to identifying and making reasonable endeavours to procure funding from government programs for training and employment programs for Ngaanyatjarra Lands People.	Clause 12.2	Metals X
13	Identify entry level positions that might be available to lower skilled workers. This might include such activities as seed collection, fencing, labouring	• Summarise likely/potential job opportunities according to job requirements (i.e. low skill, license requirements, etc) • Prepare Job Description forms outlining the job tasks, duties and responsibilities and describing pre-requisites for employment and provide to Implementation Committee for wider distribution • Make information available as per process described in *Communications Strategy* • Information from job descriptions will inform the *Aboriginal Employment Strategy*	Following FID			Metals X
14	Consult with Ngaanyatjarra Lands People to identify flexible work practices that will encourage Aboriginal participation in the workforce (e.g. shift rostering, recognition of cultural practices)	• Work with the Implementation and Review Committee to develop work rosters and practices that recognise cultural responsibilities • Investigate best practice in this area through consultation with mineral resource peak bodies (e.g. Chamber of Minerals and Energy WA) and other mineral resources companies • Recognise that mainstream working arrangements may not suit Aboriginal employees with limited engagement in the labour force	Operations	• The Company has committed to implement and maintain programs and/or procedures to assist Ngaanyatjarra Lands People and other Indigenous persons it employs to remain in the workforce and to meet job requirements • Metals X will offer rostered camp accommodation for Aboriginal employees under same conditions as other non-Aboriginal employees	Clause 12.1(d)(ii)	Metals X
15	Implement Mentoring Program for Ngaanyatjarra employees	• Employ an Indigenous Training Mentor • Investigate best practice in mentoring programs through consultation with mineral resource peak bodies (e.g. Chamber of Minerals and Energy WA) and other mineral resources companies • Provide support to trainees and apprentices working on construction • Identify (encourage) existing employees suitable to provide mentoring • Ensure workplace practices allow for time for mentors during usual work hours • Facilitate the development of effective mentoring relationships which deliver improved outcomes for employees and for the business • Monitor and report the effectiveness of the mentoring system	Operations	• The Company has committed to implement and maintain programs and/or procedures to assist Ngaanyatjarra Lands People and other Indigenous persons it employs to remain in the workforce and to meet job requirements	Clause 12.1(d)(ii)	Metals X

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	Social Impact Management Strategy items	Action	Timing	Existing Commitments and other supporting comments	Project Agreement Clause (where applicable)	Responsibility
16	Provide traineeships for local youth	• Work with Ngaanyatjarra Council in designing suitable traineeship programs • Confirm entry requirements for Aboriginal traineeships • Training to be provided at Wingellina for identified workforce needs • At least one traineeship in Environmental Services • Ensure mentors are available • Employ trainees	Operations	• The Company will provide 4 traineeships at any one time for Ngaanyatjarra Lands People provided they are suitably ready, willing and able	Clause 12.2	Metals X
17	Investigate opportunities to link with other mining operations entering the Ngaanyatjarra Lands on developing a coordinated training package and joint scholarships	• Establish relationships with other mining companies operating in the Ngaanyatjarra Lands to determine shared needs regarding Aboriginal employment and training scholarships • Develop agreement or similar to create a coordinated training package for Ngaanyatjarra Lands People • Develop cooperative strategies to provide training for existing and potential project employees • Work with training organisations to deliver training	Following FID	• Will be dependent upon status of other operations in the area		Metals X
18	Identify and support students in primary and secondary schools who demonstrate a desire for learning through mentoring	• Work with Ngaanyatjarra Lands School (Wingellina Campus) to identify 'students with potential' • Investigate opportunities to provide additional mentoring for students after school hours • Investigate opportunities to support families of 'students with potential'	Following FID	• Suggest allocation of trust funds be directed towards student learning goals. Metals X may consider sponsorship		NgC Metals X
19	Support for the Leaders in Mining program offered by Ngaanyatjarra Council	• Metals X offer to provide a Leaders in Mining session be held on site at Wingellina • Work with the Wingellina Community Council to identify suitable candidates	Following FID			Metals X NgC
20	Provide assistance for community members to attend vocational education and training at Ngaanyatjarra Community College in Warburton	• Look at opportunities where support may be offered to benefit the whole community. This may include the provision of a community bus between Wingellina and Warburton twice per week (e.g to Wingellina on Friday returning to Warburton on Sunday during school terms) • Investigate opportunities for distance education through the Media Centre	Following FID			NgC
21	Support the NgC to procure funding for the provision of training and employment programs for the Ngaanyatjarra Lands People to become work-ready	• Establish working relationships with state and federal government agencies responsible for training delivery • Collect information regarding employer (e.g. Metals X) training needs in Ngaanyatjarra Lands to provide to government agencies to assist in design of appropriate training courses (i.e. to match work demand) • Maintain records of Aboriginal employment outcomes at the Wingellina Nickel Project	Ongoing	• The Agreement describes that the Company will identify and use reasonable endeavours to procure funding from government programs for training and employment programs for the Ngaanyatjarra Lands People	Clause 12.1	NgC Metals X
22	Prepare and implement a *Contracting and Procurement Strategy* and work with established Ngaanyatjarra Lands businesses to assist entry to procurement and contracting opportunities	• Set objectives for local content policy • Develop standards required of contracting entities with regard their use of local labour/businesses and Aboriginal employment • Prepare and implement a Contracting and Procurement Strategy consistent with the Australian Industry Participation Plan • Identify work packs which can be split from principal contracts to allow Aboriginal businesses in the Ngaanyatjarra Lands to supply smaller contracts where appropriate • Develop relationships with key business representative bodies and undertake consultation with members regarding opportunities for supply and capacity of Ngaanyatjarra Lands businesses • Collect data on the % and total value of tenders being awarded by Metals X to businesses in the Ngaanyatjarra Lands and provide to Implementation and Review Committee for dissemination • Collect and disseminate number of tenders received from Ngaanyatjarra Businesses, level of compliance to tender, statistics on competitiveness of tenders and provide to Implementation and Review Committee for dissemination	Following FID	• Metals X has committed to providing reasonable assistance to Ngaanyatjarra Contracting Entities to identify contracting opportunities in connection with its mining operations. • The Company may enter into sole source or other contracting arrangements with suitably qualified and performing Ngaanyatjarra contracting entities • Contractual arrangements will be structured to maximise the opportunity for Ngaanyatjarra Contracting Entities to tender where it is reasonable to do so	Clause 12.3	Metals X

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	Social Impact Management Strategy items	Action	Timing	Existing Commitments and other supporting comments	Project Agreement Clause (where applicable)	Responsibility
23	Implement Aboriginal Cultural Awareness training to Metals X employees to increase workforce cultural sensitivities	• Invite Ngaanyatjarra Council to provide a proposal to deliver cultural awareness training to Metals X employees and contractors either by individuals or a NgC Business Unit. • Metals X Human Resources to develop a schedule of Training delivery for new employees • Implement Cultural Awareness Training	Current	• The Company agrees to provide cultural awareness training for company personnel who are in the Agreement Area for an aggregate of more than 45 days.	Clause 14	Metals X
24	Arrange site visits for Ngaanyatjarra Lands People who are interested in employment at Metals X to similar sized mining operation so that they can meet Aboriginal employees in the mining sector and learn about mining employment	• Liaise with other mining operators to facilitate a site tour for interested Ngaanyatjarra Lands People • Arrange contact with Aboriginal employees/mentors in other operations to describe the issues and benefits of employment in the mining sector • Arrange visit to site when there are 3 or more interested parties	Following FID			Metals X
25	Employ an Indigenous Liaison Officer to provide mentoring and support to Aboriginal employees of Metals X Wingellina Project	• Prepare a Job Description for the position of Indigenous Liaison Officer including primary responsibilities, requirements and remuneration • Employ an Indigenous Liaison Officer to carry out the responsibilities outlined in the Job Description • Provide training to Indigenous Liaison Officer adequate to the role as described in the Job Description	Prior to FID Current	• Metals X will fund Ngaanyatjarra Council to employ one Indigenous Liaison Officer to perform tasks as agreed between the Company and the Beneficiaries to the Agreement. • The core tasks of the Indigenous Liaison Officer to is to liaise between the Company and the Ngaanyatjarra Lands People and their representatives, provide mentoring and support to Indigenous employees of the Company • The number of Indigenous Liaison Officers employed will be commensurate with the stage of the project and number of people employed	Clause 13.6	Metals X
26	Prepare and implement a *Communications Strategy* that provides information to Ngaanyatjarra Lands People about business opportunities related to the operation of the mine	• Develop a *Communications Strategy* • Prepare and distribute project updates to key stakeholders • Support Indigenous Liaison Officer in relation to tasks identified in the *Communications Strategy* • Host community information sessions • Continue to support the Implementation and Review Committee	Following FID. Some actions are in progress.	• The Company has made commitments in the Agreement to provide information to the Beneficiaries on potential employment, contracting and business development opportunities	Clause 12	Metals X
27	Notify Ngaanyatjarra Lands businesses when calling for tenders or procuring the supply of goods	• Develop a process for notifying of tender opportunities when they become available to Ngaanyatjarra Lands businesses and describe within the *Communications Strategy* • Ensure that all notifications for tender opportunities are advertised according to the process developed	Construction/Operation	• Metals X has committed to providing reasonable assistance to Ngaanyatjarra Contracting Entities to identify contracting opportunities in connection with its mining operations.	Clause 12.3	Metals X
28	Prepare and implement an *Aboriginal Business Development Strategy*	• Assist Ngaanyatjarra Lands People with development of business plans and corporate governance to enable the establishment of sustainable businesses • Provide targeted and appropriate information to Ngaanyatjarra Lands businesses to support their understanding of contracting requirements.	Finalise at FID	• Metals X has committed to providing reasonable assistance to Ngaanyatjarra Contracting Entities to identify contracting opportunities in connection with its mining operations.	Clause 12.3	Metals X

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	Social Impact Management Strategy items	Action	Timing	Existing Commitments and other supporting comments	Project Agreement Clause (where applicable)	Responsibility
29	Provide support for people interested in business development to visit Indigenous businesses providing services to the mining industry in WA, NT and SA.	• Identify existing Indigenous businesses servicing the mining sector in WA, NT and SA • Establish relationships with existing Indigenous businesses • Maintain a database of existing Indigenous businesses to which interested Ngaanyatjarra Lands People can be directed • Facilitate entry to existing Indigenous businesses for Ngaanyatjarra Lands People	Following FID			Metals X in collaboration with NgC
30	Prepare and implement a *Cultural Awareness Training Program* to be delivered by senior Ngaanyatjarra Lands People	• Work with the beneficiaries to the Wingellina Project Agreement to develop an appropriate Cultural Awareness Training Program • Engage the services of an Aboriginal person/s of the Ngaanyatjarra Lands to conduct the Cultural Awareness training • Develop a schedule of training for employees on employment and every three years thereafter	Operation	• The Company agrees to provide cultural awareness training for company personnel who are in the Agreement Area for an aggregate of more than 45 days.	Clause 14	Metals X
31	Prepare and implement a *Cultural Heritage Management Plan* in consultation with Traditional Owners that identifies how heritage sites will be protected and maintained during construction and operation	• Develop a CHMP for each identified site that extends and supports the Aboriginal Heritage Protocol described in the Agreement in collaboration with Traditional Owner representatives • Each CHMP should describe the site and how it is to be protected • Each CHMP should also provide a process for monitoring sites on, at least, an annual basis	Folowing FID	• The Company has committed to the development of a Cultural heritage Management Plan prior to commencing construction of the project. This Plan will outline management approaches to the protection of cultural heritage sites and should describe access rights to each site. Heritage Management in accordance with Protocol in the interim.	Clause 13.2	Metals X
32	Prepare and implement a *Mine Closure Plan* that details how heritage sites will be protected and maintained following mine closure	• Develop a 30 year Mine Closure Plan as per the Department of Mines and Petroleum Guidelines	Operation	• As per regulatory requirement (DMP and EPA)		Metals X
33	Engage a panel of up to 6 members of the Ngaanyatjarra Lands People to act as heritage monitors during any ground disturbing work carried out by Metals X for the Wingellina Nickel Project	• Prepare a Job Description for the position of Heritage Monitor including primary responsibilities, requirements and remuneration, and provide training and supervision as required • Identify and engage up to 6 (no less than two men and two women) of the Ngaanyatjarra Lands People as Heritage Monitors	Construction Operation	• Following FID the Company will engage employees to act as Heritage Monitors during ground disturbing work. • Heritage Monitors will be paid according to industry standards for each day of monitoring work undertaken • Heritage Officers may be the same personnel as Liaison Officers	Clause 13.5	Metals X
34	Prepare and implement an Environmental Management System as per the requirements of the EPA	• Prepare and implement EMS in accordance with EPA Conditions and monitor and report as is standard practice • Monitoring? • Reporting to Implementation and Review Committee?	Construction Operations	• As per EPA regulatory requirements		Metals X
35	Develop 3D computer graphics, and topographic models to demonstrate mining activity)	• Prepare graphics and models of the Wingellina Nickel Project and provide to NgC • NgC assist with translation of material to local language	Current	• Models and graphics of project have been made available through Agreement consultation phase		Metals X NgC
36	Establish a 'hot line' to allow concerned parties to report concerns or complaints related to environmental impacts	• Develop complaints process including a monitoring program for annual reporting to Implementation and Review Committee • Establish hotline • Inform community about complaints process	Construction Operation			Metals X

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	Social Impact Management Strategy items	Action	Timing	Existing Commitments and other supporting comments	Project Agreement Clause (where applicable)	Responsibility
37	Establish mine tours during operations to allow interested community members to tour the operation and witness the monitoring activities that take place	• Determine areas of the mine operation suitable for inspection during a mine tour in collaboration with the Implementation and Review Committee • Work with the Indigenous Liaison Officer to build community awareness of the mine tours • Incorporate Heritage Sites into the mine tours so that community members can monitor that they are being adequately maintained/protected • Schedule and hold at least two mine tours per annum	Operations			Metals X
38	Prepare and implement a *Workforce Management Plan*	• Develop employee induction process • Develop employee behaviour protocols for inclusion *in Workforce Management Plan* to cover: — Acceptable after hours behaviour — Travel and driving — Interactions with the community — Drug and alcohol testing	Construction Operation			Metals X
39	Develop a Community-Employee Engagement Program in collaboration with the Wingellina community	• Liaise with the community to organise events/teams/initiatives to encourage employee involvement in the community if this is desired by community members • Support employee sports teams, opportunities for volunteering, attendance at local events	Construction Operation			Metals X Community members
40	Prepare and implement a Traffic Management Plan	• Liaise with WA Police and other Emergency Services in relation to traffic management and associated road safety issues • Provide workforce numbers and traffic movements to local, State and Federal Government to assist with infrastructure planning • Develop Traffic Management Plan for traffic directly related to the Wingellina Nickel Project • Conduct traffic awareness training for community as appropriate • Establish working relationships with WA Police (local OIC at Blackstone) and with SA Police	Construction Operations	• As per EPA regulatory requirements		Metals X
41	Prepare and implement *Environmental Management System* and Plans to manage dust and noise from traffic movements	• Prepare and implement Environmental Management System in accordance with EPA requirements and conditions	Ongoing	• As per EPA regulatory requirements		Metals X
42	Liaison with state and federal government agencies responsible for road maintenance to ensure roads are in good repair	• Provide targeted and appropriate information to state and federal agencies to support their understanding of maintenance requirements • Partner on submissions to state and federal agencies for funding for road and other infrastructure construction and maintenance projects (e.g. with the Shire of Ngaanyatjarraku, Ngaanyatjarra Council)	Construction Operations	• The Company has commenced communications with state and federal government agencies. • The provision and maintenance of roads is a government responsibility. Metals X responsibility will be limited to those roads/access routes under its direct control.		

4.2 If the mine does not go ahead?

The preceding discussion on the social impacts associated with Wingellina Nickel Project have been prepared in the assumption that the project will proceed. There is a possibility that the Project many not proceed depending upon financial, political or regulatory considerations.

If Metals X decides not to proceed with the Project there remains a need to manage the social impact of that decision. The work that Metals X has undertaken to date including the exploration and this social impact analysis along with the signing of the Wingellina Project Agreement have raised awareness and expectations for the project.

With the signing of the Agreement the beneficiaries received a sum of money and there is an expectation that further monies will be received. It is therefore incumbent upon Metals X to properly manage community expectations and the inevitable let-down should the Project not proceed.

4.3 Monitoring and Review

Monitoring and reporting of social impacts is critical in determining the success or otherwise of mitigation strategies designed to minimise expected impacts. The Metals X Wingellina Nickel Project will need to demonstrate that it has met the commitments defined in the Social Impact Management Plan and other agreements including Wingellina Project Agreement

High level performance criteria have been drafted as part of the Impacts framework detailed in Table 4-1. Further performance indicators, data availability and data gaps will be developed in consultation with key stakeholders including the Implementation and Review Committee, and a data collection process initiated as part of project management processes.

As the more detailed management plans are developed following FID (e.g. Workforce Management Plan, Aboriginal Employment and Training Plan, Aboriginal Business Development Plan, Procurement and Contracting Plan, etc) existing performance indicators will be supplemented with more detailed specific indicators. Each of the individual management plans developed will include specification of accountabilities for key actions and information on the extent and frequency of reporting and monitoring required. It is not possible to further describe performance indicators until such time as the project is approved to proceed and specific project parameters are finalised.

A data register will be developed to include indicators, baseline status, accountability for data collection and protocols for sharing Project and Government information.

4.3.1 Monitoring Process

Metals X will establish a process wherein performance criteria and indicators will be monitored by a Social Impacts Management Team in collaboration with the Implementation and Review Committee:

- 6 monthly prior to a decision to proceed to mining
- quarterly (where possible) to monitor progress and identify corrective actions where required; and
- annually, for reporting.

The monitoring process will be in place within 6 months of the Financial Investment Decision with the first annual report due in the financial year following, and annually thereafter.

4 Social Impact Management Plan

4.3.2 SIMP Reviews

Metals X will undertake annual reviews of the Social Impact Management Plan, in consultation with the Implementation and Review Committee and other stakeholders as required.

Amendments and updates to the Social Impact Management Plan will be made if the strategies and actions no longer meet the desired outcomes, or to improve their effectiveness. If necessary, the community engagement strategy will be updated to describe how stakeholders will be engaged in any change process at the time.

Acknowledgements

5.1 Acknowledgements

URS acknowledges with gratitude the people who provided information and advice in the preparation of the SIMP. In particular, we thank the people of the Wingellina Community for allowing us to visit their land and for their generosity in providing insights and information.

Secondly, we thank Max Maczurad of Metals X, and Mr Bruce Smith, the Indigenous Liaison officer engaged by the Ngaanyatjarra Council and funded by Metals X.

A list of the people interviewed or who were participants in group discussions for the SIMP is presented in Table 5-1.

Table 5-1 People contacted for the SIMP

Name	Affiliation	Location of interview
Ainsley Roberts	Wingellina Community	Metex Camp
Alex Knight	Land and Culture Manager, NgC	Alice Springs
Anna Cadden	Ngaanyatjarra Media Centre	Wingellina
Anthony Spry	Papulankutja Arts Centre	Blackstone
Belle Davidson	Wingellina Community	Metex Camp
Brett Cowling	General Manager Ngaanyatjarra Health	Alice Springs
Bruce Smith	Community Liaison Officer, Metex	Wingellina
Carlos Martin	Pipalyatjara Community	Pipalyatjara
Chris Reid	Chairperson, Wingellina Community	Metex Camp and Wingellina
Damien Davidson	Community member	Wingellina
Damien McLean	Shire of Ngaanyatjarraku	Warburton
Darian Bryant	Wingellina Community	Metex Camp
David Brooks	Ngaanyatjarra Council/Anthropologist	Wingellina/Perth
David Busuttil	Nganampa Health Council Inc	Alice Springs
Deano Junior Roberts	Wingellina Community	Metex Camp
Edward Jones ('EJ')	Ngaanyatjarra Services	Wingellina
Eleanor Grenhoin	Supermarket Manager	Wingellina
Gary Roberts	Community member	Wingellina
Glen and Grant	Pool Managers, Pipalyatjara	Pipalyatjara
James Gradisen	Ngaanyatjarra Council	South Perth
James Parker (Snr Sergeant)	OIC WA Police, Blackstone	Blackstone
Joanna Robertson	Community member	Pipalyatjara
Josephine	Community member	Pipalyatjara
Joshua Dawson	Wingellina Community	Metex Camp
Linda Davidson	Wingellina Community	Wingellina
Maureen Nelson	Community member	Pipalyatjara
Mick	Community member	Pipalyatjara
Mrs Paddy	Pipalyatjara Community	Pipalyatjara
Nellie Roberts	Wingellina Community	Metex Camp
Norma Bryant	Community member	Wingellina

5 Acknowledgements

Name	Affiliation	Location of interview
Paul Stenson	Manager Ngaanyatjarra Services	South Perth
Priscilla Cooper	Community member	Pipalyatjara
Priscilla Roberts	Wingellina Community	Wingellina
Shane McCullogh	Community Development Adviser, Wingellina	Wingellina
Shaun Williamson	Chairperson, Pipalyatjara Community	Pipalyatjara
Sofia Dessai	Ngaanyatjarra Media Centre	Wingellina
Sue Sokol	Ngaanyatjarra Council	Alice Springs
Mr Stanley Presley	Community member	Wingellina
Steve Jackson	CDEP Project Officer	Wingellina
Steve Strickling	Senior Housing Officer Ngaanyatjarra Council	South Perth
Tania Kells	Aboriginal Employment Strategy Ltd	Alice Springs
Thomas Williams	Ngaanyatjarra Council	South Perth
Trent Briadner	Supermarket Manager	Wingellina
Yvonne Roberts	Community member	Wingellina
	Department of Education and Children's Services	Pipalyatjara Anangu School
	Eastern Goldfields GP Network	Kalgoorlie
	Department of Housing	Kalgoorlie
	Shire of Ngaanyatjarraku Planning	Warburton
	Department of Community Services	Pipalyatjara

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Limitations

URS Australia Pty Ltd (URS) has prepared this report in accordance with the usual care and thoroughness of the consulting profession for the use of Metex Nickel Pty Ltd and only those third parties who have been authorised in writing by URS to rely on the report. It is based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the professional advice included in this report. It is prepared in accordance with the scope of work and for the purpose outlined in the Proposal dated 19 November 2010.

The methodology adopted and sources of information used by URS are outlined in this report. URS has made no independent verification of this information beyond the agreed scope of works and URS assumes no responsibility for any inaccuracies or omissions. No indications were found during our investigations that information contained in this report as provided to URS was false.

This report was prepared between April and November 2011 and is based on the conditions encountered and information reviewed at the time of preparation. URS disclaims responsibility for any changes that may have occurred after this time.

This report should be read in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties. This report does not purport to give legal advice. Legal advice can only be given by qualified legal practitioners.

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Appendix A Scope of Work (from the URS proposal)

The following has been extracted from the revised proposal submitted to Metals X and the Ngaanyatjarra Council Land and Culture Unit (November 2010).

It is included here to document the agreed methodological approach to conducting the Social Impact Analysis. It has been amended to remove any commercial in confidence information and other specifics of URS systems and processes not materially linked to the methodology but continues to provide detail of the approach proposed and agreed to.

A.1 Considerations in the methodology

A.1.1 Deciding the scope of the SIMP

We do not see a requirement to revisit the socio-economic description of the area, or the defined social impacts in any detail. The requirement of the SIMP is to take the identified impacts and strategies to the next level in formulating a concrete plan to address the strategies, with a focus on education, employment, and business development. This works needs to commence with 'bedding down' the scope of the SIMP, in terms of deciding the subjects it needs to cover, the degree of detail in terms of activities, outputs and outcomes, and the certainty of costing individual activities. Deciding the scope (in essence a 'Table of Contents') needs to be organised early in the process (see Workplan in Section A.2).

A.1.2 Recognising the key stakeholders

The key stakeholders in establishing the SIMP are listed below. We appreciate the complexity of the organisations involved in the Wingellina area, including local government, the native title representative body, Aboriginal Council and a number of Aboriginal Corporations providing a range of services into the region. We also appreciate there are tensions between some of these organisations, the Wingellina community and Metals X.

It is understood that the relationship between the Shire of Ngaanyatjarraku and Ngaanyatjarra Council Aboriginal Corporation is complex though well-established and strong. While their responsibilities relate to the same geographical area and much the same people, they are constituted in very different ways.

The shire is a local government authority in Western Australia with the same powers and responsibilities as other Western Australian local governments and an electorate that includes all residents and the few other ratepayers, notably the holders of mining tenements.

Ngaanyatjarra Council Aboriginal Corporation is a non-statutory Aboriginal organisation which represents the interests of Ngaanyatjarra people, who form the great majority of the shire's population. The Council holds Crown leasehold title for most of the land in the shire, and delivers a wide range of services to community members, including through some long-established enterprises. It has also been appointed under the Native Title Act 1993 as the native title representative body for a region of desert Australia that extends well beyond the boundaries of the shire and the lands it holds leasehold title for. As a result, it now carries extra responsibilities in statutory processes for the recognition of Aboriginal native title across this broader region. Ngaanyatjarra Council withdrew its role as the Native Title Representative Body in 2007. The council is however the agent for Yanangu Ngaanyatjaraku Parna the PBC for the Ngaanyatjarra native title determination. It therefore acts on behalf of the native title holders.

Appendix A

Recognising the effort that Metals X has committed in achieving good working relationships with these various important groups, we will at all times be guided by Metals X (and Wanati Pty Ltd) in any dealings with stakeholder organisations that are required in developing the SIMP. We appreciate completely the critical importance to the project of maintaining and building the trust and collaboration between local communities and Metals X.

The Wingellina community

The Wingellina community is located close to the Metals X project site. Advice from Richard Coles and John Clarke is that the community has a population of about 100 people, although this will vary greatly according to travel through the region for cultural purposes and family visits. The community infrastructure is understood to be relatively run-down, with housing and public infrastructure in sub-standard condition but a strong and thriving arts industry. The community has a nursing post and a school, with the nearest Police Station being at Warakuna (north of Wingellina). Other services are limited or non-existent. We understand the people at Wingellina are supportive of the mine development and are keen to see the benefits of better infrastructure after relocation, plus opportunities for education and training.

The Ngaanyatjarra Council

The Ngaanyatjarra Council is the Native Title Representative Body for the Central Desert region. It was established in 1981 with the assistance of the Pitjantjatjara Council. The Ngaanyatjarra Council had access to Pitjantjatjara Council staff such as lawyers, anthropologists, accountants and technical, horticultural and engineering staff until it was in a position to engage its own staff. It is the responsible body for a large percentage of the landholdings in the Western Australian Central Desert and is headquartered in Alice Springs, Northern Territory.

The Project is located in the heart of the Ngaanyatjarra Lands Indigenous Protected Area (IPA). This area was declared in 2002 and is the largest declared IPA in Australia covering some 9.8 million hectares. Ngaanyatjarra Council represents the interests of over 1,500 Ngaanyatjarra, Pintupi and Pitjantjatjara people in 11 communities and coordinates IPA activities across the Lands. The interests of the Wingellina community are represented by Irrunytju Community Incorporated.

The Ngaanyatjarra Council is *the* key stakeholder for this project given their broad governance role in the Lands. Additionally, the Ngaanyatjarra Council is also responsible for the management and/or administration of the Ngaanyatjarra Health Service, Ngaanyatjarra Land and Culture Program, Ngaanyatjarra Community College, Ngaanyatjarra Land Management Unit, Ngaanyatjarra Media, and enterprises including Ngaanyatjarra Services, Ngaanyatjarra Air, Ngaanyatjarra Agency and Transport Services.

We understand that Ngaanyatjarra Services offers a number of services including:

- A building and construction supervision service for all Ngaanyatjarra Communities.
- Essential Services Maintenance to community power, water and wastewater systems.

As such it will be imperative that the Council is fully involved in all discussions pertaining to any proposed works at the Wingellina community specifically the relocation and construction of infrastructure and the provision of services.

Finding the commonality between the strategic interests of Ngaanyatjarra Council and Metals X will be a complex task. Time and resources are required to establish effective partnerships and collaborative

decision-making if Metals X is to be effective in ensuring benefit to the Aboriginal people and in mitigating risks. Attention will need to be given to engaging with the appropriate people, clearly communicating the aims and intent of the project and negotiating how the consultation will take place.

The Shire of Ngaanyatjarraku

The Shire of Ngaanyatjarraku was established in 1993 and is headquartered in the Tjulyuru Cultural and Civic Centre at Warburton, about 250 km to the west of Wingellina in Western Australia. The Shire of Ngaanyatjarraku is responsible for the provision of 'mainstream' local government and delivery of services to the 10 communities and visitors within its boundaries. The Shire encompasses an area of 160,000 square kilometres and has a population of about 2,000 people, with all but 200 being Indigenous people from a range of language groups.

Other Indigenous communities

There are numerous small communities in the Ngaanyatjarra and APY lands within a 200 km radius of Wingellina. Residents at Wingellina, who are primarily Pitjantjatjara have relationships with people in many of these communities, especially those in the APY lands and will routinely travel through the whole area for cultural purposes, to maintain links with family and to obtain services. As well as being closely linked to Wingellina people, some of these APY communities are also located along possible transport routes to and from the mine.

Pastoral stations

There are no pastoral stations in the immediate area. There are three working properties in the Northern Territory along one of the transport routes to the Stuart Highway, being Mulga Park, Victory Downs and Mount Cavenagh. Further north, are the pastoral stations of Curtin Springs, Mount Ebenezer and Erldunda, along the Lasseter Highway. There are pastoral operations on the APY lands in SA but the nearest pastoral operations are approximately 200km away.

Government agencies in WA, Northern Territory and South Australia

Government agencies responsible for health, education, policing, aged care, utilities and transport will need to be consulted as part of the SIMP. This will need to be done carefully to ensure that Governments do not seek to 'shift' their responsibilities to Metals X, and instead seek to show how the contribution by the company can leverage greater support from governments to an under-serviced area. This has been an issue in other remote areas of Australia.

A.1.3 Visiting the Wingellina area

Metals X have established good relationships with the Wingellina community, and the stakeholders responsible for management of the Ngaanyatjarra and APY Lands. Our Workplan (see Section A.2) envisages two visits to the area: the first to meet with the community and the key stakeholders; and the second to 'road test' suggested activities and outputs from the SIMP with the people who will be involved. We appreciate the cultural and social issues that can come from 'outsiders'' visiting these areas, and we will be relying fully on the Metals X Liaison Officer for guiding all of our interactions with the people in the project area, and for advice with consulting with other stakeholders in the area (e.g. the Shire of Ngaanyatjarraku and the Ngaanyatjarra Council. Our indicative program for visits is presented in Sections A.2.4 and A.2.6.

Appendix A

A.1.4 Engaging with Indigenous communities

It is well-understood that allowing enough time for the project to be successful is crucial. Sufficient time is needed to allow Traditional Owners and community leaders, who are extremely busy with their own jobs and community involvements, to contribute fully to the development of the SIMP. We appreciate the need to respect their time and contributions by ensuring that our approach to obtaining the required information is seen to have clear purpose that will benefit the community, and is targeted, and courteous. This applies to all of those that we will be consulting.

We are proposing an initial meeting with Ngaanyatjarra Council to take guidance on the best approach to consultation (see Section A.2.3). In terms of our conduct when in the communities, at a minimum, we will observe the AIATSIS *Guidelines for Ethical Research in Indigenous Studies*. Our previous experience in working with residents in remote Indigenous communities is that they require time to work through the conversations that we will hold with them, and also that they may be reluctant to provide information that they know, but do not feel able for cultural reasons to provide. We are also aware of the gender issues in that men and women may not be able to discuss various business together, and we will need to structure our approaches to ensure that we are sensitive to these gender issues. Accounting for skin relationships, and different language groups will require background research to be done before visiting the communities. We will be relying largely on the advice received from Ngaanyatjarra Council and Metals X personnel on these matters, prior to visits to the region. Finally, at all times, and particularly when in smaller communities, we need to be sensitive that we are in their community and on their land. In respect of the service providers (police, teachers, health, community managers, store-keepers), we will observe all normal interview protocols.

Time flexibility will be allowed to cater for the amount of time required to consult with Aboriginal community members at Wingellina and other locations. While we will endeavour to schedule all preliminary meetings in a single week period to limit travel costs this may not be achieved. As such we will negotiate the costs associated with additional travel with Metals X prior to incurring those costs.

A.1.5 Developing a program logic for the SIMP

As well as mitigating possible negative impacts, our reading of the scoping document indicates that Metals X is keen for lasting benefits to occur from its involvement in the region. An approach we see as being valuable in developing the SIMP is to use program logic to show the relationships between the goals and aspirations of the communities, activities and inputs to those activities. Individual logframes (logical frameworks) can be developed for separate projects, which can then contribute to an over-arching Program logframe for the SIMP as a whole. A robust logframe also allows for monitoring the performance of a project/ program, and it can be simplified using graphics to enable easy explanation.

A.2 Workplan

The Workplan for the Project is shown in Figure 6-1 and described in detail following.