DRAFT ENVIRONMENTAL IMPACT STATEMENT

Rum Jungle Rehabilitation Project

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1	02 Dec 2019	Jackie Hartnett	Draft EIS Submission for Adequacy Review
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Abbreviation/ Acronym	Full form
ADT	Average Daily Traffic
AAPA	Aboriginal Areas Protection Authority
ABA	Acid Base Accounting
ABS	Australian Bureau of Statistics
ACM	Asbestos Containing Material
AHD	Australian Height Datum
ALRA	*Aboriginal Land Rights (Northern Territory) Act 1976* (Cth)
AMD	Acid and Metalliferous Drainage
ANC	Acid Neutralising Capacity (or Acid Neutralisation Capacity)
ANZECC	Australian and New Zealand Environment and Conservation Council
AP	Acid Producing Potential
ARI	Average Recurrence Interval
ARPANSA	Australian Radiation Protection and Nuclear Safety Agency (Cth)
AS (/NZS)	Australian Standard (and New Zealand Standard)
ASC	Australian Soil Classification
bgs	Below Ground Surface
BoM	Bureau of Meteorology
Bq	Becquerel (one transformation per second)
CCL	Compacted Clay Layer
CHMP	Cultural Heritage Management Plan
CCGC	Coomalie Community Government Council

Abbreviation/ Acronym	Full form
Commonwealth (or CoA)	Commonwealth of Australia
DENR	NT Department of Environment and Natural Resources
DIPL	NT Department of Infrastructure, Planning and Logistics
DoEE	Commonwealth Department of the Environment and Energy
DME	NT Department of Mines and Energy
DPIR, the Proponent	NT Department of Primary Industry and Resources
DTBI	NT Department of Trade, Business and Innovation
EA Act	*Environmental Assessment Act 1982* (NT)
EBFR	East Branch of the Finniss River
EC	Electrical Conductivity
EFDC	East Finniss Diversion Channel
EIS	Environmental Impact Statement
EMP	Emergency Management Plan
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
ERA	Energy Resources of Australia
ESCP	Erosion and Sediment Control Plan
ESD	Ecologically Sustainable Development
FRALT	Finniss River Aboriginal Land Trust
GDE	Groundwater Dependent Ecosystem
GPS	Global Positioning System
HIL	Health Investigation Level
IAP2	International Association for Public Participation
LDWQO (s)	Locally Derived Water Quality Objective (s)
LUA	section 19 Land Use Agreement [under the *Aboriginal Land Rights (Northern Territory) Act 1976* (Cth)]
MNES	Matters of National Environmental Significance
MoU	Memorandum of Understanding
Mt	Mount
NAF	Non Acid Forming
NEPM	National Environment Protection Measure
NIAA	National Indigenous Australians Agency (Cth)
NLC	Northern Land Council
NP	Net Percolation

Abbreviation/ Acronym	Full form
NPR	Neutralisation Potential Ratio (or Neutralization Potential Ratio)
NT	Northern Territory
NT EPA	Northern Territory Environment Protection Authority
NTG	Northern Territory Government
PAF	Potentially Acid Forming
PPE	Personal Protective Equipment
Project	Rum Jungle Stage 3 Rehabilitation Project
QA/QC	Quality Assurance/Quality Control
RJ	Rum Jungle
RJCS	Rum Jungle Creek South
RMP	Radiation Management Plan
SEIA	Social and Economic Impact Assessment
SEIMP	Socail and Economic Impact Management Plan
SIS	Seepage Interception System – installed around Intermediate and Main WRDs
SoCS	Sites of Conservation Significance
Sv	Sievert – the unit of absorbed radiation dose, taking into account the differing biological effects of different types of radiation.
ToR	Terms of Reference
TO	Traditional Aboriginal Owners
TPWC Act	*Territory Parks and Wildlife Conservation Act 1976* (NT)
TSS	Total Suspended Sediment
Qld	Queensland
WA	Western Australia
WDL	Waste Discharge Licence
WM Act	*Weeds Management Act 2001* (NT)
WMP	Waste Management Plan
WoNS	Weeds of National Significance
WRD	Waste Rock Dump (existing)
WSF	Waste Storage Facility (planned)
WTP	Water Treatment Plant
WWII	World War II
XRF	X-ray Fluorescence

Chemical Symbols and Formulae	
Al	Aluminium
Ca	Calcium
$CaCO_3$	Calcium Carbonate (‘Agricultural Lime’)
Co	Cobalt
CO_2	Carbon Dioxide
CO_{2-e}	Carbon Dioxide Equivalent
Cr	Chromium
Cu	Copper
Fe	Iron
K	Potassium
Mg	Magnesium
Mn	Manganese
Na	Sodium
Ni	Nickel
O^2	Oxygen
^{210}Pb	Lead-210
^{210}Po	Polonium-210
^{226}Ra	Radium-226
^{228}Ra	Radium-228
S	Sulphur
SO_4	Sulphate (or Sulfate)
U	Uranium
U_3O_8	Uranium Oxide
Zn	Zinc

Units of Measurement	
%	Percent
°C	degree Celsius
µ	micro (10^{-6})
µg/L	microgram *per* litre
µGy/h	microGray *per* hour
µm	micrometre
µS/cm	microSiemen *per* centimetre
µSv/h	microSievert *per* hour
Bq/L	Bequerel *per* litre
Bq/m^3	Bequerel *per* cubic metre
cm	centimetre (10^{-3} metres)
g/L	gram *per* litre
GL	gigalitre (10^9 litres)
h	hour
ha	hectare (10,000 m^2)
kg/t	kilograms *per* tonne
km	kilometre
km/h	kilometres *per* hour
km^2	square kilometre
L	litre
L/d	litres *per* day
L/s	litres *per* second
m	metre
mL/L	millilitre *per* litre
m/s	metre *per* second
m^2	square metre
m^3	cubic metre
m^3/d	cubic metres *per* day
m^3/s	cubic metres *per* second
mg/kg	milligrams *per* kilogram
mg/L	milligrams *per* litre
ML	megalitre (10^6 litres)

Units of Measurement	
mm	millimetre (10^{-3} metres)
mm/yr	millimetre *per* year
mSv	milliSievert (10^{-3} Sv)
Mm^3	million cubic metres
Mt	million tonne
ppm	parts *per* million
t	tonne
t/yr	tonne *per* year
yr (or a)	year

Glossary Term/Phrase	Definition
AAPA	An independent statutory organisation established under the *Northern Territory Aboriginal Sacred Sites Act 1989* (NT). It is responsible for overseeing the protection of Aboriginal sacred sites on land and sea across the whole Northern Territory.
ABA	The balance between the acid-production and acid-consumption properties of a mine waste material. ABA consists of measuring the acid generating and acid neutralising potentials of a rock sample.
Acidity	Latent acidity is a hidden stock of potential or future acid generation, based on a range of factors including local environmental geochemical conditions.
Advection Barrier	Cover layer to limit movement of gas *via* advection. (Advection is defined as the transfer of heat or matter by the flow of a fluid.)
Alluvial	Relating to a deposit of sand, mud, *etc* formed by flowing water.
Ambient Noise	The sum of (background) noise at a particular location.
AMD	A result of the exposure of some sulphide minerals (*e.g.* pyrite) to oxygen and water, resulting in drainage waters that can be acidic and/or have high concentrations of dissolved metals.
ANC	Acid neutralisation capacity refer to the overall buffering capacity of, for example, a sediment or surface water – *e.g.* its ability to keep the pH stable as acid is added
Anthropogenic	Produced by humans or human-related activity.
ANZECC Guidelines 2000 (superseded by ANZG, 2018)	These guidelines provided guidance on fresh and marine water quality management issues in Australia and New Zealand, including advice on designing and implementing water quality monitoring and assessment programs. In Australia, the ANZECC Guidelines 2000 document forms a part of Australia's National Water Quality Management Strategy (NWQMS), which provides a national approach for achieving sustainable use of Australia's water resources by protecting and enhancing water quality while maintaining economic and social development. This has been superseded by the revised Water Quality Guidelines (2018).
Aquifer	A geological formation, group of formations or part of a formation, able to receive, store and transmit significant quantities of water.
ARI	The average or expected value of the periods between exceedances of a given rainfall total accumulated over a given duration. It is implicit in this definition that the periods between exceedances are generally random.
ASC	This is a multi-category scheme with classes defined on the basis of diagnostic horizons or materials and their arrangement in vertical sequence as seen in an exposed soil profile.
Atterberg Limits	Defines the plasticity of a soil. A fine-textured material can exist in any of several states – solid, semi-solid, plastic and liquid – depending upon on the amount of water in the system. The boundaries of the four states are defined by Atterberg Limits: • Liquid limit – boundary between the liquid and plastic states • Plastic limit – boundary between plastic and semi-solid states • Shrinkage limit – boundary between the semi-solid and solid states. The difference between the plastic limit and the liquid limit is called the Plasticity Index. Completed using AS1289.2.1.1 and AS1289.3.1.2 to 3.4.1 (Standards Association of Australia, 2003).
Australian Water Balance Model (AWBM	Is a catchment water balance model that calculates runoff from rainfall at daily or hourly time increments..
Bioregion	A specific geographic zone with a repeating or similar pattern of biotic (flora and fauna) and abiotic (soils, terrain, geography, climate and rainfall) factors.
Borrow Pit	An area that is excavated to provide benign earth/material for use in construction or rehabilitation.
Bund	An embankment that is constructed around an area and/or structure that is designed to prevent inflow or outflow of various liquid types. Can also be referred to as 'a bund wall' or 'bunding'.
Calibrate	To check, adjust or standardise a measuring instrument, usually by comparing it with an accepted model.
Capillary break	A space or layer between two surfaces which is purposely constructed wide enough to prevent the movement of moisture through the space by capillary action.

Glossary Term/Phrase	Definition
Catchment	The land area draining to a point of interest, such as a water storage or monitoring site on a watercourse.
Capping	To cover waste rock/overburden with a sealant (low permeable) material such as clay in order to prohibit (or reduce) the ingress of water and/or air.
Compaction	Process of packing soil particles more closely together by rolling or other mechanical means so that air is removed from the voids thus increasing the dry density of the soil A soil compaction test determines the maximum unit weight and optimum moisture content a soil can achieve for a given compaction effort. Completed in accordance with AS1289.5.1.1 (Standards Association of Australia, 1993).
Corrective Action	Management strategies that are to be implemented in the event that targets and objectives are not being achieved.
Datum	A reference location or elevation which is used as a starting point for subsequent measurements. Sea level is a datum for elevation measurements.
Drawdown	A lowering of the water level of an aquifer resulting from the pumping of groundwater.
EC	A measure of how well a material accommodates the transport of electric charge.
Embankment	A ridge constructed of earth, fill, rocks or gravel and used most commonly to retain water. The length of an embankment exceeds both its width and its height.
Emerson Aggregate Test	Classifies the behaviour of soil aggregates, when immersed, on their coherence (or instability) in water providing an indication of the potential erodibility of a fine-textured material. Determined in accordance with AS1289.3.8.1 (Standards Association of Australia, 2003).
Emissions	The release of material into the environment (dust or gas).
Ephemeral	Watercourse flows that are short-lived and often reliant upon direct precipitation input; are intermittently dry.
Evapotranspiration	The movement of water to the air from sources such as soil, plants and water bodies.
Flood	An overflow of water onto lands that are normally above local water levels. Can be caused by stream, creek or river discharges exceeding the capacity of the channel; dam failure; pit lake level increase or local drainage capacity exceedance.
GS	A facility on a stream, lake, canal, reservoir or other water body where instruments are installed to automatically monitor selected water parameters. These can include measurements of height, flow rate discharge, water temperature and pH. Such measurements can be automatically recorded and transmitted to selected personnel *via* satellite, radio or telephone.
Hydraulic Conductivity	Is a measure of a soil or rock material's ability to transmit water through pore spaces or fractures.
Indigenous/Aboriginal	The terms indigenous and Aboriginal are often used interchangeably in historical and contemporary literature and there are many views on which terms are appropriate. Throughout this EIS, the term Aboriginal is used when discussing local and regional indigenous people.
Infiltration	The process by which surface water laterally enters soil or rock.
Karstic rock	Soluble rocks including limestone, dolomite and gypsum.
Lithology	The physical characteristics of a rock.
Lithostratigraphic units	Bodies of rock that are defined and characterised on the basis of their lithologic properties and their stratigraphic relations. These form the basic units of geological mapping.
Monitored Natural Attenuation	Natural attenuation of contaminants may be defined as the effect of naturally occurring processes to reduce the load of polluting substances in groundwater. Monitoring this can form part of the strategy for managing risks from contaminated groundwater. See NT Contaminated Land Guideline (2017)
NAF	Non-acid forming refers to geologic materials with a relatively high acid neutralising capacity. These rocks are chemically stable and will not generate any by-products which could impact on the environment. For this project, NAF waste rock is defined by a NPR value of two or higher (*i.e.* NP/AP > 2).[1]

Glossary Term/Phrase	Definition
NP	Meteoric water will either be intercepted by vegetation, run off or infiltrate into the cover surface (NP).
Overburden	Non-ore bearing material overlying and surrounding the ore.
Oxidation	A chemical reaction in which substances combine with oxygen.
PAF	A description of material that may produce acid. For this project: • PAF-I waste rock is characterised by the highest sulphide content (and hence the highest AP values) and the lowest ANC values • PAF-II waste rock is characterised by moderate AP and ANC values • PAF-III waste rock is characterised by a low sulphide content (and relatively high ANC).[1]
Palimpsest	An archaeological site evidenced by a deflated scatter of artefacts caused by erosion of sediment with artefacts settling on a single surface.
Peak Flow	The maximum instantaneous discharge of a stream or other form of water course at a specific location.
Performance Indicators	Measures by which all anticipated and potential impacts can be measured.
Permeability	A measure of how well a material can transmit water. Permeability is primarily determined by the size of the pore spaces and their degree of interconnection.
pH	Measure of the acidity of a solution – acidic at pH<7 or alkaline at pH>7.
Porosity	Is a measure of the void (*i.e.* empty) spaces in a material and is a fraction of the volume of voids over the total volume (usually expressed as a percentage).
Radon	A radioactive, colourless, odourless gas that naturally forms from the radioactive decay of uranium.
Radon decay products or radon progeny	The short lived radioactive decay products of radon-222. This includes the decay chain up to, but not including, lead-210, namely polonium-218 (sometimes called radium A), lead-214 (radium B), bismuth-214 (radium C) and polonium-214 (radium C').
Recorded site	An identified heritage site yet to be officially registered with AAPA.
Registered site	A heritage site officially registered with AAP.
Ripping	Deep cultivation with a tined implement to a depth of >300 mm.
Risk	A function of the likelihood and severity of an impact (positive or negative) on public health, safety or the environment.
Sacred site	As defined in the ALRA, Part VII, section 69, a "sacred site" means a site "that is sacred to Aboriginals or is otherwise of significance according to Aboriginal tradition, and includes any land that, under a law of the Northern Territory, is declared to be sacred to Aboriginals or of significance according to Aboriginal tradition." As AAPA describes, 'Sacred sites are places within the landscape that have a special meaning or significance under Aboriginal tradition. Hills, rocks, waterholes, trees, plains, lakes, billabongs and other natural features can be sacred sites."
Scatter	Term generally used by archaeologists to refer to artefacts which cannot be related to a place or focus of past activity (except for the net accumulation of single artefact losses).
Seepage	Loss of water from a man-made structure such as dam or an overburden emplacement facility *via* movement of water through the base or toe (lower extremities).
Shear Strength Assessment	Is used to determine the shear strength properties of a soil. Completed in accordance with AS1289.6.4.2 (Standards Association of Australia, 2003).
Shrink/Swell Assessment	Indicates the expansive potential of clay containing materials and provides an indication of swelling and shrinking (*i.e.* cracking) that may occur within a compacted clay layer that is exposed to wet/dry cycling. Completed in accordance with AS1289.7.1.1 (Standards Association of Australia, 2003).

[1] Robertson GeoConsultants Inc. and DR Jones Environmental Excellence (2016) *Physical and Geochemical Characteristics of Waste Rock and Contaminated Materials, Rum Jungle*.

Glossary Term/Phrase	Definition
Tailings	The solid, fine grained residual waste material produced after the processing of ore.
Topography	The land forms or surface configuration of a region.
(Kungarakan and Warai) Traditional Owners	The Kungarakan and Warai peoples who are recognised Traditional Owners of the Kungarakan and Warai Estate that includes the Finniss River Aboriginal Land Trust and the former Rum Jungle Mine site (which is yet to be granted).
Wetted up	When a stockpile of waste rock or overburden material is fully saturated due to infiltration and storage or water within the material pore space.
XRF	Is a non-destructive analytical technique used to determine the elemental composition of materials. XRF analysers determine the chemistry of a sample by measuring the fluorescent (or secondary) X-ray emitted from a sample when it is excited by a primary X-ray source.

Executive Summary

The Executive Summary is stand-alone to the Draft Environmental Impact Statement (EIS) and aims to provide readers with a brief overview of the Proponent's Project Proposal and the contents of the Draft EIS - namely the proposal's potential environmental implications and management objectives.

Location and Proposal Overview

The Northern Territory Government (NTG; the Proponent), *via* the Department of Primary Industry and Resources, proposes the rehabilitation of the former Rum Jungle Mine Site (the Project), located 6 km north of Batchelor, in the Northern Territory (NT). The Project area is comprised of three main components: the former Rum Jungle Mine and its associated satellite mines at Mt Fitch and Mt Burton.

The Project components were all formerly part of the Rum Jungle Uranium Field and consist of three land parcels as described here:

- Rum Jungle proper – Section 2968 Hundred of Goyder (vacant NT Crown land recommended for grant under the *Aboriginal Land Rights (Northern Territory) Act 1976* (Cth) (ALRA) by the Aboriginal Land Commissioner Justice Toohey on 22 May 1981);
- Mt Burton – Section 998 Hundred of Goyder (estate in fee simple held privately); and
- Mt Fitch – within NT Portion 3283 (Crown Lease Perpetual 862 held by the Northern Territory Land Corporation).

The Project location is shown in Figure 1-1 and the key elements of the Project are shown in Figure 1-2.

Uranium (and other minerals such as copper and lead) exploration, mining and milling occurred from 1953 to 1971 across these sites (a detailed breakdown of the historical mining activities is located within Chapters 1 and 6 of the Draft EIS). The mining and mineral processing at Rum Jungle caused significant environmental impacts, primarily elevated dissolved copper from Acid and Metalliferous Drainage (AMD) which polluted the East Branch of the Finniss River (EBFR). From 1982 to 1986 a four year rehabilitation project, funded by the Commonwealth Government, was undertaken by the NTG, which at the time was considered to be at the forefront of mine rehabilitation and attracted international attention from the scientific and mining communities. The rehabilitation effort was considered successful in achieving its project objectives supported by a subsequent 12-year monitoring program from 1986 to 1998. Whilst historical rehabilitation efforts did achieve the four project objectives outlined at the time more work is required to reduce ongoing environmental impacts.

Routine monitoring of the EBFR and site inspections post-rehabilitation led to a study on how the waste rock dump (WRD) cover was performing (Taylor *et. al.*, 2003) and since that time, ongoing investigations have been carried out to understand the contamination processes at the Rum Jungle site and the consequent ecological impacts.

Since 2009, the NTG and the Australian Government have been working under a National Partnership arrangement to complete investigative work to inform a rehabilitation plan, deliver site maintenance and continue environmental monitoring. The results of these programs have been used to develop an improved rehabilitation strategy that is consistent with the views and interests of traditional Aboriginal owners and that meets contemporary environmental and mined land rehabilitation standards.

The Project's high-level objectives are two-fold and focus on environmental remediation and restoration of cultural values of the site as described below:

- Improve the environmental condition onsite and downstream of site within the EBFR. This includes the following key outcomes:
    - Improved surface water quality conditions within EBFR in accordance with locally derived water quality objectives (LDWQOs).

  - Achieve chemically and physically stable landforms.
  - Support self-sustaining vegetation systems within rehabilitated landforms.
  - Develop physical environmental conditions supportive of the proposed Land Use Plan.

- Improve site conditions to restore cultural values. This includes the following key outcomes:
  - Restoration of the flow of the EBFR to original course as far as possible.
  - Remove culturally insensitive landforms from adjacent to sacred sites and relocate ensuring a culturally safe distance from the sacred sites.
  - Return living systems including endemic species to the remaining landforms.
  - Preserve Aboriginal cultural heritage artefacts and places.
  - Isolate sources of pollution including radiological hazards.
  - Maximise opportunities for Traditional Owners to work onsite to aid reconnection to country.

It is envisaged that the achievement of these objectives may support the potential future Land Use Plan (detailed within the EIS).

In mid-2016, the Proponent submitted a proposal to rehabilitate the former Rum Jungle Mine site to both the Northern Territory Environment Protection Authority (NT EPA) and Department of the Environment and Energy (Cth) (DoEE) under the *Environmental Assessment Act 1982* (EA Act) and *Environment Protection and Biodiversity Conservation Act 1999* (Cth), respectively. Both governments determined that the proposal requires assessment under their respectively environmental protection legislation at the level of an Environmental Impact Statement (EIS).

Finalisation of the scope of work with lower technical risk, improved sustainability and lower cultural impacts led to submission of a variation to the Notice of Intent to the NT EPA (pursuant to clause 14A of the *Environmental Assessment Administrative Procedures 1984*) and a variation to the original proposal to DoEE under section 156A(1) of the EPBC Act.

On 24 October 2019, the Proponent was informed *via* the delegate of the Australian Government Minister that the Australian Government had accepted the variation to the proposal in accordance with section 156B of the EPBC Act. The proposal remained a controlled action and is to be assessed under the EPBC Act prior to proceeding.

On 16 October 2019, the NT EPA informed the Proponent that the significance of the altered proposal had not changed and would continue to be assessed at the EIS level. The finalised Terms of Reference (ToR) were released to the Proponent on 12 November 2019.

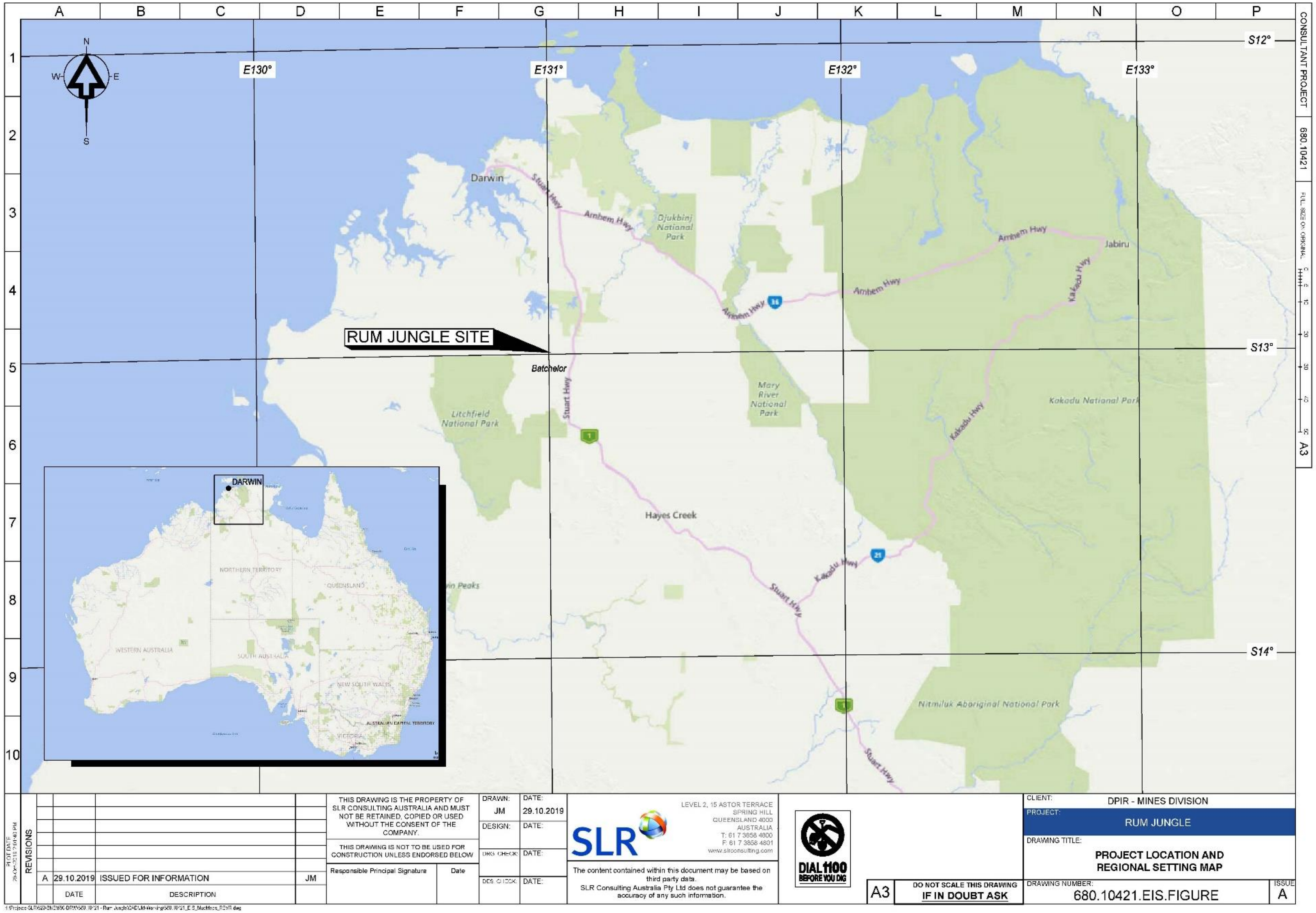


Figure 1: Project Location

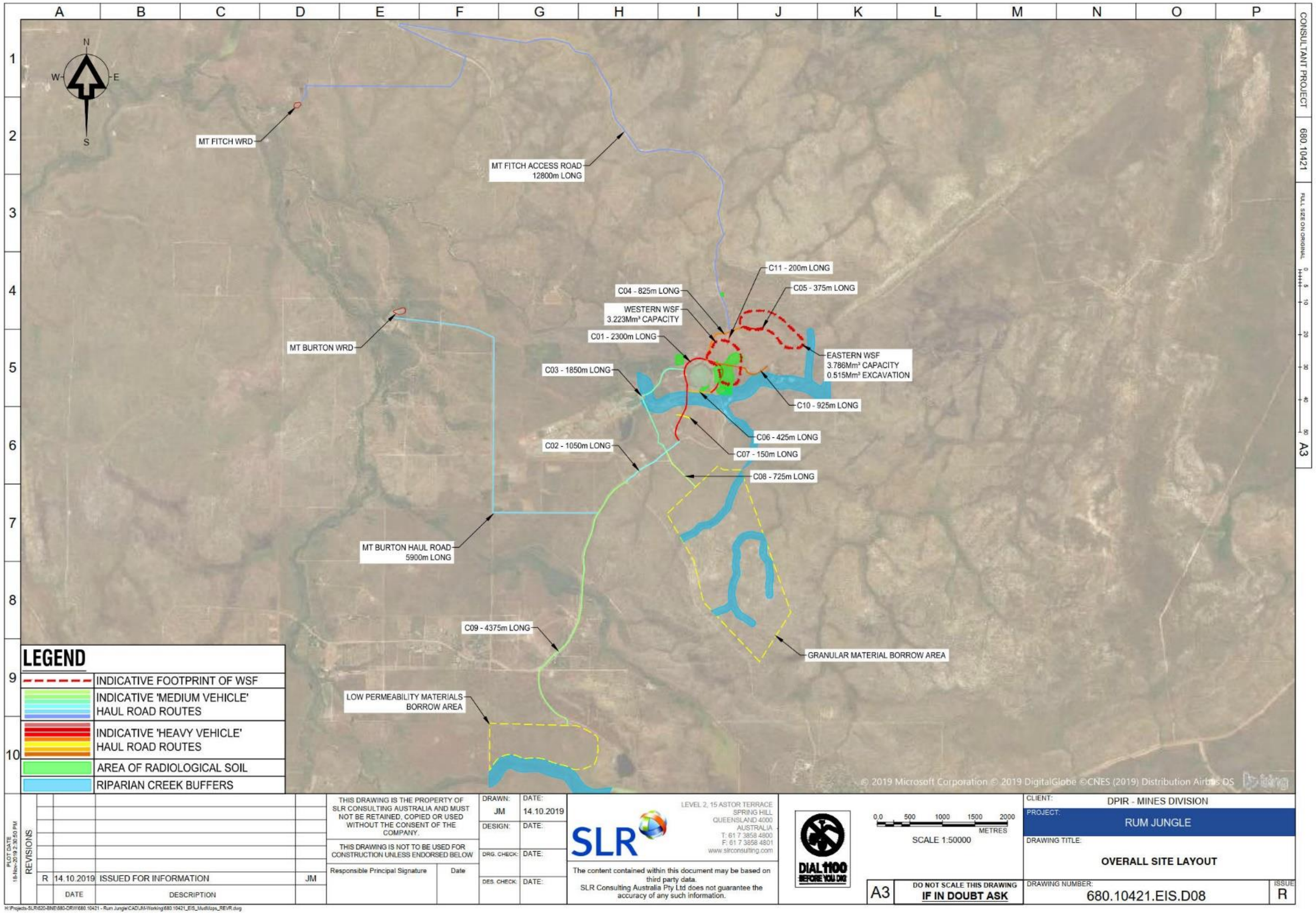


Figure 2: Overall Site Layout

Traditional Owners

The Finniss River Land Claim No. 39 was lodged by the Northern Land Council (NLC) on behalf of claimants on 20 July 1979, under section 50(1)(a) of the ALRA. Rum Jungle formed part of the area subject to the claim. An inquiry into the claim was conducted by the Aboriginal Land Commissioner, Justice John Toohey, who presented findings in the Finniss River Land Claim No. 39 (Report No. 9) on 22 May 1981 (Commonwealth of Australia, 1981). The Aboriginal Land Commissioner recommended that the majority of land subject to the claim, including Rum Jungle, be granted to Aboriginal Land Trusts established under ALRA for the benefit of Aboriginals entitled to the use and occupation of the land. Kungarakan and Warai Peoples were found to be the joint Traditional Owners of Rum Jungle and other areas subject to claim. The Aboriginal Land Commissioner noted that it was open to the responsible Commonwealth Minister to act on all, some or none of the recommendations contained in Report No. 9.

Between 1991 and 1993, the majority of the land recommended for grant was vested in two Aboriginal Land Trusts. No decision on the potential grant of the Rum Jungle site has been made, pending the outcome of negotiations between the Commonwealth, NTG, NLC, and Kungarakan and Warai Peoples about the future of the site, including rehabilitation.

Kungarakan and Warai objectives for rehabilitation and post-rehabilitation land use are summed up in their vision for the site. As they do not differentiate between environment and culture, their vision is largely drawn from their cultural and social principles:

Kungarakan and Warai desire that Rum Jungle will be returned to a natural, living environment that also provides for a return to traditional ceremony, culture and subsistence use of natural resources. In modern society, this may include development of commercial operations that are managed according to Kungarakan and Warai traditional principles.

To Kungarakan and Warai, rehabilitation of the physical landscape will allow spiritual healing of the country.

Project Elements and Duration

Detail and methodologies for the key components are described in Chapter 2 – Proposal Description, Chapter 6 – Existing Environmental Condition and Chapter 7 – Rehabilitation Strategy of the EIS. The rehabilitation program for the former Rum Jungle Mine is a multi-phase process, however the EIS is temporally constrained to the Stage 3 phase. The EIS will lightly touch on future stages as they pertain to the setting of objectives that may be achieved beyond this temporal scope.

Project durations for the purpose of the EIS are summarised below:

Construction (five years): scope to consist of groundwater remediation and earthworks to isolate contaminated soils and waste rock within the Waste Storage Facility (WSF) and Main Pit. Phase will require an initial year of mobilisation and establishment followed by 5 years of construction works.

Stabilisation and Monitoring (five years): monitoring of surface water, groundwater, erosion and rehabilitation success metrics. Monitoring and maintenance of civil structures, such as the WSF and surface water control features, will also be undertaken.

Project Benefits and Justification

A summary of potential benefits from completing the Project include:

- Improvement in Environmental Conditions onsite and downstream within the EBFR and the Finniss River proper.
- Site conditions allowing the Land Use Plan to be enacted.
- Potential resolution of the outstanding Land Claim.
- Development opportunities for Traditional Owners.

- Development opportunities for local residents.
- Local and regional economic impacts.
- Opportunity to expand knowledge, skills and experience in mine rehabilitation processes.

Structure of the Draft EIS

Below is a brief outline of the contents of each chapter in the Draft EIS.

Chapter 1 - Introduction
Chapter 1 provides an in-depth introduction to the Project, including the historical context and background of the site, Proponent details, a summary of the EIS team, a summary on the regional setting in which the Project will be undertaken, and summary information on the Project's anticipated benefits, should it proceed.
Chapter 2 – Proposal Description
A detailed description of the Project including construction sequence and layout, duration, workforce and accommodation, transport and logistics network, handling and treatment of contaminated materials (waste rock and soil), and water treatment/water management.
Chapter 3 – Compliance and Risk
This chapter addresses both Project compliance and the risks associated with the proposal. The relevant legislative requirements are outlined. . Included are approvals and agreements that are necessary for the Project to commence Stage 3, some of which have already been obtained. The applicable guidelines and standards relevant to the Project have also been included in summary and considered within the relevant section of the draft EIS. The process for the project risk assessment is also included within this chapter while the Risk Assessment itself is included in the Appendix of the Draft EIS.
Chapter 4 – Stakeholder Engagement and Consultation
Additional details on how stakeholders including, Traditional Owners and Custodians, were engaged, consulted and communicated with throughout the Project, including throughout the EIS process.
Chapter 5 – Regional Setting
A detailed description of the general project context including information on the regional context and cumulative impacts, the environmental legacy and the rehabilitation legacy.
Chapter 6 – Existing Environmental Condition
A detailed description of compromised site environmental and cultural values and a description of the contamination processes.
Chapter 7 – Rehabilitation Strategy
A detailed description of the proposed actions to rehabilitate the Rum Jungle site including earthworks, water treatment and ecological restoration processes.
Chapter 8 – Historic and Cultural Heritage
Description of the existing conditions relative to historical and cultural heritage, assesses the potential impact of the Project on historical and cultural heritage, and proposes management and mitigation measures relative to the potential impacts.
Chapter 9 – Terrestrial Environmental Condition
Description of the existing conditions relative to the terrestrial environment, assesses the potential impact of the Project on the terrestrial environment, and proposes management and mitigation measures relative to the potential impacts.
Chapter 10 – Inland Water Environmental Quality
Description of the existing conditions relative to water quality, assesses the potential impact of the Project on water quality, and proposes management and mitigation measures relative to the potential impacts.
Chapter 11 – Hydrological Processes

Description of the existing conditions relative to hydrological processes, assesses the potential impact of the Project on hydrological processes, and proposes management and mitigation measures relative to the potential impacts.
Chapter 12 – Aquatic Ecosystems
Description of the existing conditions relative to aquatic ecosystems, assesses the potential impact of the Project on aquatic ecosystems, and proposes management and mitigation measures relative to the potential impacts.
Chapter 13 - Social and Economic Impact
Description of the existing conditions relative to socio-economic aspects, assesses the potential impact of the Project on socio-economic aspects, and proposes management and mitigation measures relative to the potential impacts.
Chapter 14 – Terrestrial Flora and Fauna
Description of the existing terrestrial flora and fauna, assesses the potential impact of the Project on flora and fauna, and proposes management and mitigation measures relative to the potential impacts.
Chapter 15 – Human Health and Safety
Provides the methodology used to identify, manage, eliminate or mitigate risks to human health and safety which may result from undertaking the Project.
Chapter 16 – Radiation
Description of the current radiological condition of site, assess the impact of the potential impact of the Project on radiological conditions, and proposes management and mitigation measures relative to the potential impacts.
Chapter 17 – EPBC Act Matters
Description of the Project impacts to EPBC Act matters. Chapter includes justification for the Project to have no Environmental Offsets and a description of Ecological Sustainable Development elements included into the Project.
Chapter 18 – Project Alternatives
Provides a high level summary of key alternatives for delivery of the Project including project scale alternatives and rehabilitation strategy alternatives.
Appendix
Key supporting figures, documents, technical reports and Management Plans that support EIS Chapters are provided.

EIS Overview

Compliance and Risk

The primary approvals for the Project will be *via* the EIS mechanism. However, additional approvals and agreements likely to be required for Project implementation are detailed below.

Authority Certificate: there are several sacred sites at the Rum Jungle property therefore an Authority Certificate under the *Northern Territory Aboriginal Sacred Sites Act 1989* (NT) is required for Stage 3 works.

Approval to discharge: it is likely that treated water will be required to be discharged throughout the Stage 3 works. As a result, a Waste Discharge Licence (WDL) is likely to be required under the *Water Act 1992* (NT). The WDL will detail quantity and quality of water to be discharged, and associated conditions such as monitoring and reporting.

Approval to abstract groundwater: while groundwater abstraction will be for the treatment of AMD-impacted groundwater, it is likely that an exemption will be required under the Water Act.

Agreement for the use of low permeability material: low permeability material is located on land owned by Coomalie Community Government Council (CCGC). As a result, its agreement, including final land use, will be required prior to implementation of the Project. The instrument of agreement is yet to be determined.

Agreement for the use of granular material: as the granular material is located on the Finniss River Aboriginal Land Trust (FRALT), a section 19 Land Use Agreement (LUA) is required under ALRA. The LUA process provides Traditional Owners the opportunity to consider and develop terms and conditions, and the right to consent to or reject proposals on their land and seas (NLC, 2019).

Potential approval for WSF: pursuant to the *Waste Management and Pollution Control Act 1998* (NT) either an Environmental Protection Approval (EPA) or Environmental Protection Licence (EPL) may be required for the proposed WSF.

Agreement for land access and rehabilitation: Mt Burton works are planned to take place on privately held land therefore an agreement for access and rehabilitation of the land will be required to ensure that works are carried out with respect to the land owner’s instructions and to protect public safety during these works.

Land Clearing Permit: pursuant to the *Planning Act 1999* a Land Clearing Permit may be required for unzoned lanned such as the proposed borrow pit locaitons on the properties belonging to FRALT and CCGC as described in this document.

Applicable legislation, standards and guidelines are documented in Chapter 3 – Compliance and Risk.

The EIS Risk Register takes a whole-project-approach and incorporates all relevant project domains, phases of activity and environmental values. The Proponent implemented a series risk identification and assessment workshops from 2018 to 2019 to identify, assess and review project risks; a process that has been refined by the results of the supporting technical study programs. The full EIS Risk Register can be found in the Appendix of the Draft EIS and a high level summary of the risk profile before and after implementation of control strategies is shown here. Figure 3 shows a summary of the initial uncontrolled risks for the Project and Figure 4 shows the residual controlled risk profile.

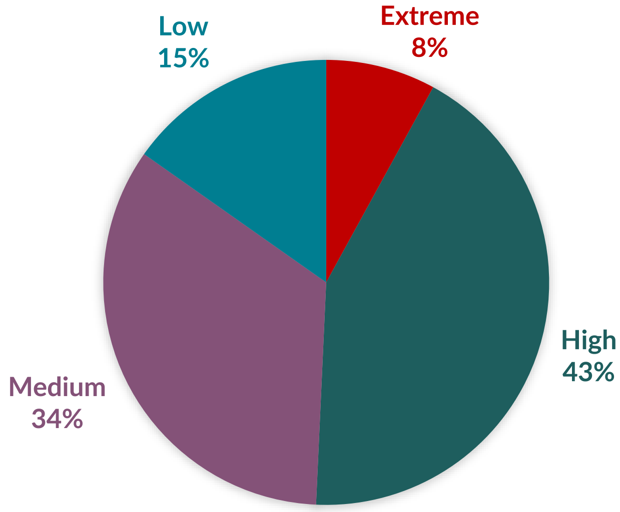


Figure 3: Initial Risk Rating Profile

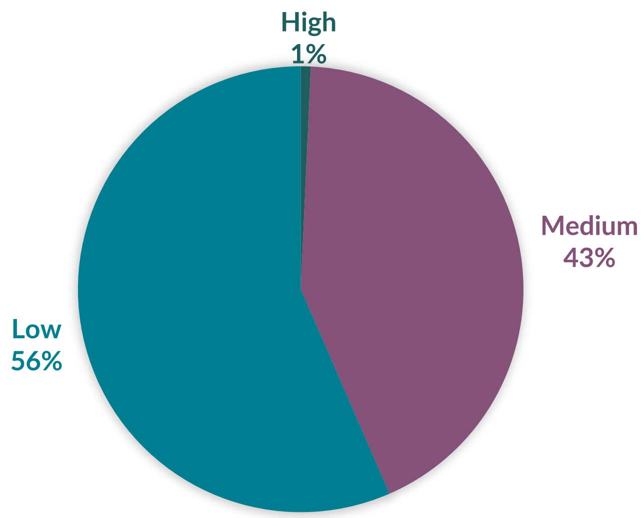


Figure 4: Residual Risk Rating Profile

Based on the results as presented in the EIS Risk Register a total of 138 initial risks were identified with 59 (43%) classified as High and 11 (8%) as Extreme (Figure 3). The adoption of mitigation measures as proposed within this EIS and the Risk Register result in a significant shift in the risk profile (Figure 4) - the residual risks have been reduced to zero classified as Extreme, one as High and the remainder reduced to Medium (43%) or Low (56%).

Stakeholder Engagement

The Proponent has sought meaningful engagement from the early stages of the Rum Jungle Rehabilitation Project with a long-term objective to achieve overall positive outcomes for the community and stakeholders.

In more recent consultation activities, the purpose and objectives of stakeholder engagement has been set with a focus on environmental rehabilitation, advancing the likelihood of achieving the Land Use Plan, and maximising positive project benefits. The improvement of site conditions to restore cultural values as far as possible and support future progress of the Finniss River Land Claim over the Rum Jungle site has been a key aspect of the Project design and as such has been set as a high priority when engaging with stakeholders. Stakeholder engagement has heavily focused on communicating Project objectives as outlined in Chapter 1 - Introduction (Section 1.2.1 Summary of Project Objectives) and utilising stakeholder feedback to inform Project design.

The knowledge gained from stakeholder engagement has enable the Project to deliver aspects that support stakeholder's short- and long-term interests and needs. The Proponent has aimed to work with the community to understand and reduce risks identified and maximise positive outcomes.

The Project has documented around 100 formal engagement events and this is not inclusive of informal interactions, enquiries and daily engagement with stakeholders in project development. Stakeholder engagement has been incorporated in the Project from Stage 1 in 2009 through to Stage 2A in 2019, and included a wide cross-section of stakeholder in the community. Stakeholder engagement is to continue into Stage 3 to maintain open channels with all stakeholders.

Comments and concerns received during stakeholder engagement activities are assessed on a case-by-case merit basis to ensure that if the Project has not already taken them into account, they are addressed at the appropriate level in design and assessment. Over the considerable number of stakeholder engagement opportunities that have taken place during Stages 1 to 2A, feedback received from stakeholders has altered the Project's direction. Key themes arising from the consultation process have been on the whole, environmental, cultural, economic and project delivery based. The Project has a long history in Batchelor and for the Traditional Owners, future consultation is critical to Project success.

Regional Setting

Social and Economic

The Project lies within the CCGC local government area which formed in 1990 and includes the towns of Batchelor and Adelaide River, and surrounding rural areas. Approximately 20% of the area forms part of the FRALT and a further 15% is allocated to the protection of the catchment of the Darwin River Dam (CCGC, 2018). At the 2016 census, the area had an estimated population of 1,319 (ABS, 2017) and the average age was 50-54, significantly higher than the rest of the NT (CCGC, 2018).

The Coomalie region has a diverse mix of cultural aspects. Traditionally, indigenous people lived in the area and the original inhabitants were the Awara, Kungarakan and Warai Peoples. Warai and Kungarakan are recognised as the joint Traditional Owners of the Rum Jungle site. European settlement commenced around 1870 when the Township of Adelaide River was established to service the Overland Telegraph Line. Since that time, agriculture, mining and defence services formed the foundation for economic and population growth in the area (RDA NT, 2019). It is this history that has given rise to the cultural values addressed within this EIS.

The Coomalie regional economy is underpinned by a narrow base, with vocational education and training, and tourism, respectively, being the region's principal provider of jobs and the main drivers of its economic development (ABS, 2017).

Climate

The climate of the Top End, including the Coomalie region, is classified as 'tropical savanna' under the Köppen climate classification system and is characterised by a distinctly seasonal dry-wet monsoon cycle (BoM, 2016). The Wet season generally extends from October to April with average rainfall of 1,564 mm and experiences predominantly westerly to north-westerly winds, while the Dry season (May-early October) experiences minimal (or lower) rainfall and experiences predominantly easterly to south-easterly winds.

Northern Australia experiences seasonal extreme weather events such as storms, intense rainfall and strong winds; these weather events are likely within the Coomalie region. The Australian tropical cyclone season occurs between November and April. Increased tropical cyclone activity has been associated with

La Niña years, while below normal activity has occurred during El Niño years (CSIRO and BoM, 2015). The long-term average number of tropical cyclones in Australia is 11, of which three occur in Northern Australia (including the Gulf of Carpentaria) (BoM, 2019d). In the NT, tropical cyclones generally affect coastal areas up to 50 km inland (NTG, 2019b).

Geology

The Coomalie region is located in the north-western section of the Pine Creek Orogen which covers an area of about 47,500 km^2 and extends north from Katherine to near Darwin (McCready *et al.*, 2004; Ahmad *et al.*, 2006; Ahmad and Hollis, 2013) (Figure 5-5). It is comprised of sequences of carbonaceous, clastic and volcanogenic sediments deposited over two Archaean granitic basements.

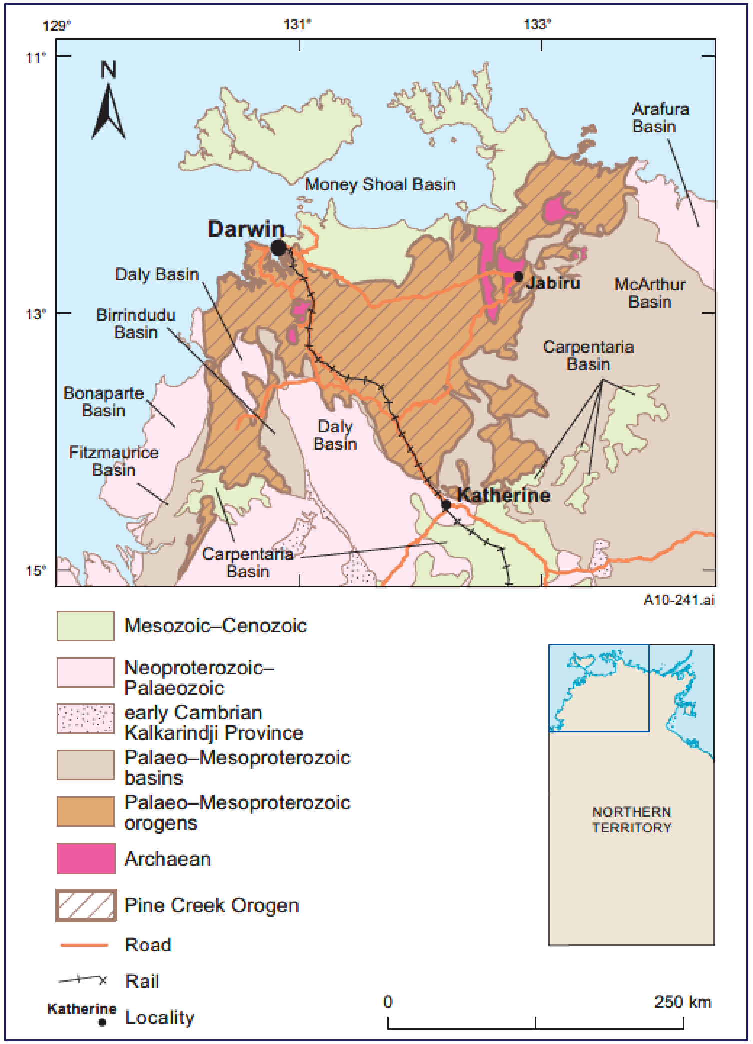
The area around Rum Jungle features two dome-like Archaean basement highs – the Rum Jungle and Waterhouse Complexes. Both Complexes are primarily granitic overlain with meta-sedimentary and subordinate meta-volcanic rocks called the Mount Partridge Group.

Rum Jungle sits within a triangular area known as 'The Embayment' (Ahmad *et al.*, 2006; Ahmad and Hollis, 2013). The area lies in a shallow-dipping limb of a northeast trending, southwest plunging asymmetric syncline that has been cut by northerly trending faults. The main lithology units of The Embayment are granites of the Rum Jungle Complex (south-eastern side of the Giants Reef Fault) and meta-sedimentary rocks of the Mount Partridge Group (north of the Giants Reef Fault) (Figure 4-4). Each of the polymetallic ore deposits within The Embayment occurs within the Whites Formation near its contact with Coomalie Dolostone. Deposits are strongly associated with fault zones (and hence structurally controlled).

Near surface, *in situ* laterisation has occurred since the early Mesozoic era and Tertiary period and, as such, deeply weathered soil profiles are present. Laterite tends to occur above the Coomalie Dolostone, whereas saprolite is more common in areas where the predominant bedrock is Geolsec Formation or Rum Jungle Complex. Alluvium occurs near Fitch Creek and the upper EBFR. Unconsolidated sediments also occur in the diversion channel, but they are relatively thin and discontinuous.

Coomalie region's soils are classified as:

- Kandosols – red, yellow and brown earths.
- Tenosols – weakly developed or sandy soils that show some degree of development (minor colour or soil texture increase in subsoil) down the profile.
- Hydrosols – seasonally inundated soils.



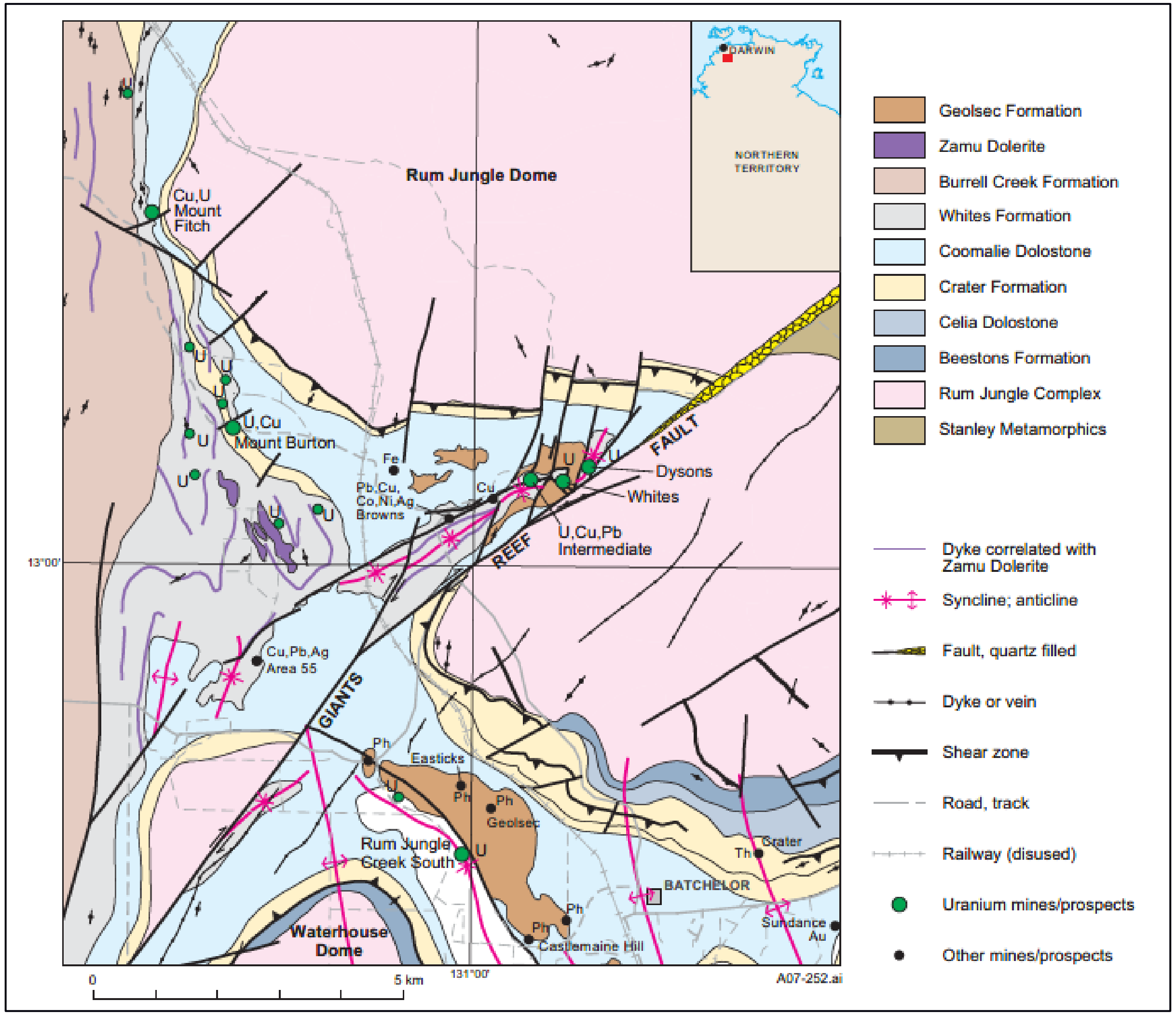


Figure 5: (Left) Geological setting of the Pine Creek Orogen: inset shows its location within NT (Ahmad and Hollis, 2013)

Figure 6: (Right) Geology of the Rum Jungle Mineral Field showing uranium and other mineral occurrences (Ahmad and Hollis, 2013)

Hydrology

The Project area sits within the headwaters of the Finniss River catchment; the majority of the Project footprint is within the EBFR sub-catchment, the exceptions being Mt Burton and Mt Fitch which are adjacent to the West Branch of the Finniss River, and the low permeability borrow area which is adjacent to Meneling Creek (which flows into the West Branch).

The EBFR is an ephemeral stream which drains north-west, joining the Finniss River approximately 8 km downstream of the Rum Jungle site. Base flow is generally not established until sustained monsoonal rains arrive. The Finniss River is a perennial river that flows to Fog Bay. During the Wet season the river often overbanks whilst during the Dry season the river typically consists of a series of billabongs about 3 m in depth connected by shallower sections.

Water Quality

The surface water quality onsite and within the impact footprint has been well monitored over time to establish the extent of surface water impacts resulting from AMD. Earlier rehabilitation works gave rise to a substantial improvement in water quality onsite and downstream, however the system remains impacted from ongoing AMD generation. A downstream impact assessment (Hydrobiology, 2016) found the impact on aquatic ecosystems within the Finniss River were:

- Several metals were in exceedance of the Water Quality Objectives (WQOs) on a regular basis;
- Wet season first flush pulses of elevated metals above WQOs have been observed downstream for several elements (copper, cobalt, manganese, nickel and zinc); and
- Metals typically evapo-concentrate onsite thus increasing onsite concentrations, though downstream of site the Dry season metal concentrations reduce.

Existing Environmental Condition

Historic mining and rehabilitation activities have altered the landscape within the former Rum Jungle Uranium Field, most prominently seen at the Rum Jungle site. Future rehabilitation will see a final landscape that, whilst altered, has improved functionality and reduced environmental and cultural impact. The former Rum Jungle uranium field is a typical example of an open pit legacy mining site of which there are many examples across Australia's landscape. Rum Jungle features, such as open pits and WRDs are mapped below (Figure 7) along with an overview table summarising key landscape mining features. Table 1 outlines the site features and includes a brief description of the history of each feature and dimensions.

Most of the environmental and cultural values within the Rum Jungle site are compromised because of historic activities that have led to present-day contamination processes and physical changes. The primary goal of the Project is to remedy the environmental condition onsite and downstream within the EBFR by addressing the AMD sources, the physical aspects and the ecological condition of site. Historic mining operations diverted the EBFR from its original course through the site and this is to be remedied as far as possible to restore cultural value of the EBFR.

As a result of residual contamination across the site ongoing production of AMD and copper loads within surface water are significant and breach recommended LDWQOs. The EBFR is currently characterised by elevated SO_4, Mg and most metals related to AMD. Concentrations of most parameters are highest in the early Wet season during the so-called “first flush” when seepage that has accumulated in the Dry season is driven downstream by pulses of clean water from upstream. The contaminant loads flushed to the EBFR ultimately impact the aquatic ecosystem to the degree that the system is in poor health and the beneficial use of the river system for local residents and Traditional Owners is limited. All proposed actions are driven by restoring the above contamination causing processes and restoring ecological function.

Figure 8 below is a plot of dissolved copper concentrations in the EBFR immediately downstream of the site over time. The plot shows the significant improvement in water quality as a result of the early 1980s rehabilitation works and the current variation in water quality as compared to the LDWQOs.

Table 1: Mining Landscape Features, Dimensions, and History

Feature	Brief History	Horizontal Area (m^2)	Maximum Height/Depth (m)	Volume (m^3)
Main Pit	Open pit mined for Uranium. From 1965-1971 approx. 700,000 t of tailings was discharged into the Main Pit from the northern perimeter.	100,243	110 m to base of Pit 47 m to top of backfilled tailings	3,530,000 *(original)
Intermediate Pit	Open pit mined for Copper.	41,882	55	1,087,000 *(original)
Dyson's Pit	Open pit mined for Uranium, then used for tailings storage (approx. 600,000 t discharged 1961-1965). During 1980s rehabilitation it was backfilled with tailings from the Tailings Dam and copper ore from the Copper Extraction Pad.	58,450	NA	917,000 (original)
Main WRD	Storage of waste rock from Main Pit.	958,575	21	4,750,000
Intermediate WRD	Storage of waste rock from Intermediate Pit.	253,875	13	819,225
Dyson's WRD	Storage of waste rock from Dyson's Pit.	87,547	21	1,258,000
Old Tailings Dam	During historic mining operations, un-neutralised mill tailings discharged to this area over natural surface. Area was stripped of tailings and contact soils during 1980s rehabilitation; claimed materials disposed of in Dyson's Pit.	308,165	NA	NA
Old Copper Extraction Area	Area used as copper leach pad. Ore stripped in 1980s rehabilitation and disposed of in Dyson's Pit.	116,250	NA	NA
Old Stockpile Area	Run of Mine ore stockpile - stripped and covered during 1980s rehabilitation	195,381	NA	NA
Old Borrow Area	Several onsite used for 1980s rehabilitation	126,000	NA	NA
Mt Burton Pit	Open pit mined for Uranium	7,490		NA
Mt Burton WRD	Storage of waste rock from Mt Burton Pit	13,893	5	105,000
Mt Fitch Pit	Open pit explored for Uranium. No ore abstracted – overburden was stripped.	6,608	NA	NA
Mt Fitch WRD	Stockpiled overburden from Mt Fitch Pit	7,000	11	<10,000
Radiological Soils	Areas where Uranium ore was stockpiled and milled/processed	154,900	NA	NA

**Original pit volumes after Verhoevan (1988)*

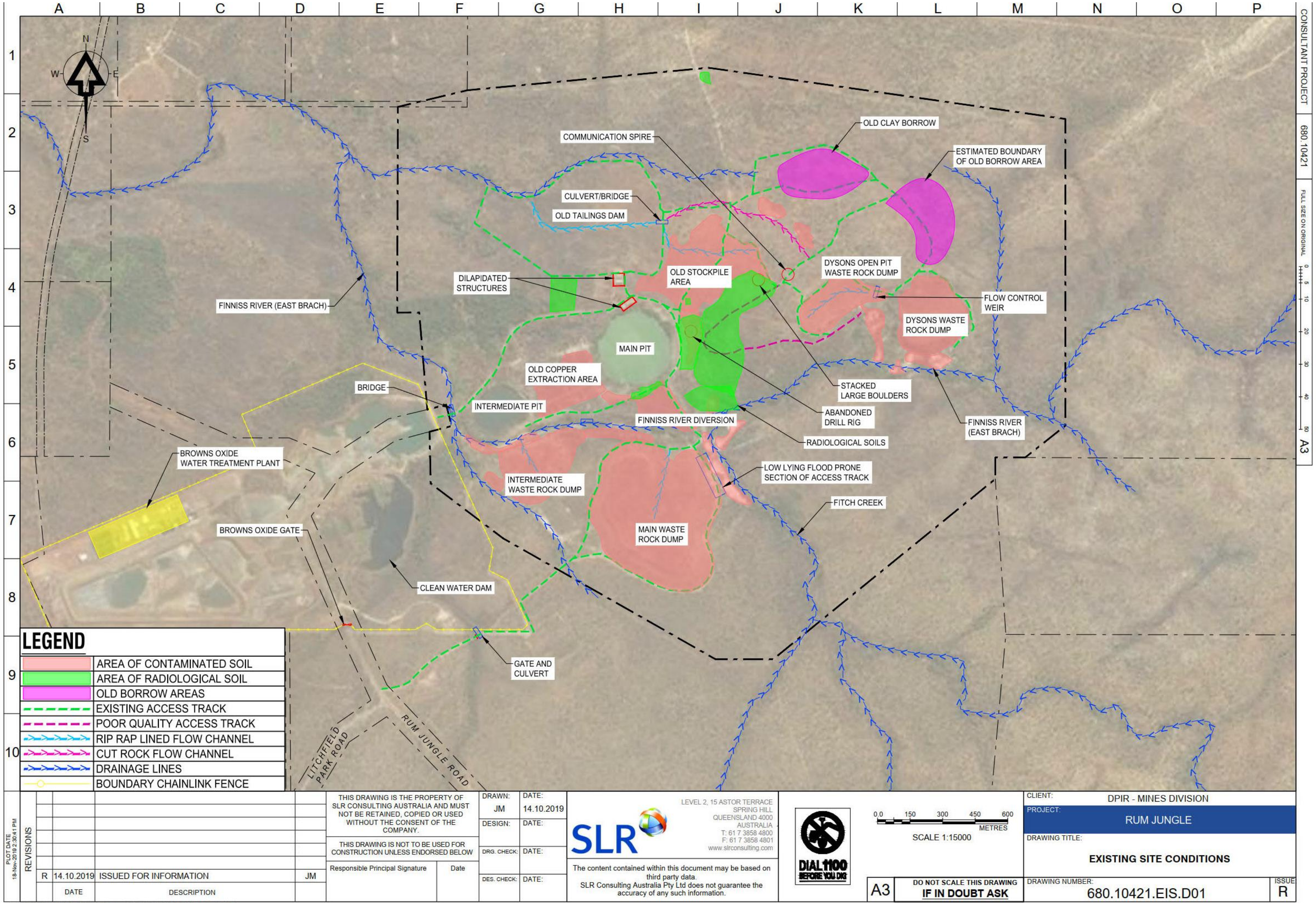


Figure 7: Existing Features at Rum Jungle Site

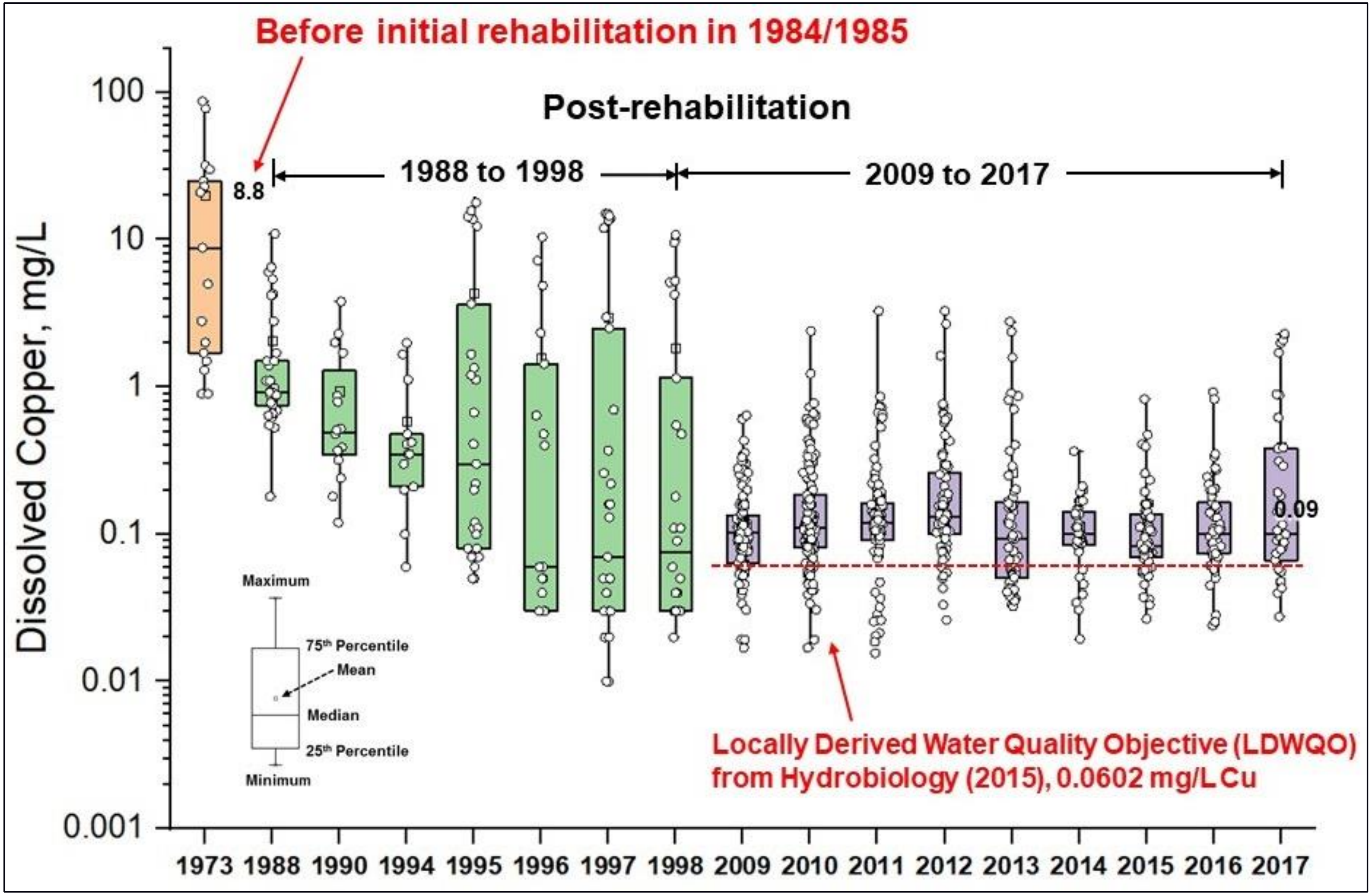


Figure 8: Copper Concentrations Downstream EBFR (GS150200) Prior and After 1980s Rehabilitation vs LDWQOs (figure produced by Robertson GeoConsultants 2019)

AMD processes onsite are driven by the waste rock that is stored within the existing site mining landforms. The waste rock materials at Rum Jungle have been well characterised over time (RGC and Jones, 2019) with approximately 85% of the volume of waste rock at the Rum Jungle site being Potentially Acid Forming (PAF). Figure 9 is a graphical representation of the PAF waste rock characterisation across site by current storage location. A high proportion of all waste rock stored at the site is classified as having a high acid forming potential (PAF-I) and only a small portion is classified as Non-Acid Forming (NAF). It is important to note that each pie chart represents a storage facility though stored volume at each facility varies.

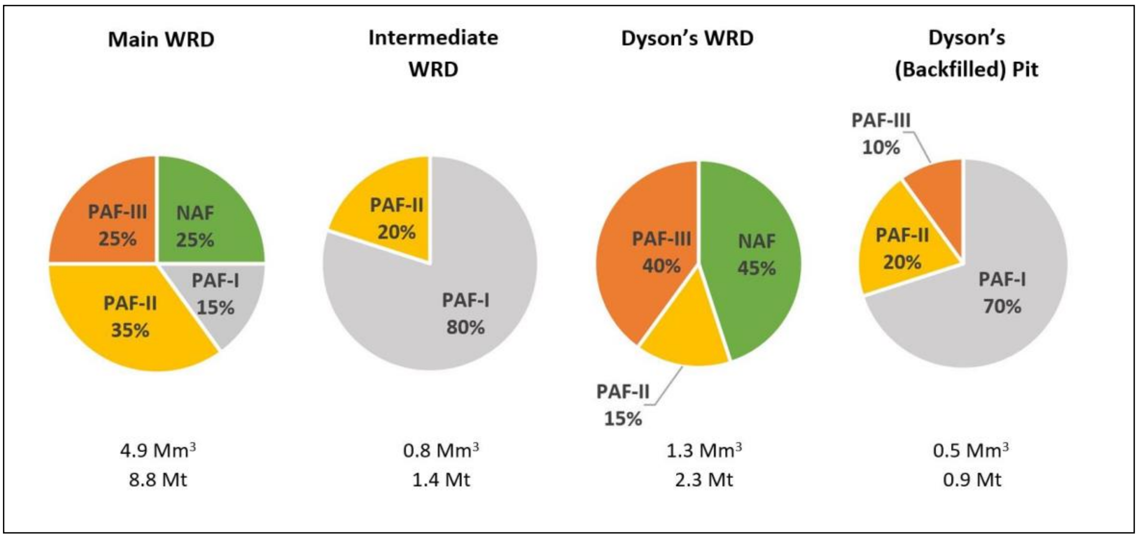


Figure 9: Distribution of PAF materials by Current Waste Storage Location on the Former Rum Jungle Mine Site

The contribution of copper loading to the EBFR varies across the site, however the majority of this load is sourced from the Intermediate WRD and Main WRD reaches as described here in Figure 10 produced by RGC (2019). These reaches correspond to the largest volume of PAF-I and PAF-II storage onsite.

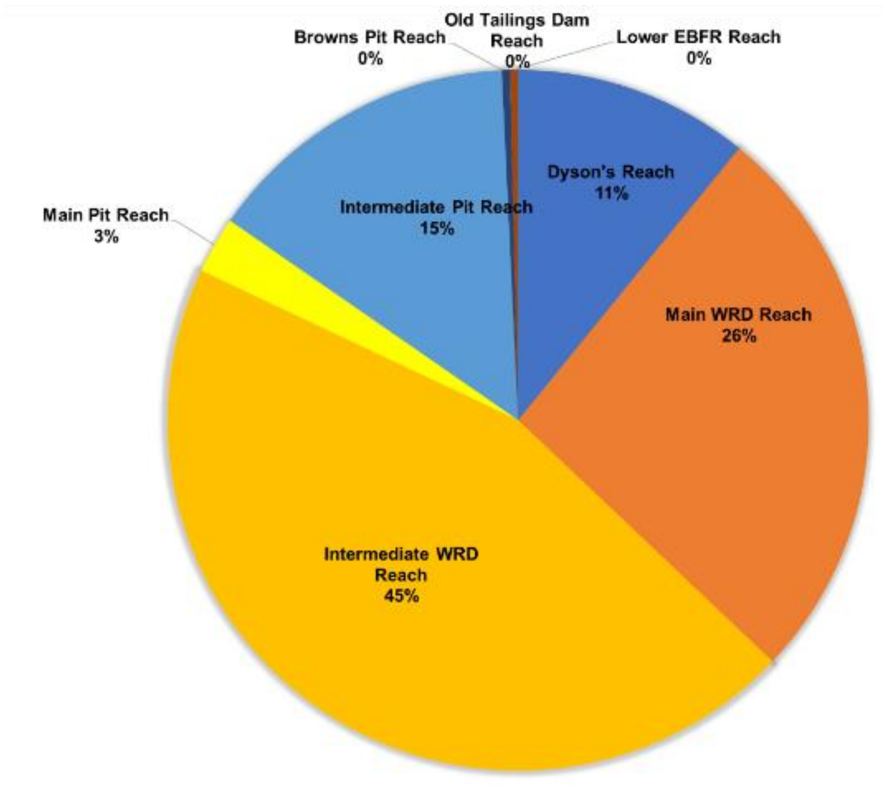


Figure 10: Copper (Cu) Load to EBFR by Rum Jungle Mine Reach (RGC, 2019)

The impacts to site from historic tailings storage were, by in large, remediated during the 1980s rehabilitation works. Minor traces of tailings materials remain on surface at the Old Tailings Dam and are not contributing significant loading to the EBFR.

Beyond principal sources of contamination affecting the EBFR (WRDs and AMD-impacted groundwater), significant tracts of land affected by mine operations also require rehabilitation in order to achieve the overall project objectives. The identification and evaluation of risks posed by ‘contaminated soils’ is somewhat confounded by the presence of naturally elevated background concentrations of several metallic elements in regional soils borne from the highly mineralised underlying parent geology of the Rum Jungle Complex. However, unacceptable soil contamination or soil conditions exist in several areas. Soils impacted by copper, AMD precipitates and radiological contaminants have been identified as part of site investigation works.

Limited amounts of Asbestos Containing Material remain onsite associated with buildings and relic mining equipment and machinery. These are mainly located in the former plant and workshop areas north of Main Pit, but also include remote and isolated equipment, such as an old drilling rig and davit equipment (east of Main Pit) and pumping/piping materials (eastern end of Old Tailings Dam).

The following table is the generalised Conceptual Site Model summarising the contamination sources, pathways and receptors.

Table 2: Tabulated Conceptual Site Model (Generalised)

<table>
<tr><th colspan="2">Source Details</th><th>Pathway Details</th><th>Receptor Details</th></tr>
<tr><td rowspan="5">Legacy WRDs and Operational Features
(primary contamination sources)</td><td rowspan="5"><u>Tailings and Waste Rock Dumps</u>
Intermediate WRD - predominantly PAF-I
Main WRD - full range of PAF and NAF
Dyson’s (backfilled) Pit - shallow backfill predominantly PAF-I
Dyson’s WRD - predominantly NAF
Main North WRD - contaminated spoil (NAF)

<u>Rehabilitated Former Operational Areas</u>
Copper Extraction Area - copper and sulphate
Former Plant Site - radiological soils and asbestos containing legacy structures
Old Tailings Dam Area - leached metal impacts in subsoils
Old Stockpile Areas - radiological soils and isolated pocket of process liquor (in sub-surface)</td><td><u>Contamination Vectors from Waste Rock and Contaminated Soils</u>
Atmospheric exchange due to cover-system absence or deterioration leading to increased acidification, sulphate and heavy metal release via seepage and/or leaching to groundwater.
Capillary rise of contaminants through cover systems to surface soils.
Seepage of impacts from landforms caused by infiltration and formation of elevated hydraulic pressure within mounded features.
Salt affected soils and drainage channel / watercourse sediments (secondary source).</td><td rowspan="2">Surface water body and sediments (ultimately EBFR)
Groundwater aquifer (and secondary source)</td></tr>
<tr><td><u>Surface Water and Groundwater Vectors</u>
Lateral migration of impacted soils through fluvial and aeolian dispersion.
Lateral migration of exposed residual contamination via surface water flow.
Vertical or lateral seepage of contamination within groundwater.</td></tr>
<tr><td><u>Radiation Vectors</u>
Release of radon and radiation associated with radiological sources.</td><td>Atmospheric and dispersion</td></tr>
<tr><td><u>Ecological Vectors</u>
Direct contact between terrestrial fauna and surface contaminants (sub-surface contaminants with burrowing fauna).
Bioaccumulation in terrestrial and aquatic flora and fauna.</td><td>Terrestrial flora and fauna (within riparian zone)
Aquatic flora and fauna (within nearby surface water bodies)</td></tr>
<tr><td><u>Human Health Vectors</u>
Ingestion of contaminated media via consumption of impacted flora, fauna, surface water and groundwater.
Direct contact with contaminated soils, sediment, surface water and groundwater.</td><td>Traditional land owners / users
Site workers
Other site visitors</td></tr>
<tr><td rowspan="4">Surface/Ground Water Features
(acting as secondary sources and pathways)</td><td rowspan="4"><u>Contaminated Groundwater</u>
AMD-impacted groundwater
Cu liquor impacted groundwater
<u>Legacy Mine Pits – Surface Waters</u>
Intermediate Pit
Main Pit
<u>Surface Water Channels (and sediments)</u>
East Finniss Diversion Channel
Upper EBFR (incorporating former Acid Dam)
Fitch Creek (incorporating former Sweetwater Dam)
Former EBFR Channel (now incorporating Copper Creek)</td><td><u>Surface Water and Sediment Vectors</u>
Dispersion / migration of contaminants in surface water and sediments.
Short term sinks for contaminated sediments.
Concentration / settling of contaminants in slow moving or stagnant waters during dry seasons.</td><td>Surface water body and sediments</td></tr>
<tr><td><u>Groundwater-Surface Water Interaction (seasonally ephemeral)</u>
Lateral seepage from groundwater to river in wet seasons.
Vertical or lateral seepage from river to groundwater in dry seasons.</td><td>Groundwater aquifer</td></tr>
<tr><td><u>Ecological Vectors</u>
Impacts to riparian zones from contaminated surface water, groundwater, sediment, or WRD seepage.
Bioaccumulation in aquatic flora and fauna.</td><td>Terrestrial flora and fauna (within riparian zone)
Aquatic flora and fauna (within surface water body)</td></tr>
<tr><td><u>Human Health Vectors</u>
Ingestion of (drinking) or direct contact with (bathing, recreational use) surface water.
Ingestion of contaminated media via consumption of impacted flora, fauna, surface water and/or groundwater.</td><td>Traditional land owners / users
Site workers
Other site visitors</td></tr>
</table>

Rehabilitation Strategy

A Land Use Plan has recently been developed by a panel of Traditional Owners, the Proponent and Australian Government officers. This panel discussed traditional views of the Rum Jungle site and developed a vision of the future that was cognisant of potential limitations due to current environmental conditions that will be rehabilitated to the extent reasonably possible and require future management. Traditional Owners expressed a range of views and beliefs about the importance of this land ranging from a view held by some that this land is associated with 'sickness country' through to strong connections to sacred sites. The Land Use Plan is shown in Figure 11. The future land uses proposed are conservation of new landforms to protect structural integrity, access to site for cultural practices, and potentially to utilise the cultural centre as a base for future land management activities across the FRALT. Other future land uses proposed include access to onsite and nearby country to teach younger generations bush skills and culture, practicing caring for country and potential cultural tourism ventures combining access to the cultural centre and bushwalks in undisturbed country. It is important to view this Plan through a lens of connected country where the current project boundary may not exist in future if the land claim is resolved. Already the undisturbed portions of land onsite connect to undisturbed FRALT land surrounding the Rum Jungle site.

The scope of works for the Stage 3 Rehabilitation Project was developed from an understanding of current site conditions, contamination processes and a Land Use Plan goal. In summary, the actions planned to address contamination processes are:

- Slow down the AMD production reactions from waste rock onsite by consolidating waste rock into one of three new facilities based on PAF characteristics. These facilities are:
  - Main Pit backfill zone – 1.9 Mm^3 stored volume
  - Eastern WSF – 3.8 Mm^3 stored volume
  - Western WSF – 3.2 Mm^3 stored volume
- Employ design criteria and construction methodology at the new surface WSFs to slow down AMD production reactions and solute transport. These include:
  - Thicker store and release covers than current WRD covers
  - Waste rock lime treatment to reduce heavy metal mobility
  - Waste rock compaction to reduce oxygen influx and water infiltration
- Treat existing groundwater sources (*i.e.* the Main and Intermediate WRDs) that contaminate the EBFR by pumping and treating these impacted waters.
- Treat other AMD-impacted groundwater that does not contribute to the EBFR copper load (*i.e.* old ore stockpile area) by pumping and treating these impacted waters.
- Isolate radiological and AMD affected soils at the Rum Jungle site and Mt Burton from environmental and human receptors by relocating these soils to the new WSFs on site.
- Isolate asbestos materials from environmental and human receptors by removing from surface soils and relocating to the new WSFs or by another approved means offsite.
- Slow down or halt the future generation and transportation mechanisms for copper and other metals in the new WSF by adopting leading practice methodology for storage of PAF waste rock.

The actions that are planned to address the compromised environmental and cultural values that are not related to contamination processes are:

- Return the EBFR to its original course as far as possible.

  Restore land parcels that are poorly vegetated such as the Old Tailings Dam area and vine thicket.
- Revegetate new landforms to stabilise the surface and restore ecological function as far as practicable.

A high level summary of the rehabilitation strategy elements is shown in Figure 12.

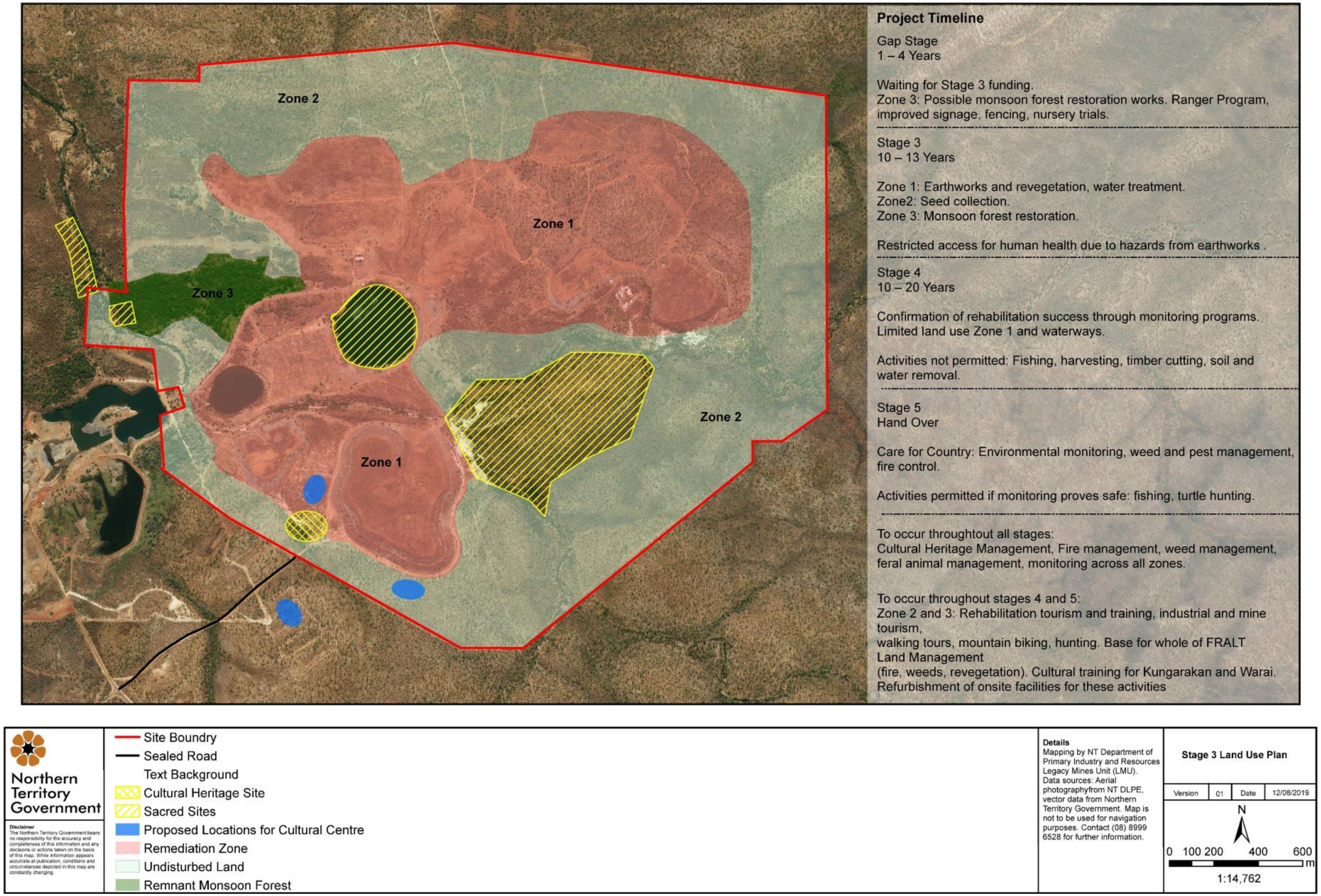


Figure 11: Land Use Plan

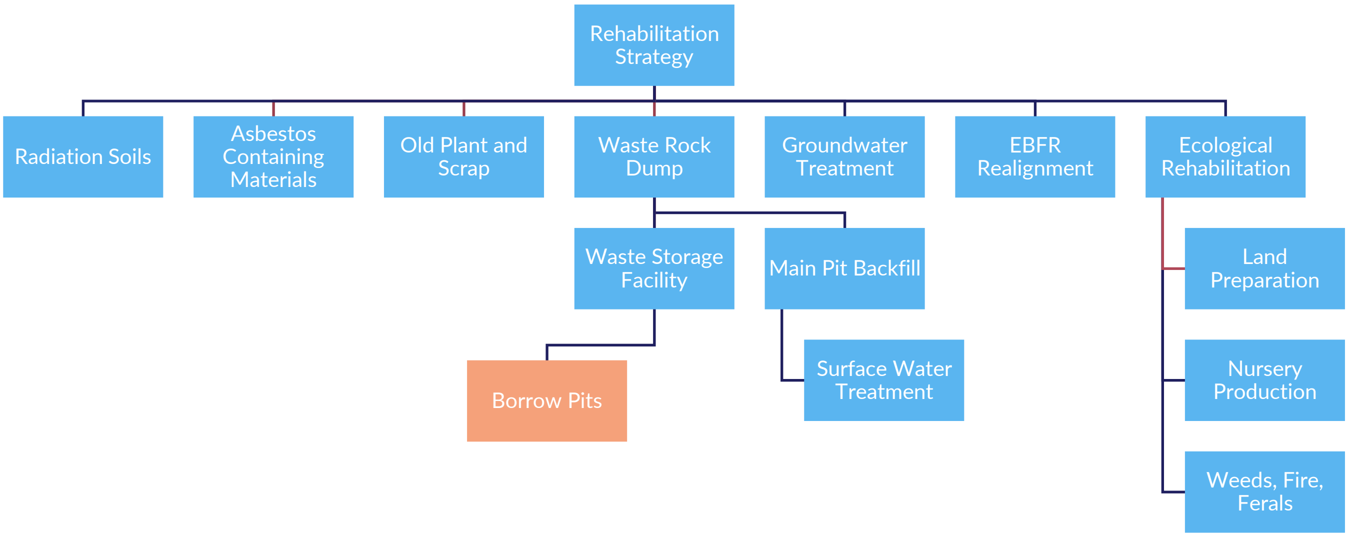


Figure 12: Rehabilitation Strategy Summary

Detailed methodology for key elements are described within the EIS Rehabilitation Strategy and other Chapters and include:

- Existing WRD deconstruction
- Radiological soil, Copper contaminated soil and salt affected soil remediation
- New WSF construction including waste rock placement, lime treatment compaction, and cover systems to mitigate operational and future AMD risk
- Risk mitigation measures during construction works to reduce potential safety and environmental risk as far as possible in the Project design phase
- Groundwater and surface water treatment processes
- Water management processes to achieve a safe and environmentally sound operating space
- Ecological rehabilitation including revegetation and management of threatening processes (fire and weeds).

The Stage 3 rehabilitation project is estimated to continue over a 10 year period as summarised in Figure 13.

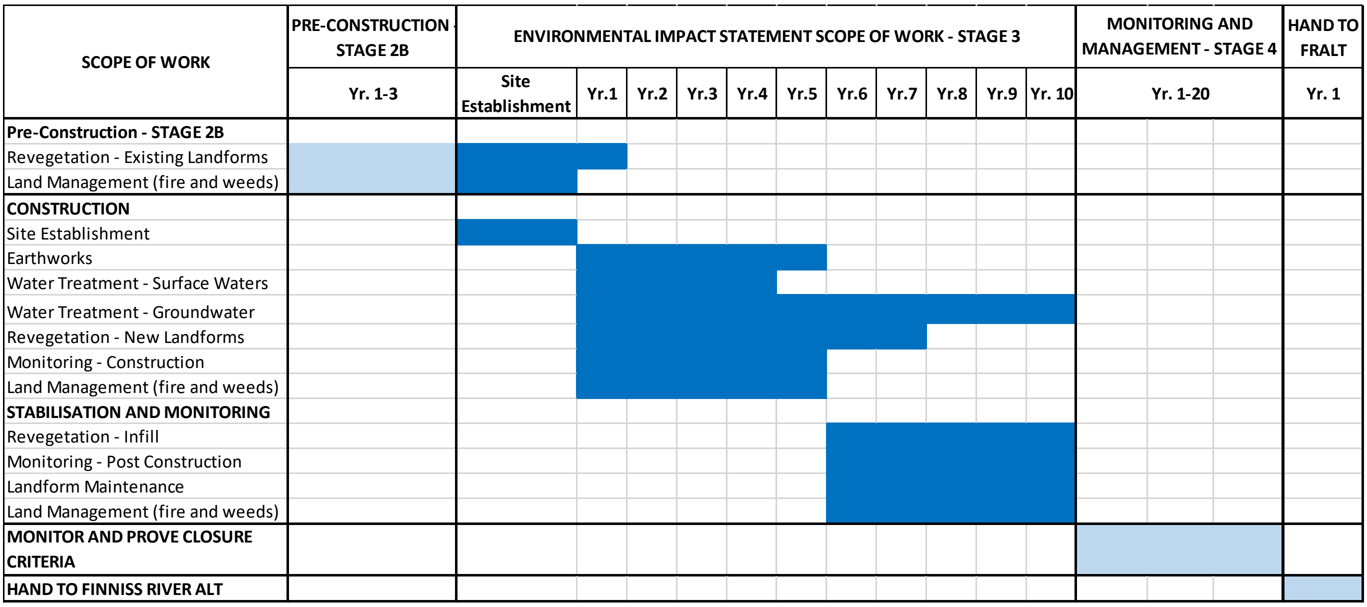


Figure 13: Project Phase Schedule

Construction of the new WSFs and other rehabilitated site landforms will require the import of approximately 3.7Mm3 of clean earthen materials to develop the covers for the new landforms. Generally, low permeability and granular materials are required to complete the earthworks tasks. Two potential borrow pits have been identified although formal agreements with the landholders are yet to be complete. The potential borrow pits are located as shown on Figure 2:. Haulage routes from these potential borrow sources to site are via a combination of public and private roads.

The most significant long term risk to site remains continued AMD generation and release in to the environment. Guidelines referenced in the establishment of the AMD methodology include the *Preventing Acid and Metalliferous Drainage, Leading Practice Sustainable Development Program for the Mining Industry* (DIIS, 2016) and the International Network for Acid Prevention (2019) *Global Acid Rock Drainage Guide*.

Key elements of the AMD management plan include methods to reduce oxidation of pyritic minerals and secondary minerals by submergence of the highest risk PAF material within the Main Pit void and WSF construction utilising 0.5m layers of lime amended compacted waste rock. Covers for these landforms incorporate further AMD reduction elements as described in detail within this EIS.

Threatening processes of uncontrolled bushfire and weed infestation are also likely to present long term challenges for the site and surrounding lands. Rehabilitation success metrics are also proposed within Chapter 7 – Rehabilitation Strategy.

Cultural Heritage

Protection of existing cultural heritage values within the Project footprint remains one of the highest priorities. A Heritage Branch search of the NT Archaeological Sites Register showed a large number of Aboriginal places and objects across the Rum Jungle area. These places and objects include stone artefact scatters, a quarry, a non-portable grinding place and isolated stone artefacts.

Several archaeological field surveys have been carried out over time in order to develop an understanding of the cultural heritage profile across the entire Project area. The 2010 archaeological survey identified 11 Aboriginal heritage objects (isolated stone artefacts) and 10 Aboriginal heritage places within the Rum Jungle Mine site (Martin-Stone and Wesley, 2011). The heritage places range from small artefact scatters to more concentrated occupation sites, including a quarry and artefact production site and an extensive palimpsest. The 2018-19 archaeological survey identified 16 Aboriginal heritage objects (isolated stone artefacts) and three Aboriginal heritage places (stone artefact scatters).

Figure 14: Aboriginal isolated stone artefacts found on Rum Jungle former mine site

The compilation of mapped cultural heritage sites was used to inform the Project design in order to protect and preserve cultural heritage. Of particular importance is the location of infrastructure, such as roads and the new WSF, which were designed around known cultural heritage features.

No heritage places or objects were identified in the proposed low permeability material borrow area and several objects were identified in the proposed granular material borrow area, however these are planned to be avoided through project design.

The Project area contains several sacred sites and an AAPA Authority Certificate has been issued for the Rehabilitation Project.

Consultation with Traditional Owners over time has led to the development of an understanding of culturally significant species and flora specimens. In order to minimise impact to culturally significant species and specimens, the Project footprint has been designed around existing vegetation stands as far as possible.

The proposed final site layout demonstrates that the rehabilitation design prevents impact on known cultural heritage values. The rehabilitation success metric is to protect and preserve cultural heritage places and objects *in situ* as priority and to comply with legal requirements and procedures within a Cultural Heritage Management Plan for relocation of any objects that may be required. All heritage values that are protected under the terms of the Sacred Sites Act and the *Heritage Act* 2011 (NT) will be protected in accordance with those laws.

The conditions within the Authority Certificate, combined with the implementation of additional measures within the Cultural Heritage Management Plan, reduce the residual impact of the initial risk ranking of Extreme for the disturbance of registered sacred sites to a Medium risk ranking. The residual impact of all previously High risk heritage impacts has been reduced to a Medium risk rating, through the implementation of the proposed mitigation measures.

Terrestrial Environmental Quality

The Rum Jungle Rehabilitation Project exists within a highly disturbed terrestrial environment due to historic mining activities. Previous rehabilitation works have improved the terrestrial environment, however, the environmental values of the Rum Jungle Mine site remain impacted by the altered mining landscape, weeds, altered fire regimes and contaminated sites. The Project area is comprised of natural undisturbed landforms areas, areas impacted by mining such as the Mt Burton WRD, the Main and Intermediate Pits and their WRDs, and areas where contaminated soils/tailings were both removed from and relocated to during rehabilitation works. The assessment of impacted terrestrial environmental values is therefore somewhat confounded by the industrial and rehabilitation history of the site alongside mineralised geology, which has influenced natural soil quality in the area.

Key risks to the Stage 3 terrestrial quality values include erosive stability and geotechnical stability of the newly constructed landforms which are to be mitigated through the design, construction and post construction monitoring phases. Revegetation success plays a critical role in stabilisation and is described further in the rehabilitation strategy.

Threatening processes of weed invasion and uncontrolled bushfire will remain a long term hazard for the project as they are for surrounding properties at present.

Inland Water Environmental Quality

Water quality at the former Rum Jungle Mine site is degraded by AMD and this impacts the health of the Finniss River downstream. The primary AMD sources are sulphide-bearing waste rock in the historic WRDs and leached low-grade ore and contaminated soils placed in shallow zones of Dyson's Pit during rehabilitation in 1984/1985 (Allen and Verhoeven, 1986). Groundwater quality in some areas of the site is further degraded by historic AMD sources that were eliminated by rehabilitation in the 1980s or by metalliferous liquor lost during an experimental heap leach operation from 1965 to 1971 in the Copper Extraction Pad area.

The EBFR is characterised by elevated SO_4, Mg and most metals related to AMD. Concentrations of most parameters are highest in the early Wet season during the first flush when seepage that has accumulated in the Dry season is driven downstream by pulses of clean water from upstream. During higher flow periods during the Wet season, LDWQOs for Al, Cu, Co and Fe are commonly exceeded in the EBFR whereas LDWQOs for SO_4, Mg, and Zn are rarely exceeded. Cu has been identified as a key contaminant of concern because it consistently exceeds LDWQOs and has a higher toxicity than other metals present in the AMD produced onsite.

Further rehabilitation works as proposed in the EIS are predicted to greatly improve groundwater and surface water quality such that LDWQOs are met for most of the time. The annual average Cu load in the EBFR is predicted to be reduced by about 90% during Stage 3 water treatment operations and for 5 years thereafter. Loads of other metals, including Al, Fe and Co will likely be reduced by a similar margin, meaning each of the LDWQOs for the EBFR would be achieved.

Post-rehabilitation

Post-rehabilitation the average annual Cu load in the EBFR is predicted to be approximately 1.0 t/year, or about 60% lower than the current load in the EBFR (from 2010 to 2018). The Cu load in the EBFR in Year 40 (30 years after construction is complete) is predicted to be 0.6 t/year, which is 75 to 80% lower than current conditions. In Year 40, residual AMD-impacted groundwater is predicted to be the primary source of Cu and other metals to the EBFR, as lime-amended waste rock in the WSF and backfilled Main Pit will likely be minor sources of Cu to groundwater and, in turn, the EBFR.

Future updates/refinements of the groundwater model and water and load balance model would provide more certainty regarding the timing and degree of future improvements in groundwater and surface water quality onsite. These models will be updated in Stage 3 when further calibration data are available and additional information is obtained on groundwater conditions near the new WSF. Further details on recommended work and model updates are provided in RGC (2019).

Hydrological Processes

The Project area exists within the Finniss River catchment, the watercourse is referred to as the Finniss River (main or trunk) until a confluence where it branches into the East and West Branches. The majority of the project footprint is within the catchment of the East Branch. The exceptions are Mt Fitch and Mt Burton which are adjacent to the West Branch, and the low permeability material borrow area which is adjacent to Meneling Creek (which flows into the West Branch).

The Finniss River is dynamic in terms of flow and sediment processes, the key elements of which include monsoonal/season rainfall, high rates of sediment delivery from an eroding mine landscape, a sand-bearing geology and high groundwater connectivity

The following summary of the two branches has been constructed from information in Metcalfe (2002):

- The West Branch (and, indeed, the main Finniss River) is a large, permanent watercourse. It typically has steep banks (3 to 5 m high) that are terraced, a relatively extensive floodplain and is characterised by sandy, heavily-vegetated levees. Billabongs are associated with the watercourse and floodplain areas, and downstream it flows through the Finniss River Coastal Floodplain Site of Conservation Significance which supports several listed threatened species.
- The East Branch is a semi-permanent stream within a distinct channel that dries to a number of pools in the mid to late Dry season depending on the amount of rainfall in the preceding Wet season. The stream bed is typically broad with low, earthy banks 1 to 3 m high with many sandy to rocky mid-stream shoals. Although riparian vegetation on the East Branch shows obvious signs of degradation, it currently supports a reasonable density and diversity of riparian species. The East Branch riparian corridor typically merges rapidly with surrounding Eucalypt woodland areas; there is little to no surrounding floodplain areas.

Flows in the East Branch vary predictably in response to intra-annual variability in rainfall and typically vary by several orders-of-magnitude over the course of a single year.

The low permeability material borrow area has only a first order drainage depression transecting it north to south, possibly created by an old track as it supports no riparian vegetation. The proposed borrow area is adjacent to Meneling Creek. The granular material borrow area contains two, low order ephemeral creeks that are, in the lower reaches, bordered by riparian vegetation; these flow into Fitch Creek. Mt Fitch contains an artificial waterbody (a water-filled pit from historic mining) and a north-south drainage line which runs into the main Finniss River. Mt Burton is adjacent to a spring-fed creek and is near to the West Branch (Figure 15).

During operation, Rum Jungle Mine delivered substantial downstream contamination – primarily caused by copper derived from AMD – into the East Branch, causing severe detriment to the water and sediment quality downstream, and appreciable detriment in the main Finniss River for 15 km downstream of the junction with the West Branch (based on measures made in 1973/4; cited in Jeffree *et al.*, 1992; Jeffree and Twining, 1992). Some of the hydrological processes are already compromised because of historic watercourse diversion activities at the Rum Jungle Mine and the East Branch is a highly disturbed ecosystem. One of the primary goals of the Project is to remedy this as much as possible; nevertheless, as detailed below, there remains the possibility that certain Project activities could temporarily have the opposite effect.

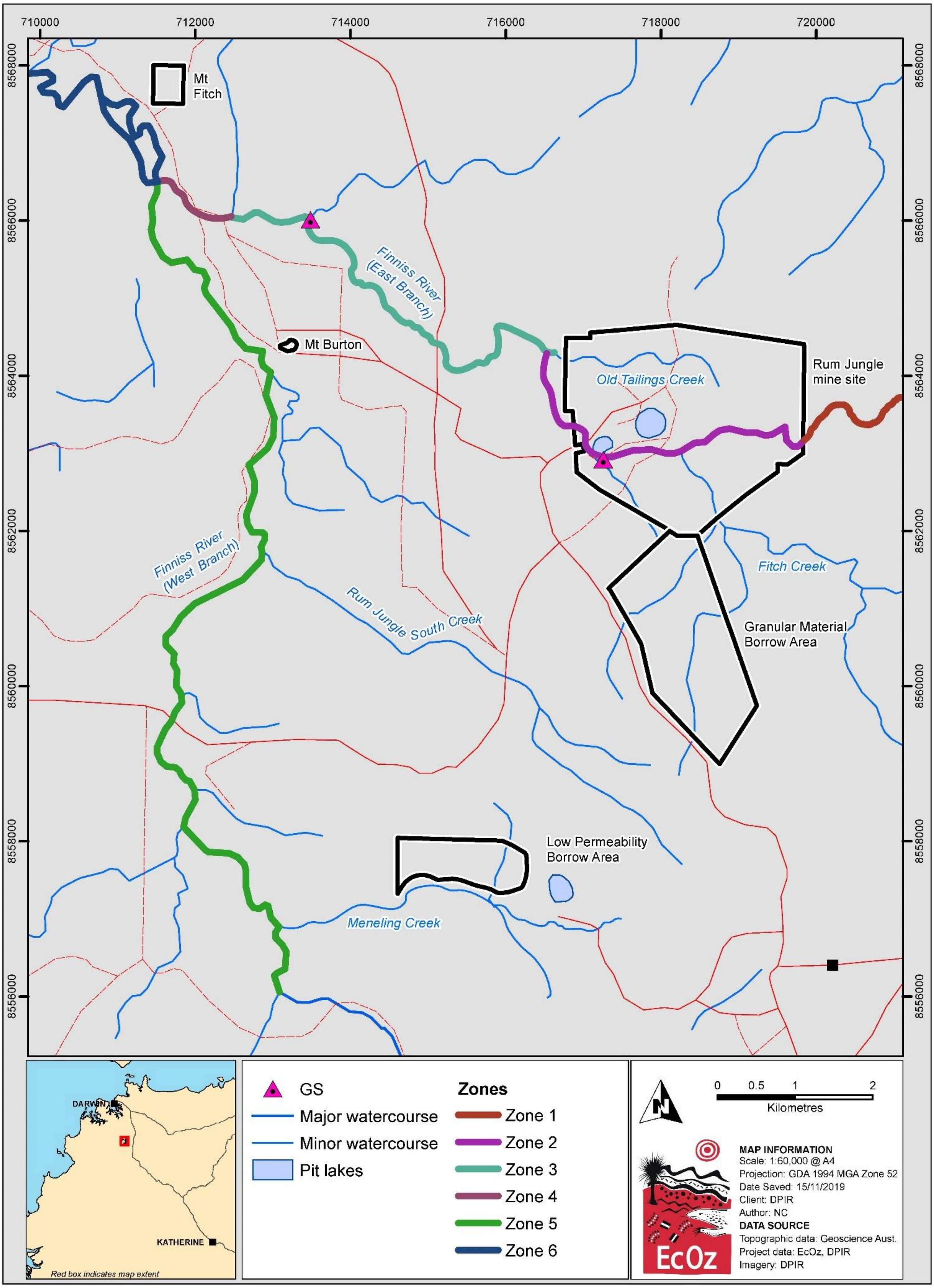


Figure 15: Project Elements in Relation to Water Courses

Impacts due to Altered Flow Regimes

The majority of the annual flow volume in the section of the EBFR that bisects the former mine site occurs during the Wet season, and this section often has standing water for most of the year although flow ceases fairly early on in the Dry.

There are currently no planned works that would result in reduced Wet season flow regimes in the East Branch. However, in order to safely manage surface waters within the site pits and to backfill Main Pit in the most efficient manner possible, it is proposed that surface water discharge from site would be required during the Cease to Flow period (Dry season). The volume of this discharge is estimated at 10-17 L/s (totalling approximately 0.2 GL) and is equivalent to the Water Treatment Plant outflow. This discharge period would run in conjunction with the Main Pit backfilling operation proposed to be carried out over three Wet seasons. The total additional volume to EBFR (ephemeral) from the treatment system is approximately 6% of a typical 'drier' year flow. The total additional volume to the Finniss River proper (near-perennial) is <1% at the confluence with the EBFR.

The impact to hydrological processes due to altered surface water flow regimes during backfilling operations will also be moderated by maximising use of treated water in the dust suppression and construction processes onsite. The Dry season correlates with the highest water demand period for dust suppression and construction as all work areas will be subject to low humidity, warm conditions and high equipment movement rates. The availability of this treated water also offsets the need to abstract from clean water sources for the purpose of dust suppression and construction.

Although it would be desirable to discharge to the EBFR during the Dry season for the post-backfill period of six years, this additional period of time may be considered to pose an unacceptable risk to the downstream ephemeral systems. Alternatives to the Dry season discharge include the construction of a substantial water storage facility onsite or the further drawdown of Intermediate Pit during the East Branch flow period. Both alternatives are considered to be not warranted, as the resulting additional potential risk to the local Groundwater Dependant Ecosystem (GDE; vine thicket immediately north of Intermediate Pit) and additional expenditure of public funds cannot be outweighed by the potential impact to downstream aquatic ecosystem health. The impact to downstream aquatic ecosystem health is considered to be Moderate due to:

- The short-term nature of this activity (three seasons);
- The current impacted aquatic ecosystem health of the downstream East Branch due to historic water quality impacts from Rum Jungle AMD; and
- The Finniss River proper is a large permanent watercourse, therefore impacts to it can be absorbed.

Therefore, at worst, any detrimental impact would be experienced in the East Branch section from site up to 8 km downstream at the point of confluence with the permanent watercourse. This is the section of the river that is most heavily impacted by historic and ongoing AMD generation. An efficient alternative storage arrangement for the post-backfilling period can be found in the Intermediate Pit.

Impacts due to Groundwater Drawdown

There is the potential that changes, either positive or negative, in groundwater levels of surrounding aquifers due to Project activities could be detrimental to GDEs such as the vine thicket to the north of Intermediate Pit. Groundwater drawdown is expected to be impacted by the groundwater treatment process throughout Stage 3 works and Intermediate Pit drawdown over the three year Main Pit backfilling process. The Intermediate Pit drawdown has the potential to impact the vine thicket GDE as the water body is hydraulically connected to the groundwater to the north.

The impact to this GDE is expected to be mitigated by the short three year treatment duration, and the groundwater recovery and treatment process is not expected to impact the vine thicket ecosystem in the long-term. Upon completion of the Main Pit backfill and the return of Intermediate Pit water levels, the water body will buffer fluctuating groundwater levels during the remaining Stage 3 works and into the future.

The risk of impact to the GDE during the Main Pit backfilling process is balanced by the need to maintain the 'live storage' volume within Intermediate Pit during backfilling to mitigate the risk of overtopping the impacted surface waters to the EBFR. The risk appetite for overtopping was determined to be lower than that for the groundwater drawdown. Potential impact to the GDE could be reduced by reducing the 'live storage' capacity and accepting a higher potential likelihood of overtopping during high rainfall events.

Stage 3 East Branch Water Course Re-instatement

A cornerstone of the cultural restoration of the Rum Jungle site is to restore, as far as possible, the original flow path of the EBFR. This has been explicitly requested by senior Traditional Owners and Custodians of the site. This will involve the reconstruction of a flow path that safely conveys water through the Main Pit Lake, the original river bed, the Intermediate Pit Lake and then discharge to the main channel of the East Branch. This is expected to have a positive impact on restoration of site cultural values, on seasonal passage of aquatic fauna, on aquatic fauna colonisation of onsite features such as the Main Pit Lake and on control of site AMD contamination processes.

The reinstatement of the EBFR flow path will not significantly alter downstream hydrology. There may be a slight delay in 'wetting up' of this section of the watercourse as the Main and Intermediate Pits fill to the point of overflow.

Most of the existing hydrological processes and aquatic ecosystems within the Project footprint – especially in the East Branch – are already compromised because of historic and present-day contamination processes. One of the primary goals of the Project is to remedy this as much as possible; nevertheless, there remains the possibility that certain Project activities could have the opposite effect. Minor alteration of surface water flows are unavoidable. However, the Proponent proposes that the temporary (*i.e.* three Dry seasons) and spatially-constrained nature of this potential impact is an acceptable compromise in order to efficiently and effectively backfill the Main Pit void. The potential impact is also moderated by the existing condition of the East Branch and the small volume and flow rates of released water in comparison to those in a typical Wet season.

At the end of Project completion, the EBFR flow will be split across the current diversion channel and the newly reinstated EBFR watercourse. Currently, the EBFR flow through site is split across the current diversion channel and the EBFR watercourse however the hydraulic control is to be modified to maximise flow as far as possible through the original course. The final landform around Main Pit will be safe, stable and suitable for revegetation as required by site Custodians. The vegetation system must act as a 'screen' to block the view of this water body as requested by Custodians.

The groundwater elevations post-construction are expected to rebound to current conditions as the two pits will aid in the re-establishment of groundwater elevations. Assuming proper adoption of the mitigation measures, the residual incremental risks relating to aquatic ecosystems and beneficial uses have all been assessed as Medium to Low.

Aquatic Ecosystems

The Finniss River has been subject to contamination from the Rum Jungle Mine for more than sixty years. The assessment of Hydrobiology (2013a) is that along the main Finniss River:

> *The riparian vegetation assemblage was recovering well from the severe dieback resulting from the Old Tailings Dam failure and other unregulated pollution events during and immediately following the period of active mining.*

Hydrobiology (2016a) concluded from its longitudinal study of fish survey results (*i.e.* prior to rehabilitation, ~10 years (1990s) and ~30 years post-rehabilitation (2010s) that:

> *Fish communities from sites downstream of mine inputs prior to the 1980's remediation were significantly different from unexposed sites, being depleted in abundance and diversity. However, this was not the case for samples post-remediation, where there appeared to have been recovery of fish communities …. [immediately downstream of the confluence]…*

Throughout several rounds of downstream aquatic ecosystems survey, three threatened species have been identified within the aquatic and riparian zones – the Lorentz Grunter, Merten's Water Monitor and Mitchell's Water Monitor.

The completion of the Stage 3 rehabilitation works is likely to see an improvement in physical conditions for all aquatic and riparian species and it follows that an improvement in aquatic ecosystem health may occur. Recovery noted by Hydrobiology (2016) after the early 1980s works provide an indication that the system will recover further if water quality improves. Delivery of the Stage 3 works potentially presents some risks to the aquatic ecosystem such as risk of impact due to water contamination, sedimentation and altered flow regime. All of these potential impacts, however, can be controlled through the mitigation measures detailed in relevant chapters of the EIS that have been developed to minimise impacts to water quality or water quantity.

Social and Economic Impacts

The policy context for the Project includes Commonwealth, Territory and Local Government policies, plans and frameworks with key policy being the Closing the Gap Strategy (Refresh), Our North, Our Future: White Paper on Developing Northern Australia and the NTG's Local Decision Making 10 year plan. Locally, the Project may impact the implementation of CCGC's Strategic Plan 2019-2023.

Key communities of Batchelor, Adelaide River, Darwin and surrounds are likely to be positively impacted by the Project's provision of potential employment and economic development. There are likely to be opportunities for employment, training and economic development from provision of goods, services and materials. Potential negative impact may include increase local traffic impacts through import of materials to complete the Project. This will be managed under the NTG's existing traffic safety management framework (overseen by DIPL). The risk of the Project not meeting community expectation in regards to environmental and social outcomes is a risk that will be managed through sound stakeholder consultation continuing into the future.

In addition to local benefits, mine closure and mine rehabilitation are expanding fields and Rum Jungle offers a unique opportunity to advance the profession and provide meaningful lessons learned. Successful implementation of the Project will significantly benefit the mining industry, the mine rehabilitation and closure profession, and the NTG. Further, the skills developed by professionals, Traditional Owners and local contractors will be transferrable to other mining, mine closure and rehabilitation projects. This is likely to result in increased knowledge and experience in the public arena but also increased future employment opportunities for Traditional Owners and NT companies and individuals.

Terrestrial Flora and Fauna

The nature of this Project is such that one of its key purposes is to improve terrestrial flora and fauna values which have been impacted by historic mining practices and modern threats of weed invasion and fire regimes. The Project area has been well studied over time and the borrow pit areas have been specifically selected as they carry low ecological value due to historic degradation from agriculture and sand mining practices. Key risks posed to flora and fauna during Stage 3 works include potential exacerbation of local weed distribution and subsequent altered fire regimes.

Impact due to land clearing is a risk that has been well examined through Project design with the most important control being to prioritise areas of disturbance within footprints that have low ecological value. As a result total predicted area of remnant bushland that will be cleared is less than 12 ha. The Land Clearing Guidelines (DENR, 2019) are to be applied. Project design has minimised terrestrial ecological impacts while preserving geotechnical stability of new landforms. Stage 3 operating controls will include a vegetation clearing procedure, weed and fire management plans.

The most significant risk to terrestrial flora and fauna values, and one that could be exacerbated by Project activities, is the scale and density of Gamba Grass infestations within the footprint and the concomitant increase in bushfire intensity. Mitigation of that risk is possible, but will require the thorough implementation of the weed management strategy and a dedicated commitment of resources (personnel, equipment and chemicals) for an indefinite period. The residual impact will be Low if implementation of these steps are successful. If this commitment does not occur during rehabilitation and weed invasion carries through to the post-rehabilitation period there is a significant risk that weed infestations will jeopardise revegetation efforts and the site will return to a reflection of what is today.

Dust and bushfire, both risks to occupational health and safety, as well as terrestrial biodiversity, will be managed using a suite of standard industry mitigation and control measures. Consequently, the residual impact of these is projected to be Low.

Threatened Species

As detailed in the EcOz 2019 report (included in the appendix of the EIS) five species were identified as having a high or medium likelihood of occurring within the Project footprint:

- Darwin Cycad (*Cycas armstrongii*)
- Partridge Pigeon (eastern subspecies) (*Geophaps smithii smithii*)
- Black-footed Tree-rat (Kimberley and mainland NT subspecies) (*Mesembriomys gouldii gouldii*)
- Masked Owl (mainland Top End subspecies) (*Tyto novaehollandiae kimberli*)
- Red Goshawk (*Erythrotriorchis radiatus*).

For the latter two species, the areas within the Project footprint that will be directly disturbed by land clearing are unlikely to represent important habitat.

Darwin Cycad

The Darwin Cycad (*C. armstrongii*) is the only threatened flora species recorded within the Project footprint and its surrounds. Flora surveys recorded the Darwin Cycad as abundant in numerous locations across the region however the highest densities onsite are considerably lower than those recorded at sites further north. Therefore, even the highest densities within the Project footprint would be considered low in a regional context. Although there are recent records of the species within and proximate to the Project footprint, these do not constitute a key source population nor one near the limit of the species' distribution. For these reasons, the occurrence of this species within the Project footprint is not considered an 'important' population (as defined in *EPBC Significant Impact Guidelines 1.1*). The species is, however, a culturally-significant species and measures will be employed to minimise the impact of land clearing on this species.

Partridge Pigeon

The Project footprint lies within the core of the Partridge Pigeon's range and there are two confirmed recent records (2014) from just north of the mine site, as well as recent detection of Partridge Pigeon calls (2016) in the centre-north of the mine site. However, there is no evidence that Partridge Pigeons in the region constitute a key source population or one that is necessary for maintaining genetic diversity. Moreover, the Project footprint is located well within the known distribution of this species, not at its limits. For these reasons, the occurrence of this species within the Project footprint is not considered an 'important' population (as defined in *EPBC Significant Impact Guidelines 1.1*).

Black-footed Tree Rat

Black-footed Tree-rat was recorded by EcOz (2019) in the *Eucalyptus* woodland in the northern-centre of the mine site. In the same survey, the species was also recorded at three sites in undisturbed areas of the potential granular material borrow area south of the mine site and at a site along a rocky ridge between Litchfield Park Road and Rum Jungle Road – see Figure 14-25. All these areas contain remnant woodland that is not infested with Gamba Grass. It is likely that Black-footed Tree-rats occur in any such habitat within the Project footprint. The Black-footed Tree-rat is listed as Endangered under the EPBC Act and Vulnerable under the *Territory Parks and Wildlife Conservation Act 1976* (NT). The occurrence of this endangered species within the project footprint is considered an 'important' population.

The inherent risk of significant impact on this species has been assessed as Low as the Project footprint is predominantly within already disturbed areas. In the adjacent undisturbed areas there are very large areas of suitable habitat available to support the local Black-footed Tree-rat population. A negligible proportion of this habitat will be disturbed (temporarily) during construction works (<12 ha). A few individuals may be impacted upon directly or indirectly during construction activities or all individuals that were potentially impacted upon may temporarily relocate to adjacent suitable habitat. None of these consequences constitute a significant impact to this species and no offsets are required.

Black-footed Tree-rats seldom occur in areas infested with Gamba Grass and so, in the absence of weed management measures, there is an inherently High risk that Black-footed Tree-rat habitat could be lost to Gamba Grass invasion regionally. It is therefore imperative that Gamba Grass management is successful to avoid a significant impact to Black-footed Tree-rats.

Assuming weed management and rehabilitation is effective in reintroducing native species, the Project could be of net benefit to this species and other threatened species such as Partridge Pigeon and Darwin Cycad.

Radiation, Health, and Safety

Stage 3 of the Project is relatively high risk to worker health and safety due to being a bulk earthmoving and water treatment activity, undertaken on a relatively remote brownfield site with a challenging climate. Unmitigated, select Project activities have a high likelihood of having a significant impact on the health and safety of site personnel and possibly the general public. All of these potential impacts, however, can be controlled through the mitigation measures detailed within the EIS. Assuming proper adoption of the mitigation measures, the residual risk ranking for all human health and safety has been assessed as Medium or Low.

Previous studies have informed the extent of radiological contamination at Mt Fitch, Mt Burton and Rum Jungle that requires remediation. Contaminated material will be excavated, moved and encapsulated within the WSF. There will be sufficient monitoring procedures in place to ensure all material above a certain radiological level is treated appropriately. Upon the conclusion of works, there should be no residual areas with unacceptable radiation levels.

Working with radioactive materials is a heavily-regulated activity. The Proponent's objective is best practice – *i.e.* to not just be below reference levels for dose limits, but to further reduce exposure to as low as reasonably achievable. The Radiation Management Plan (EcOz, 2019d, included in the EIS Appendix) details procedures and measures that will ensure no workers on this Project will receive unacceptable doses of radiation. Because of site access limitations and the distance to sensitive receptors, there is a very low risk that the total effective dose equivalent to individual members of the public would exceed the recommended level.

Post-works, some additional studies may be needed to inform potential impacts to certain critical groups – particularly regarding ingestion pathways. Those studies, and the interpretation of their results, will be informed by the Land Use Plan which has only just recently been developed. Certain land use activities may be restricted or modified depending on the outcomes of those studies. On the basis of the assessment of potential impacts and the recommended mitigation measures in the EIS, overall, the proposed rehabilitation of the site is not likely to impose significant adverse radiological effects on the environment or humans.

Matters of National Environmental Significance

This proposal requires assessment and approval under the EPBC Act before it can proceed. The controlling provisions protected under Part 3 of the EPBC Act are:

1. Listed threatened species and communities (sections 18 & 18A).
2. Protection of the environment from nuclear actions (sections 21 & 22A).

The Project is being assessed under the bilateral agreement between the Australian and Territory Governments made under section 45 of the EPBC Act.

Protected Matters Search

A Commonwealth Department of the Environment and Energy Protected Matters Search was conducted by the Proponent in preparation for this EIS (Rum Jungle Mine site and a 100 km buffer). The results of the search supported and directed the subsequent surveys onsite, the results of which have informed project design to ensure any and all potential impacts on MNES have been reduced to acceptable levels through design, schedule or other controls. The outcomes of the Protected Matters Search, relevant to the project's controlling provisions, are presented in Table 3.

Table 3: Summary of protected matters (100 km buffer)

Protected matter	Number	Comment
World Heritage Properties	1	Kakadu National Park
National Heritage Places	1	Kakadu National Park
Wetlands of International Importance	1	Kakadu National Park
Commonwealth Marine Area	1	EEZ and Territorial Sea
Listed threatened ecological communities	0	-
Listed threatened species	50	8 flora species 34 fauna species 8 estuarine/marine species
Listed migratory species[2]	69	23 Marine Species 6 Marine Birds 6 Terrestrial Species 34 Wetland Species

Other matters protected by the EPBC Act of note include the Finniss Floodplain SoCS which is listed as a Nationally Important Wetland. The SoCS forms a component downstream receiving environment.

Listed threatened Species and Communities

The Project footprint is predominantly a highly disturbed landscape because of historical mining activity and/or infestation by Gamba Grass which has also caused altered fire regimes. This has had a negative impact on the terrestrial flora and fauna values of the footprint and surrounds. The goal of the Project is to rehabilitate previously disturbed land in such a way that environmental values and habitat condition are significantly improved. Because of the nature of the Project and the already reduced habitat quality within most of the footprint, most Project activities present a low risk to those values (see Chapter 14 – Terrestrial Flora and Fauna). If successful, the result should be net increase in terrestrial flora and fauna values – namely improved vegetation health and habitat condition, reduced landscape fragmentation and increased fauna diversity and abundance.

Active steps in the project design phase have been taken to reduce the need to further disturb currently undisturbed footprint. The new WSF to be constructed onsite is to be placed in an area that is by majority, already disturbed. Additionally, clean cover borrow materials are to be sourced from historically disturbed footprints thus reducing the impact to intact ecological communities.

Protection of the Environment from Nuclear Actions

On the basis of the assessment of potential impacts and the recommended mitigation measures in Chapter 16 of the EIS, overall, the proposed rehabilitation of the site is not likely to impose significant adverse effects on the environment. The implementation of a Radiation Management Plant and the Land Use Plan will further reduce risks to both humans and the environment resulting in a low residual impact. Active steps in

[2] Not a controlling provision on Notification of Referral Decision dated 4 August 2016.

the project design phase have been taken to reduce the need to handle radiological materials across the project and to retain existing below surface storage for the majority of the historic mine tailings.

The assessment of risks to MNES and mitigation measures described to protect biodiversity, surface and ground water, and cultural heritage values will minimise risks to the environment within (and beyond) the project area. The project therefore is unlikely to cause significant impacts to MNES.

Project Alternatives

The range of alternatives explored by the Proponent throughout the development of this Project are described in Chapter 18 of the EIS. Alternatives include scope reductions such as the ‘no project’ option and the ‘groundwater pump and treat only’ option. Alternatives also include rehabilitation strategy options such as the WSF location, Main Pit backfilling (including management of *in situ* tailings) options and borrow material source options. Further alternatives are discussed in Chapter 18 of the EIS.

Several of these alternatives have not been entirely ruled out and provide a safety net in the event of unforeseen change or an opportunity yet to be realised. For example, the option to utilise the existing facilities at Browns Oxide Mine would have significant ecologically sustainable development gains for the Project as the lease of already existing facilities greatly reduces the need for capital expenditure, for resources in construction and subsequent decommissioning. Additionally, the alternative borrow location on FRALT adjacent to Woodcutters Mine may be revisited in the event that formal agreements for the proposed preferred borrow locations cannot be reached.

The Rehabilitation Project has been in development for several years and comprehensive studies of the site and current available technologies have been carried out. The Proponent considers that the proposed strategy outlined within this EIS includes the best fit of iterated alternative elements for the existing site conditions and planned rehabilitation outcomes.