Assessment Report 98

Assessment method: Environmental Impact Statement

Rehabilitation of the former Rum Jungle Mine Site Department of Industry, Tourism and Trade February 2023



This assessment report has been prepared by the Northern Territory Environment Protection Authority (NT EPA) pursuant to section 7(2)(g) of the *Environmental Assessment Act 1982*, sections 296 and 299 of the *Environment Protection Act 2019* and in accordance with section 45 of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). It describes the outcomes of the NT EPA's assessment of the Rehabilitation of the former Rum Jungle mine site proposed by Department of Industry, Tourism and Trade.

This assessment report documents potential environmental impacts and risks identified during the environmental impact assessment process, focusing on those that could be significant, and the measures and recommended conditions required to address potential significant impacts on the environment.

In accordance with section 64 and 65 of the EP Act, the assessment report is for the Northern Territory Minister for Environment, Climate Change and Water Security to consider when making a decision about whether to approve the action under the EP Act.

In accordance with clause 6.7 of the bilateral agreement between the Northern Territory of Australia and the Commonwealth of Australia, the assessment report will be provided to the Commonwealth Minister for the Environment to consider when making a decision about whether to approve the action under the EPBC Act.

Dr Paul Vogel AM NT EPA Chairperson

13 February 2023

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Summary

This assessment report has been prepared by the Northern Territory Environment Protection Authority (NT EPA) pursuant to section 7(2)(g) of the *Environmental Assessment Act* 1982 (EA Act) and sections 296 and 299 of the *Environment Protection Act* 2019 (EP Act) for the rehabilitation of the former Rum Jungle mine site (proposal).

The Department of Industry, Tourism and Trade (proponent) proposes to rehabilitate the former Rum Jungle mine site, approximately 6.5 km north of Batchelor. The proposal also includes rehabilitation of the nearby former satellite mine sites Mt Burton and Mt Fitch, and sourcing of materials from two borrow areas.

This proposal involves site remediation to address long-term legacy contamination issues at Rum Jungle caused primarily by the ongoing generation of acid and metalliferous drainage, including neutral and saline drainage (AMD), which pollutes surface waters, groundwater and downstream receiving environments. The proposed rehabilitation works intend to significantly improve environmental conditions and values. However, if not designed and implemented adequately, the proposed works have the potential to cause significant environmental impacts as large amounts of contaminated materials, including radiological soils, would be moved. In addition, the long-term integrity of the final landform poses a potential environmental risk if the rehabilitation strategy, design and implementation are inadequate.

The proposal is the third stage of the five-stage Rum Jungle Rehabilitation Project, comprising a five-year construction phase and a five-year stabilisation phase. Prior stages included technical studies and stakeholder consultation for the identification and development of a feasible rehabilitation option. Later stages will focus on short-term and long-term monitoring and maintenance of rehabilitated areas.

The objective of the rehabilitation is to improve the environmental condition onsite and downstream within the East Branch of the Finniss River (EBFR). It is proposed to achieve this through removal, treatment or containment of existing contaminant sources in soils, groundwater and pit water, and the prevention of future generation of AMD through the construction of two new waste storage facilities. Importantly, this objective includes contribution to restoring cultural values and associated future uses of the land as described in a Federation Funding Agreement – Environment (Management of the Former Rum Jungle Mine Site – Stage 3) between the Australian and Northern Territory governments.

The proponent states that it has consulted extensively with the traditional owners, and the proposed rehabilitation strategy is consistent with the views and interests of the Kungarakan and Warai people.

The NT EPA assessed the proposal by environmental impact statement (EIS) in accordance with the requirements of the EA Act, Environmental Assessment Administrative Procedures 1984, EP Act and Environment Protection Regulations 2020. The NT EPA examined the potential for significant impacts on the environment as a whole and in accordance with the principles of ecologically sustainable development.

The proposal is a 'controlled action' under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and is being assessed under the bilateral arrangements between the NT and Australian Governments. The relevant controlling provisions are:

- listed threatened species and communities (sections 18 and 18A EPBC Act)
- protection of the environment from nuclear actions (sections 21 and 22A EPBC Act).

The NT EPA examined potential significant impacts on the following eight environmental factors:

- Culture and heritage
- Terrestrial ecosystems
- Terrestrial environmental quality
- Hydrological processes
- Inland water environmental quality
- Aquatic ecosystems
- Community and economy
- Human health.

Environmental values that require protection from the proposal are the Finniss River downstream of the proposal area and the sites of conservation significance: the Finniss River Coastal Plain and Fog Bay. If the proposal is designed and implemented successfully, the contaminated EBFR is expected to recover progressively over time, and values associated with the cultural significance of the area and local community are likely to benefit from the proposed rehabilitation.

The NT EPA has considered the precautionary principle of ecologically sustainable development in the assessment, which states that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. The NT EPA considers that the success of the proposed rehabilitation, and uncertainties about actual and potential impacts on environmental values into the long-term success can be addressed by using the *National Environment Protection (Assessment of Site Contamination) Measure 1999* (ASC NEPM) and national remediation framework guidance (CRC CARE 2018) under the advice of suitably experienced and accredited auditors. The framework would also ensure that recommended monitoring, adaptive management and mitigation measures are effectively implemented and audited.

The NT EPA concludes that the proposal can be implemented and managed in a manner that is environmentally acceptable and recommends that environmental approval be granted subject to the conditions recommended in Appendix 1. This assessment report and the draft environmental approval (Appendix 1) are provided to the Minister for Environment, Climate Change and Water Security for consideration in deciding whether to grant an environmental approval.

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1. Introduction

This assessment report provides advice and recommendations of the Northern Territory Environment Protection Authority (NT EPA) to the Minister for Environment, Climate Change and Water Security (Minister) on completion of the NT EPA's environmental impact assessment of the former Rum Jungle mine site (proposal). The proposal is to remediate and rehabilitate environmental degradation caused by mining activities at the former Rum Jungle uranium-copper mine, and its associated satellite sites Mt Burton and Mt Fitch near Batchelor.

The NT EPA has prepared this report in accordance with section 7(2) (g) of the *Environmental Assessment Act 1982* (EA Act), clause 14(3) of the Environmental Assessment Administrative Procedures 1984 (EAAP), and in accordance with sections 296 and 299 of the *Environment Protection Act 2019* (EP Act). Consistent with the EAAP, this assessment report is to:

- inform the Minister of the NT EPA's review and assessment of environmental aspects of the proposal
- make comments, suggestions or recommendations concerning safeguards or standards for the protection of the environment in relation to the proposal.

Pursuant to section 301(2) of the EP Act, an environmental approval is required for the proposed action. This assessment report and the draft environmental approval (Appendix 1) are provided to the Minister in accordance with sections 64 and 65 of the EP Act, for consideration in deciding whether to grant an environmental approval for the proposal. Matters taken into account during the assessment are tabulated in Appendix 2. An environmental impact assessment timeline is provided at Appendix 3.

1.1. Proponent

The proponent is the Northern Territory Government (NTG) Department of Industry, Tourism and Trade (DITT) (formerly Department of Primary Industry and Resources) (Australian business number 84 085 734 992).

The proposal is funded by the Australian Government, under a Federation Funding Agreement – Environment (Management of the Former Rum Jungle Mine Site – Stage 3) between the Australian and Northern Territory governments, which commenced on 31 January 2022 and ends on 31 December 2031.

1.2. Location and context

The proposal area includes the former Rum Jungle Mine site located approximately 6 km north of Batchelor and 61 km south-east of Darwin, and its associated satellite sites Mt Burton and Mt Fitch located about 4 km to the west and 7 km to the north-west, respectively. There are also two borrow areas, one located immediately south of Rum Jungle, and the other about 5 km south. The location of proposal components is shown in **Figure 1**.

The proposal area is within the Coomalie Community Government Council (CCGC) local government area which covers 2,056 m² and includes the localities of Adelaide River, Batchelor and Lake Bennett. The land tenure for each proposal component is shown in **Table 1**. The primary land uses in the Finniss River catchment surrounding the proposal area are mining exploration, conservation, recreation, agriculture, horticulture, and rural residential living.

Located immediately to the west of Rum Jungle is the Browns Oxide Project, a base metals (cobalt, copper, lead, nickel and silver) mine which operated from 2007 to 2009. The Browns Oxide Project is currently in care and maintenance, with treated water and stormwater runoff managed under a waste discharge licence (WDL177) pursuant to the *Water Act* 1992.

The former Rum Jungle Mine site is significantly degraded and a heavily impacted legacy mine site contained within Area 4 of the Finniss River Land Claim No. 39 (1981)¹. The section of land on which the former Rum Jungle Mine site lies (Section 2968) was excluded from the 1993 grant to the Finniss River Aboriginal Land Trust due to concerns of the traditional owners, the Warai and Kungarakan people, about the adequacy of rehabilitation and the legacy environmental risks associated with it. No decision on the potential grant of the Rum Jungle site has been made due to the current environmental condition of the site.

Traditional owners have demonstrated strong spiritual affiliations to land in the Finniss River region and are the custodians for a number of sacred sites on and surrounding the Rum Jungle site. Sacred sites within the proposal area were either destroyed or heavily impacted by companies conducting historic mining activities. The proponent stated that the EIS deals with matters that are of deepest concern for some Kungarakan and Warai people, and that the land and waters discussed throughout the EIS form part of the sacred sites that inform Mookununggunuk (the Cycle of Life).

Under the Federation Funding Agreement for the proposal, traditional owners are to be consulted on proposed rehabilitation planning and maintenance matters, as both the Australian and NT governments acknowledge their desire that rehabilitation at the former Rum Jungle Mine site allows for the return to traditional ceremony, culture and subsistence use of natural resources.

A Land Use Plan developed by a panel of traditional owners, the proponent and Australian Government officers in 2019 (Draft EIS Main Report Figure 6-8) takes into account the cultural values of Rum Jungle, a traditional view of connected country beyond the current project boundary and potential limitations due to current environmental conditions. The plan identified future cultural land uses including access to site for cultural practices, caring for country and the use of the cultural centre as a base for future land management activities, access to country to teach younger generations bush skills and culture, and potential cultural tourism ventures combining a cultural centre and bushwalks in undisturbed country.

Proposal area	Tenure
	Section 2968 Hundred of Goyder,
Rum Jungle	NT Vacant Crown Land, part of Finniss River Land Claim, unzoned
Mt Burton	Section 998 Hundred of Goyder,
MIL DUITON	estate in fee simple held privately, unzoned
	NT Portion 3283,
Mt Fitch	Crown Lease Perpetual 862 held by the NT Land Corporation, unzoned
Borrow Area A	Section 2940 Hundred of Goyder,
(Granular material)	Finniss River Aboriginal Land Trust, unzoned
Borrow Area B	Section 2830 Hundred of Goyder,
(Low permeability material)	Coomalie Community Government Council, unzoned

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NORTHERN TERRITORY ENVIRONMENT PROTECTION AUTHORITY

¹ <u>Finniss River Land Claim</u> Report by the Aboriginal Land Commissioner, Mr Justice Toohey, to the Minister for Aboriginal Affairs and to the Administrator of the Northern Territory. Canberra. 1981.



Figure 1 Location and overview of proposal area

1.3. Mining history

Rum Jungle is a legacy mine site with the mining title relinquished. The site was declared a restricted use area in 1989 under the *Soil Conservation and Land Utilisation Act 1969* (NT) and is closed to public access. Exploration for uranium at Rum Jungle and its associated satellite mine sites, Mt Burton and Mt Fitch, began in 1949 and mining and mineral processing took place between 1954 and 1971.

Mining activities and waste management practices led to significant and long-lasting environmental impacts primarily caused by acid and metalliferous drainage, including neutral and saline drainage (AMD). The oxidation of sulfidic mine waste rock and tailings and consequent release of AMD has resulted in ongoing pollution of the East Branch of the Finniss River (EBFR) and downstream aquatic ecosystems over the past 50 years.

Rehabilitation was conducted by the Australian Government at Rum Jungle in the 1980s with the primary objectives being to reduce the pollution loads to the receiving environment and reduce public health hazards including radiation. These rehabilitation works reduced the generation of AMD and metal loads reaching the Finniss River in the short-term and were deemed successful; however, more recent studies have documented the gradual deterioration of rehabilitated mine waste landforms and increased waste rock dump (WRD) infiltration leading to intensified AMD generation in the following years.

At Mt Burton, uranium-copper ore was mined from one open pit in 1958, with waste rock stored onsite and ore processed at Rum Jungle. At Mt Fitch, one open pit was created for exploration in 1968-69 but not mined, with the overburden stockpiled south-west of the pit.

1.4. Site contamination

1.4.1. Rum Jungle

The primary pollution source at the former Rum Jungle mine site (**Figure 2**) is AMD generated from sulfidic mine waste including tailings and waste rock. The site is contaminated with acids, metals, salts and radioactive material as a result of historical mining and failed rehabilitation. There are also minor amounts of asbestos-containing materials onsite associated with buildings and relic mining equipment.

Groundwater underlying the site is heavily impacted by AMD seepage and likely contributes to pollutant loads in surface waters, along with loads from surface runoff containing high concentrations of salts and metals. The polluted surface and groundwater that discharges from the site are the main contaminant pathways to the Finniss River.

1.4.1.1. Primary sources of AMD

Waste rock and tailings are the primary sources of AMD pollution requiring remediation and rehabilitation. A number of waste rock investigations conducted by the proponent (e.g. SRK Consulting 2012, RCG & Jones 2019 and SLR Consulting Australia 2020k) identified the location, volume and type of contaminated materials and these are summarised in **Table 2**.

Potentially acid forming (PAF) waste rock has been categorised as PAF-I, PAF-II and PAF-III with a respective AMD generating potential of high, medium and low based on total sulfur content. The relative proportions of the PAF categories in the WRDs are depicted in **Figure 3**. The Intermediate WRD and Dysons backfilled pit contain the highest proportions of PAF-I. The highest proportion of non-acid forming (NAF) waste rock with a very low total sulfur content is contained primarily in Dysons and Main WRDs.

Approximately 95% of the total volume of contaminated material is PAF and contained within WRDs. A significant proportion of this PAF material is categorised as PAF-I, which has the highest acid forming potential. Apart from Dysons WRD, the waste rock contained within WRDs and stockpiles has significant residual sulfides and therefore has potential to continue to generate AMD in the long-term. The proponent's investigations identified copper as the main contaminant of concern. The greatest contributor to the EBFR's copper load is the Intermediate WRD that contains 80% PAF-I and 20% PAF-II.

The tailings from the processing of uranium ore at Rum Jungle are currently stored below water, either in an open pit lake (Main and Intermediate pits) or below groundwater level (Dysons backfilled pit). The tailings have a moderate AMD potential, corresponding to PAF-II classification for waste rock (Jones 2019) and are likely to be radioactive. The EIS states that they do not appear to contribute to copper contamination loads across site.



Figure 2 Existing site conditions at Rum Jungle

Table 2 Location, area, volume and type of contaminated material (SLR Consulting Australia, 2020k)

Location	Footprint (m ²)	Volume (m ³)	Material
Intermediate WRD	80,925	734,900	PAF I
Main WRD	303,550	4,529,675	PAF I and PAF II
Dysons Pit Overburden	63,000	443,425	PAF I
Dysons WRD	96,000	1,190,250	PAF III and NAF
Main North WRD	46,375	119,000	PAF II and PAF III
Copper Extraction Area	63,700	143,050	AMD impacted soil
Radiation Soils (to be relocated)	74,325	135,725	Radiological soil
Old stockpile area (to be relocated)	16,850	62,700	Metal impacted soil
Metal and salt impacted soils	58,350	12,400	AMD impacted soil
Main WRD Levee	22,750	68,975	AMD impacted soil
Miscellaneous rocky waste	4,550	2,850	AMD impacted soil
Mt Burton WRD	21,100	110,575	PAF III
Mt Fitch WRD	7,000	10,000	PAF III
TOTAL AREA AND VOLUME	858,475	7,563,525	



Figure 3 Relative distribution and categories of PAF material in WRDs (RGC & Jones 2019)

1.4.1.2. Secondary sources of AMD

Contaminated groundwater plumes at Rum Jungle are known secondary sources of AMD pollution, as the shallow groundwater interacts with surface waters including the EBFR. The highest copper levels were measured in a groundwater plume beneath the former Copper Extraction Pad.

During the dry season salt-affected soils form white sulfate salts on surfaces including the northern face of the Intermediate WRD, the toe drain of the Main WRD, and on Dysons Pit and WRD. These salts dissolve in the first rains of the wet season and contribute to high concentrations of salts and metals together with diversion and river bed loads, resulting in a 'first flush' effect observed in downstream surface waters at the start of the wet season.

A contaminated site investigation (CSA Global 2011) and other reports (e.g. Allen & Verhoeven 1986) identified additional contaminant source areas including:

- south of Dysons Pit (backfilled)
- former treatment plant area (the 70s clean-up used lead ore and below ore grade uranium material from remaining stockpile as fill material)
- filter cake from 80s water treatment plant buried three metres below surface in an old borrow pit north-east of the Main Pit (approximately 66,700 m² of land fill)
- base of WRDs
- fluvial soils in Rum Jungle's drainage system, including EBFR, Fitch Creek and the EBFR diversion channel.

1.4.1.3. Other contaminants

Uranium concentrations are naturally elevated in soils in the area, including in mine waste rock and tailings. The proponent's investigations identified that WRDs contain low levels of naturally occurring radioactive materials.

Areas with elevated radioactivity exist at Rum Jungle as a result of historic mining, covering a combined area of approximately 155,000 m². Radioactive material management is discussed further in section 6.7 (Human health).

Minor amounts of asbestos containing materials are present in relic buildings and mining equipment onsite.

1.4.2. Mt Burton

Approximately 10,000 t of uranium-copper ore was mined from the Mt Burton deposit leaving a 7.5 ha open cut pit void. The water quality of the residual pit lake is currently unknown, and is directly adjacent to a spring fed creek which flows into the Finniss River upstream of the confluence with the EBFR. The EIS states that the residual waste stored in the Mt Burton WRD covering approximately 14 ha is mainly non-acid producing (NAF), and that radiation levels at the site are not likely to pose a significant occupational health risk.

1.4.3. Mt Fitch

The EIS identified the overburden stockpile at Mt Fitch as NAF. Gamma radiation was generally low (< 0.5 μ Gy/h) with some higher radiation levels along the access track (2 μ Gy/h). The water quality of the small pit is unknown, other than uranium concentration (124 μ g/L) which is above ANZG (0.5 μ g/L).

1.4.4. Finniss River

The passive movement of polluted surface and groundwater off the Rum Jungle site has resulted in significant pollution of the EBFR and the downstream Finniss River and its coastal floodplain. The contaminant load from the EBFR to the Finniss River is stated in the EIS by the proponent to be 2.5 t/year total copper (Cu) and 2000 t/year total sulfate (SO₄). The water quality in the EBFR and Finniss River downstream of Rum Jungle is heavily impacted and this is discussed in section 6.2 of this report.

2. Proposal

The proposal is to remediate and rehabilitate the former Rum Jungle mine site, and two satellite mine sites at Mt Burton and Mt Fitch. Clean granular and low permeability construction materials will be sourced from two borrow areas (**Figure 1**). The final landforms have been designed in consultation with the Kungarakan and Warai people with an aim to restore or improve cultural values associated with the proposal area. The proposal includes restoring the original alignment and flowpath of the EBFR as far as possible, which involves redirecting flows through Main Pit and Intermediate Pit.

This proposal is Stage 3 of the Rum Jungle Rehabilitation Project. Implementation of the action would be in two phases, a construction phase scheduled to occur over a five-year period, and a stabilisation phase including intensive monitoring and maintenance, which would occur over a five-year period, post-construction. Further detail about the project stages is provided at Appendix 4 – Rehabilitation stages.

2.1. Description

The proposal would deliver rehabilitation works at Rum Jungle, Mt Burton and Mt Fitch, leading to improved environmental conditions and cultural values and generating benefits for traditional owners and local and regional communities and businesses (Australian and NT governments 2022).

Overview of key rehabilitation components:

- Excavation and removal of mine waste from existing WRDs and other landforms for relocation and placement in Main Pit or new Waste Storage Facilities (WSF)
- Backfilling of Main Pit to two metres below dry season standing water level, permanent storage of PAF-I waste rock under a water cover
- Construction of two new WSFs for the containment of remaining mine waste, and contaminated and radioactive soils
- Construction of infrastructure, including water treatment plant(s) (WTP) and associated pipelines, sediment ponds, one workshop, one administrative office, one laydown area, and an access ramp in Main Pit
- Operation of a water treatment plant (WTP) to treat:
 - o contaminated pit waters prior to and during backfilling
 - AMD-impacted groundwater
- Operation of groundwater recovery bores (seepage interception system (SIS)) to extract surface water seepage and groundwater for treatment
- Discharge of water from Intermediate and Main pits, and the WTP
- Construction of a cultural centre
- Rehabilitation of Mt Burton, with WRD (NAF) and surrounding contaminated soils transported to Rum Jungle for inclusion in the new WSFs
- Rehabilitation of Mt Fitch, with overburden (NAF) relocated into the Mt Fitch Pit.
- Sourcing of construction materials extracted from two borrow areas
- Upgrade existing access tracks and a culvert crossing at Rum Jungle
- Rehabilitation and revegetation, of disturbed areas at Rum Jungle, Mt Fitch, Mt Burton, haul roads and laydown areas

• Construction of a final landform, which aims to restore cultural values to the greatest extent possible, including re-diversion of the EBFR flow through Main Pit and Intermediate Pit as far as possible.

The proposal would adopt a "no fly-in fly-out (FIFO) workforce policy", and would maximise Kungarakan and Warai and local employment opportunities. Transport to and from site would be provided by bus from Batchelor, with non-Batchelor residents accommodated in Batchelor.

The proponent's traffic assessment (SLR 2020g) indicates that increased traffic on public roads (Rum Jungle Road and Batchelor Road) would be limited with up to 35 movements per day during the construction phase.

Onsite diesel powered generators are proposed for electricity supply, and the proponent has committed to investigate potential solar power options. Domestic waste would be segregated to maximise recycling rates and serviced by the local council. Grey water and sewage would be stored in septic tanks and collected by liquid waste management contractors. Water would be sourced from the WTP.

A detailed description of the proposal is presented in the Draft EIS (DPIR 2020a) with updates outlined in the Supplement to the Draft EIS (Supplement) (DPIR 2020b) and the Additional Information (DITT 2021, 2022). The proposal scope and key components are summarised in **Table 3**.

Total volume of waste rock to be relocated 7.2 Mm ³	
Total volume of AMD impacted soils to be relocated 0.227 Mm ³	
Total volume of radiological soils to be relocated 0.246 Mm ³	
Total volume of clean borrow materials required 2.304 Mm ³	
Duration:	
construction phase 5 years	
 stabilisation and monitoring phase 5 years 	
Waste rock remediation (lime treatment):	
• submerged in Main Pit 15 Mm ³	
• stored in two new WSFs 6.1 Mm ³	
Tailings storage (Main Pit and Dysons Pit).	
Main Pit water treatment in WTP and backfill 3 years	
Groundwater remediation	
 estimated volume captured through SIS and 764 ML/year 	
treated in WTP	
estimated duration of WTP operation 10 years	
Estimated volume of water treated:	
construction phase (pit water) 2.125 ML/year	
 stabilisation phase (groundwater) 764 ML/year 	
Estimated discharge to EBFR:	
• construction phase 1 736 ML/year	
 dry season dry season 9 MI /week (0.053 MI /hr) 	
• wet season \sim 66 MI /week (0.050 ML) /m/	
• stabilisation phase 762 MI /vear	
• stabilisation phase 0 10 ML/week	
• dry season	
Estimated water demand:	
annual total (daily) incl. potable (construction annual total (daily) incl. potable (construction	
phase) 300.23 ML/year (1.1 ML/day)	
annual total (daily) potable	

Table 3 Overview of the scope of the proposal

Component	Size/Capacity
Estimated lime requirement (total)	216,000 t
Estimated fuel requirement (diesel generators):	
 mobilisation and establishment phase 	0.2 ML/year
 construction phase 	2.5 ML/year
stabilisation phase	0.6 ML/year
Estimated greenhouse gas emissions:	
land clearing	below calculation threshold
construction phase	7538.36 t CO ₂ -e/year
 stabilisation phase 	866 t CO ₂ -e/year
• total (10 years)	42,021.8 t CO ₂ -e/year
Number of jobs (full time equivalent):	
 construction phase 	48
stabilisation phase	5-7
Clearing total	490.4 ha
 including remnant native vegetation 	14 ha

2.2. Objectives

The proponent has stated two high-level objectives for the proposal, focusing on the environmental remediation and restoration of cultural values of the site within the EBFR (DITT 2022):

- Improve the environmental condition onsite and downstream of site within the East Branch Finniss River (EBFR). This includes the following key outcomes:
 - improve surface water quality conditions within EBFR in accordance with locally derived water quality objectives (LDWQOs)
 - o achieve chemically- and physically-stable landforms
 - o support self-sustaining vegetation systems within rehabilitated landforms
 - o develop physical environmental conditions supportive of the proposed land use
- Improve site conditions to restore cultural values. This includes the following key outcomes:
 - o 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
 - use appropriate local indigenous plant species to stabilise constructed surfaces and achieve a substantial subset of characteristic assemblage of biota present
 - o preserve Aboriginal cultural heritage artefacts and places
 - o isolate sources of pollution including radiological hazards
 - maximise opportunities for traditional owners to work onsite to aid reconnection to country.

The proponent states that the achievement of these objectives may support the potential future Land Management and Use Plan (DPIR 2020a, b) and that the proposed rehabilitation strategy is consistent with the views and interests of the Kungarakan and Warai people.

2.3. Justification for the proposal and alternatives

The proponent states that the proposal would provide benefits for the community in the local area through the following outcomes:

- improve the contamination status of the former mine sites Rum Jungle, Mt Fitch and Mt Burton, and downstream environments including the Finniss River
- improve the preservation of, and access to, sacred sites and other sites of cultural value
- future opportunity for traditional owners to access Rum Jungle for conservation and cultural practices
- creation of up to 45 direct jobs, a trainee program, and local economic development opportunities during the five-year construction phase.

The proponent considered the feasibility of a range of alternative rehabilitation strategies and methods in the development of the proposal, informed by technical investigations and consultation with stakeholders (see chapter 18 of the Draft EIS for details).

The proponent stated that various rehabilitation strategies, including the option not to rehabilitate, were workshopped with the (former) Rum Jungle Working Group and traditional owners in 2013 (DME 2013). An evaluation process identified the backfilling of both the Main and Intermediate pits and relocation of the remaining material into a new WRD as the preferred rehabilitation strategy.

Since 2013, further studies of rehabilitation methodologies and stakeholder consultation refined the preferred strategy to the one proposed. Investigations included different methods to store tailings in Main Pit, if and how to backfill Main Pit, identification of the optimum location of the WSF, availability of borrow material, water management of dry season discharge, AMD management, WSF cover design, and the use of Browns Oxide mine facilities.

If the land is not remediated, there would be continued risk to the environment and community through leaching of contaminants and the site could not be made suitable for a future land use.

3. Strategic context

The proposal is consistent with NT Government strategic plans and initiatives to create economic development and employment opportunities for regional communities and Aboriginal people, such as:

- Darwin Regional Land Use Plan 2015 (DLPE 2015) includes Coomalie region
- 10 Year Infrastructure Plan (NTG 2017) includes future projects in the Coomalie Region
- NT Economic Development Framework
- Masterplan for the Batchelor Airport
- NT Government Procurement Framework
- Aboriginal Contracting Framework (Draft)
- Local Decision Making 10 Year Plan
- The Territory's Economic Reconstruction.

Australian Government's strategic plans and initiatives relevant to the proposal include:

• Closing the Gap Refresh (COAG 2018)

- Indigenous Advancement Strategy
- The Australian Industry Participation National Framework (2001)
- Our North, Our Future: White paper on Developing Northern Australia (Commonwealth of Australia 2015).

Further detail is provided in chapter 13 of the Draft EIS.

4. Statutory context

4.1. NT regulatory framework

The environmental impact assessment of the proposal was conducted by the NT EPA under the EA Act and EAAP. After the commencement of the EP Act and EP Regulations 2020 on 28 June 2020, the assessment process incorporated transitional provisions in accordance with section 296 of the EP Act. The purpose of an environmental approval is to manage the potentially significant environmental impacts of a proposal. The Minister is the approval authority.

Under section 92 of the EP Act, an environmental approval prevails over other NT statutory authorisations. The *Mineral Titles Act 2010* and *Mining Management Act 2001* do not apply to the proposal. However, statutory authorisations under other laws would be required. It is the responsibility of the proponent to obtain the required authorisations. These may include, but are not limited to:

- waste discharge licence(s) (WDL) under the Water Act 1992
- land clearing permit(s) for clearing of native vegetation on unzoned land under the *Planning Act 1999*
- mineral title(s) for borrow areas under the Mineral Titles Act 2010
- Authority Certificate(s) under the Northern Territory Aboriginal Sacred Sites Act 1989
- any relevant authorisations under the Radiation Protection Act 2004
- permit(s) to burn under the Bushfires Management Act 2016.

4.2. Commonwealth regulatory framework

On 4 August 2016, the Australian Department of Agriculture, Water and the Environment (now Department of Climate Change, Energy, the Environment and Water) determined that the proposed action was a controlled action and required assessment and approval under the EPBC Act (EPBC Number 2016/7730). The relevant controlling provisions for the proposal under the EPBC Act are:

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

The proposal is being assessed under the Northern Territory Assessment Bilateral Agreement (the agreement) in accordance with section 45 of the EPBC Act. The agreement accredits the NT environmental assessment process to ensure an integrated and coordinated approach to the assessment of controlled actions requiring approval from both the Australian and NT Government Ministers and enables the NT EPA's assessment to meet the impact assessment requirements of both jurisdictions.

In line with provision 6.7 of the agreement, this assessment report will be provided to the Australian Government Minister for the Environment who will decide whether or not to approve the proposal under the EPBC Act.

4.3. Mandatory matters for consideration

In preparing this assessment report, the NT EPA considered the following information in accordance with section 7(2) (g) of the EA Act:

- the Notice of Intent (NOI)
- the Notice of Significant Variation
- the Terms of Reference (TOR)
- the Draft EIS
- the Supplement
- two additional information submissions
- comments from the public on the draft TOR and Draft EIS
- comments from NT and Australian government authorities on the NOI, Draft TOR, Draft EIS, Supplement and additional information
- technical and other reports and guidelines (noted in section 10 References to this report).

The NT EPA considered the object of the EA Act, and took into account the purpose of the environmental impact assessment process under section 42 of the EP Act and the general duty under sections 43 of the EP Act:

- the objects (EP Act, section 3)
- the principles of ecologically sustainable development (EP Act, part 2, division 1)
- the environmental decision-making hierarchy (EP Act, section 26)
- the waste management hierarchy (EP Act, section 27)
- ecosystem-based management
- the impacts of a changing climate.

Appendix 2 provides further detail about matters that the NT EPA has taken into account during its assessment.

5. Consultation

During the environmental assessment process, statutory opportunities for public comment were provided for the draft TOR and the draft EIS. As the Supplement was received before the commencement of the EP Act, consultation on the Supplement was not required.

Four public submissions were received on the draft TOR and were taken into consideration in the finalisation of the TOR. Eight public submissions were received on the Draft EIS and the proponent responded to these issues in the Supplement. Two public submissions were received outside of the commenting period and these were considered and responded to by the proponent in the Supplement.

The NT EPA received submissions from ten government authorities throughout the environmental impact assessment process. Submissions received were considered in making this assessment report.

The NT EPA consulted with, and invited submissions from, the proponent and statutory decision-makers who may have a view on the draft environmental approval. Seven submissions were received from the proponent, Aboriginal Areas Protection Authority, the Heritage Branch of the Department of Territory Families, Housing and Communities, the DEPWS Rangelands

Division, NT Controller of Water Resources, Northern Land Council (NLC) and DCCEEW. The NT EPA considered the submissions in finalising its recommendation to the Minister.

6. Assessment of key environmental factors

6.1. Overview

The NT EPA identified that the proposal has the potential to have a significant impact on environmental values associated with eight environmental factors (**Table 4**). The NT EPA defined proposal-specific environmental objectives, recognising the current site environmental condition and the purpose of the proposal.

The NT EPA acknowledges that the proposed action for remediation of a contaminated legacy mine site (where the intent of the proposal is to restore environmental values that have previously been heavily impacted), differs from a typical proposed action for development (where environmental values exist and must be protected and maintained).

THEME	FACTOR	ENVIRONMENTAL OBJECTIVE
LAND	Terrestrial environmental quality	Improve the quality and integrity of land and soils so that environmental values are supported and maintained.
	Terrestrial ecosystems	Protect terrestrial habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.
	Hydrological processes	Improve the hydrological regimes of groundwater and surface water so that environmental values including ecological health, land uses and the welfare and amenity of people are maintained.
WATER	Inland water environmental quality	Improve the quality of groundwater and surface water so that environmental values including ecological health, land uses and the welfare and amenity of people are maintained.
	Aquatic ecosystems	Restore aquatic habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.
PEOPLE	Culture and heritage	Protect culture and heritage.
	Community and economy	Enhance communities and the economy for the welfare, amenity and benefit of current and future generations of Territorians.
	Human health	Protect the health of the Northern Territory population.

Table 4 Key environmental factors and proposal-specific environmental objectives

The NT EPA considered other environmental factors during its consideration of the environmental impact assessment; however, the impact on those factors was not considered to be significant.

The assessment of Inland water environmental quality, Hydrological processes and Aquatic ecosystems factors has been combined into one section in this report due to the strong interconnectedness between those factors.

6.2. Culture and heritage

The NT EPA respectfully acknowledges the Kungarakan and Warai people as the traditional owners of the proposal area. The NT EPA acknowledges the work of the Kungarakan and Warai people who have actively participated in engagement and consultation during rehabilitation planning and design, and the contribution of their valuable knowledge. The NT EPA acknowledges that the environmental impact assessment of the proposal deals with matters that are of deep concern for some Kungarakan and Warai people and that the land and waters discussed in this report form, in part, the sacred sites that inform Mookununggunuk (the Cycle of Life).

The NT EPA acknowledges the desire of the Kungarakan and Warai people to restore the land to a natural, living environment that provides for a return to traditional ceremony, culture and subsistence use of natural resources. The NT EPA acknowledges the importance of the proponent's objective to restore cultural values through rehabilitation and restoration of the biophysical environments associated with cultural and social landscapes, and understands that the cultural objectives must be achieved alongside the remediation objectives, to the extent practicable within the scope of the proposed action.

The purpose of this section is to examine the potential significant impacts and risks to culture and heritage from carrying out the proposal and the measures proposed to avoid or mitigate those impacts and risks, and to make recommendations for additional measures to protect culture and heritage while carrying out works. The NT EPA's assessment of whether the traditional owners' cultural objectives for the proposal can be met relies on findings across all environmental factors, and will be concluded in this section.

6.2.1. Environmental values and existing environment

The Kungarakan and Warai people are the traditional owners of the land on and surrounding the proposal (also known as Unrunkoolpum) as identified in the Finniss River Land Claim No.39 of 1981 under the *Aboriginal Land Rights (Northern Territory) Act 1976* (ALR (NT) Act). Traditional owners are a group of Aboriginal people who have primary spiritual responsibility for sacred sites on a piece of land, and who are entitled by Aboriginal tradition to hunt and gather on that land.

The proposal area is of mutual interest and cultural significance to the Warai and Kungarakan peoples who each maintain a deep sense of connection and custodianship to the land, both physically and spiritually, which is intrinsically linked to their cultural beliefs and values. Kungarakan and Warai people are two separate land and language groups and therefore do not necessarily share the same spiritual or cultural values across the Unrunkoolpum landscape. This depth of cultural diversity is reflected in their differing beliefs and values in relation to the proposal area. For example, Warai people recognise the proposal area and parts of Miniling dreaming track as 'sickness country', whereas Kungarakan cultural values arise from the Cycle of Life (Mookununggunuk) and feature strong connections to a number of highly valued women's sacred sites (DPIR 2020b).

Access to, and use of, land for cultural purposes within the proposal area has been limited since it was declared a restricted use area in 1989 under the *Soil Conservation and Land Utilisation Act* 1969, and closed to public access. In their vision for future land use, Kungarakan and Warai people expressed a desire that the proposal area be returned to a natural, living environment that provides for a return to traditional ceremony, culture and subsistence use of natural resources.

A land use plan was developed by a panel of traditional owners, the proponent and Australian Government officers in 2019, taking into account the cultural values of Rum Jungle, a traditional view of connected country beyond the proposal area and potential limitations due to current land and water conditions. The plan identified the following future cultural land uses:

- access to site for cultural practices
- caring for country and the use of the cultural centre as a base for future land management activities
- access to onsite and nearby country to teach younger generations bush skills and culture
- potential cultural tourism ventures combining access to the cultural centre and bushwalks in undisturbed country.

Aboriginal sacred sites protected by the Northern Territory Aboriginal Sacred Sites Act 1989

There are a number of registered and recorded sacred sites on and surrounding the proposal area, including Rum Jungle as identified in Authority Certificate (C2019/082) issued to the proponent under the *Northern Territory Aboriginal Sacred Sites Act* 1989 (NT ASS Act). Previous mining activities have directly and indirectly impacted sacred sites at Rum Jungle, in particular through diverting the flow of the EBFR from its original course and placement of landforms adjacent to sacred sites.

The details of sacred site locations and features within the proposal area is not discussed further in order to protect the privacy and cultural knowledge of the Aboriginal people who are custodians of those sites.

Declared Aboriginal heritage places and objects under the Heritage Act 2011

Archaeological surveys carried out in 2010 and 2018-19 within the proposal area identified a number of Aboriginal heritage places and objects including isolated stone artefacts, stone artefact scatters, a stone quarry, a non-potable grinding place, artefact production site and an extensive palimpsest. Many of the identified heritage places and objects have been partially or fully disturbed by previous mining and rehabilitation activities. The proponent's archaeological survey report states that these Aboriginal heritage places and objects have been assessed as having high cultural significance and moderate archaeological significance (DPIR 2020b).

It is noted that only part of the proposal footprint has been subject to archaeological survey, and that surveys were conducted in conditions of low visibility due to vegetative ground cover. Therefore, it is probable that more objects are present and many of the recorded objects form part of larger heritage places (Martin Stone 2019).

Historical places and objects

Archaeological survey identified historical places and objects including WWII era dry stone walls, which were assessed as being of moderate significance; and a drill rig from the 1950's which was also assessed as being significant. It is noted that these places and objects are not declared heritage places and objects under the *Heritage Act 2011* (Martin-Stone 2019).

Culturally important vegetation

Large multi-stemmed cycads and large sand palms (*Livistona humilis*) are recognised as culturally important vegetation species that are present within the proposal disturbance footprint. The Authority Certificate granted under the NT ASS Act included a request by custodians that best efforts are made to preserve individuals.

6.2.2. Investigations and surveys

Investigations and surveys undertaken by the proponent and reported as part of the Draft EIS, Supplement and additional information responses, informed the NT EPA's assessment of potential impacts to culture and heritage (Appendix 5 – Investigations and surveys).

6.2.3. Consultation

Matters raised during public and government authority consultation relating to potential significant impacts to culture and heritage include:

- the AAPA raised concern about the level of protection of sacred sites in relation to the proposed borrow pit and haul road areas if additional Authority Certificates are not obtained
- the NT Heritage Branch advised that heritage and archaeological issues had been adequately addressed for the proposal and that it was satisfied that the project would not impact any further on known heritage sites
- the NLC highlighted:
 - the need for ongoing engagement and consultation with traditional owners and the NLC during proposal planning, implementation and closure
 - the need to acknowledge the deep connection that Aboriginal people have to the biophysical and social environment, and the intrinsic link between the environment and cultural values
 - the need for a Cultural Heritage Management Plan (CHMP) to be developed and implemented.
- the NLC and the Kungarakan Culture and Education Association (KCEA) highlighted the need to clearly acknowledge the Kungarakan and Warai people as traditional owners and to recognise that although their interests and cultural foci are similar, their languages, heritage, cultural beliefs and spiritual practices are diverse
- the Australian Conservation Foundation (ACF), Environment Centre Northern Territory (ECNT) and the Mineral Policy Institute (MPI) highlighted in a joint submission the need for consideration of project alternatives for rehabilitation of the Main Pit through engagement with Kungarakan and Warai people
- the Amateur Fishermen's Association of the Northern Territory (AFANT) expressed a view that cultural considerations were being addressed at the cost of increased environmental risk and urged that realignment of the EBFR through the pit should not take place at this time.

6.2.4. Potential significant impacts and benefits

Potential significant impacts to culture and heritage could occur as a result of:

- direct or indirect disturbance of sacred sites during proposal implementation
- direct or indirect disturbance to declared Aboriginal heritage places and objects during proposal implementation
- direct or indirect disturbance of historical places and objects
- implementing the proposal without effective consultation and engagement with traditional owners and the NLC, or in a culturally insensitive manner that fails to meet traditional owner expectations.

6.2.5. Avoidance and mitigation of impacts

The NT EPA notes that the proposal has the potential to enhance and restore cultural values directly through remediation, rehabilitation and reconstruction of the biophysical environments associated with cultural and social landscapes, such as the return of the EBFR to its original course, and indirectly through improvement of environmental conditions.

The proponent's application of the management hierarchies includes measures to avoid and mitigate potential significant impacts on culture and heritage:

- obtain, and comply with the conditions of Authority Certificates under the NT ASS Act for all areas of the proposal to avoid significant impacts to sacred sites
- obtain, and comply with the requirements of, approvals to carry out work on a heritage place or object under the *Heritage Act* 2011
- avoid impacts to Aboriginal heritage places and objects, as far as reasonably practicable
- develop and implement a CHMP to document the measures to be applied to protect sacred sites and heritage places and objects, manage any unexpected finds and provide for traditional owner involvement and participation
- avoid impacts to culturally important vegetation, as far as reasonably practicable; and implement salvage and relocation procedures in consultation with traditional owners and the NLC
- ensure ongoing engagement and consultation with traditional owners and the NLC throughout proposal implementation.

6.2.6. Assessment of impacts to environmental values

The NT EPA considered that the key environmental values for culture and heritage that would potentially be impacted by the proposal are sacred sites and declared heritage places and objects. The NT EPA acknowledges that a key objective of the proposal is to improve onsite environmental conditions to support future land use, and that the proposal has been designed to enhance and restore environmental values, including cultural values.

6.2.6.1. Impacts to sacred sites

Sacred sites are places within the landscape that have a special meaning or significance under Aboriginal tradition and are recognised and protected as an integral part of the Territory's and Australia's cultural heritage, under the ALR (NT) Act and the NT ASS Act.

The proponent was issued an Authority Certificate (C2019/082) in 2019 by the AAPA under the NT ASS Act. The AAPA consulted with Aboriginal custodians during its consideration of the proponent's Authority Certificate application, and imposed conditions on the proposed works. The NT EPA notes that Authority Certificate C2019/082 subject land only covers the main Rum Jungle mine site (Section 2968 Hundred of Goyder) and does not include Mt Burton, Mt Fitch, and external borrow and haul road areas.

In its submissions on the EIS, the AAPA expressed concern about the protection of known sacred sites in the vicinity of works proposed to occur outside of the subject land of the existing Authority Certificate. The AAPA recommended that the proponent apply for an Authority Certificate for proposed works not covered by the existing authorisation, as this would provide certainty about the existence and extent of sacred sites and impose conditions on the proposed works. Compliance with Authority Certificate conditions would also provide the proponent with indemnity from prosecution under the NT ASS Act.

The NT EPA considers that effective implementation of the proposed remediation works would potentially enhance and restore the cultural values of sacred sites in the proposal area, to some extent. However, it recognises that the alteration of sacred sites from their natural condition by previous mining activities has resulted in significant and long-lasting impacts to cultural values.

The NT EPA acknowledges the unique relationship traditional owners have with their land, and that the permanent, transcendental and non-negotiable nature of this relationship underpins their group identity, cultural values and dynamics, and therefore remains distinct from the type of relationships that other stakeholders have with the land.

The NT EPA considers that it is unlikely that the proposal would provide for overall restoration of the cultural values of the sacred site within with the proposal area due to the nature, type, intensity, magnitude and extent of landscape alteration and damage from previous mining activities. However, it considers that the proposal would likely enhance the cultural values associated with the site to support future land use, provided that there is ongoing engagement and consultation with traditional owners and the NLC and that their objectives are met.

The proponent's commitment to comply with Authority Certificate C2019/082 would protect sacred sites within the main Rum Jungle mine area from being significantly impacted during proposal implementation. The NT EPA supports the AAPA recommendation that the proponent obtain Authority Certificates for all areas of the proposal; and notes that although it is not mandatory for the proponent to obtain an Authority Certificate for all work areas, there is a risk of prosecution if a sacred site is entered or damaged to carry out works. The NT EPA recommends condition 3 to ensure the environmental outcome is consistent with the NT EPA's objective for the culture and heritage factor.

The NT EPA considers that potential significant impacts to Aboriginal sacred sites can be appropriately avoided through implementation of recommended condition 4 requiring that the proponent consult with, and have regard to the views of, traditional owners and the NLC, and recommends condition 5 requiring that a CHMP is developed and implemented, and statutory decision-making processes under the NT ASS Act.

6.2.6.2. Impacts to Aboriginal archaeological places and objects

Aboriginal archaeological places and objects relate to the past human occupation of the Territory by Aboriginal people and are automatically protected under the *Heritage Act 2011*. These places and objects may be important to, or contribute to our understanding of, the course of the Territory's cultural history; or may have a strong association with the Kungarakan and Warai people, for cultural and spiritual reasons.

The proponent carried out archaeological surveys of the proposal area in 2010 and 2018-19. The 2010 survey identified 11 Aboriginal archaeological objects (isolated stone artefacts) and 10 Aboriginal archaeological places within the Rum Jungle mine site (Martin-Stone and Wesley, 2011) ranging from small artefact scatters to more concentrated occupation sites, including a quarry and artefact production site and an extensive palimpsest. The 2018-19 survey identified 16 Aboriginal archaeological objects (isolated stone artefacts) and three Aboriginal archaeological places (stone artefact scatters) in and surrounding Rum Jungle. Archaeological surveys and assessments (Martin-Stone 2019) found proposed activities at the borrow areas have very low risk of disturbing archaeological heritage.

The proponent committed to develop and implement a comprehensive CHMP to avoid and mitigate potential significant impacts to cultural heritage values. The CHMP would include measures to protect sacred sites and heritage places and objects, identify areas where further archaeological survey and pre-clearance survey is required, include procedures for unexpected finds, procedures for ground disturbance, and provide for ongoing consultation with traditional owners and the NLC.

The archaeological report for field surveys conducted in 2018-19 stated that there were poor ground visibility conditions due to vegetation cover, and recommended further archaeological survey be undertaken in better visibility conditions to properly document the spatial extent and cultural significance of archaeological materials. The proponent indicated that further investigation prior to ground disturbance is warranted to ensure Aboriginal archaeological places and objects are appropriately managed, and that this could be managed through implementation of the proposed CHMP.

Where the proposal would result in unavoidable impacts to known Aboriginal archaeological places and objects within the proposal area, the proponent committed to obtain relevant authorisations under the *Heritage Act 2011* for the relocation and preservation of artefacts. The NT EPA has recommended a CHMP be developed prior to commencement, in consultation with the NLC, traditional owners, the NT Heritage Branch of DTFHC, AAPA and other relevant stakeholders; and implemented for the duration of the proposal. It has also recommended requiring that any updates to the CHMP must be done in consultation with traditional owners. Additionally, the NT EPA has recommended a condition requiring that the proponent consult with and have regard to the views of traditional owners and the NLC prior to finalising the RAP and prior to finalising the site audit report.

The NT Heritage Branch of DTFHC provided advice in its submissions that all heritage and archaeological issues have been adequately addressed and that the proposal would be unlikely to impact any further on known archaeological sites.

The NT EPA considers that potential significant impacts to known Aboriginal archaeological places and objects can be appropriately avoided through implementation of the recommended conditions and statutory provisions under the *Heritage Act 2011*.

6.2.6.3. Impacts to historic places and objects

Potential impacts on historic heritage places and objects related to WWII and previous mining activity that are not currently protected under the *Heritage Act 2011*, could be effectively managed through implementation of the proponent's commitments, and are not considered to be significant.

6.2.6.4. Impacts to culturally important vegetation

The NT EPA notes that the proposal would result in the removal of culturally important plant species (multi-stemmed cycad trees and large sand palms *Livistona humilis*) in area where disturbance is unavoidable. The proponent made efforts during the proposal design to avoid and minimise the number of multi-stemmed cycad trees and large sand palms that would be cleared; and committed to implement the Cycad Salvaging Procedure included in the EIS.

The NT EPA considers that the proponent's commitment to implement the cycad salvage procedure and to use translocated plants in rehabilitation where practicable, would ensure that any related impacts are not significant.

6.2.6.5. Failure to meet cultural objectives

The NT EPA recognise the desire of the Kungarakan and Warai people that rehabilitation at the former Rum Jungle mine site allows for the return to traditional ceremony, culture and subsistence use of natural resources. The NT EPA also considers that in order to meet the cultural objectives, the environmental conditions onsite and downstream must be improved, given that the proposal area contains sacred and significant sites and in those spaces rest the laws and stories that connect Kungarakan and Warai people to their ancestors, neighbours and the ecological foundations of their country. The NT EPA recognises the importance of input by traditional owners into decision making processes and has recommended a condition requiring that the proponent consult with and have regard to the views of traditional owners and the NLC

prior to finalising the RAP and prior to finalising the site audit report. The NT EPA also acknowledges the proponent's commitment to continue to engage with traditional owners throughout the proposal to ensure that cultural objectives are met.

6.2.7. Summary of factor assessment and recommended regulation

The NT EPA has considered the potential significant impacts of the proposal on culture and heritage values. In doing so, the NT EPA has considered whether reasonable conditions could be imposed, or whether other statutory decision-making processes could ensure the NT EPA's factor objective is likely to be met. The NT EPA assessment findings are presented in **Table 5**

The NT EPA has also taken into account the objects and principles of the EP Act (Appendix 2) in assessing whether the residual impacts will meet its environmental factor objective and whether reasonable conditions can be imposed.

Residual impact to environmental value	Assessment finding	Recommended conditions and regulation by other statutory decision-makers
Cultural heritage: Potential impacts to sacred sites	The NT EPA concludes that potential significant impacts to Aboriginal sacred sites can be appropriately avoided through statutory provisions under the NT ASS Act. Residual impact should be subject to conditions 3, 4 and 5 so that the environmental outcome is likely to be consistent with the NT EPA's objective for culture and heritage.	 Regulated through: other statutory decision- making processes under the NT ASS Act condition 3 - culture and heritage outcome condition 4 - consultation with traditional owners
Cultural heritage: Potential impacts to heritage places and objects	The NT EPA concludes that potential significant impacts to Aboriginal heritage places and objects can be appropriately avoided through statutory provisions under the Heritage Act 2011. Residual impact should be subject to condition 5 (CHMP) so that the environmental outcome is likely to be consistent with the NT EPA's objective for culture and heritage.	 Condition 5 - CHMP. Regulated through: other statutory decision-making processes under the <i>Heritage Act 2011</i> condition 3 - culture and heritage outcome condition 4 - consultation with traditional owners condition 5 - CHMP.
Cultural heritage: Potential impacts to historic places and objects	The NT EPA concludes that there is not likely to be a significant residual impact to cultural heritage (historic places or objects) from implementation of the proposal.	Regulated through other statutory decision-making processes under the <i>Heritage Act</i> 2011.
Cultural heritage: Potential impacts to culturally important vegetation	The NT EPA concludes that there is not likely to be a significant residual impact to cultural heritage (culturally important vegetation) from implementation of the proposal.	No recommended conditions required.

Table 5 Summary of assessment for culture and heritage

Residual impact to environmental value	Assessment finding	Recommended conditions and regulation by other statutory decision-makers
Cultural heritage: Potential failure to achieve cultural objectives	The NT EPA concludes that the proposal can be implemented in a manner that meets the cultural objectives.	Regulated through the recommended conditions in the draft environmental approval.

6.2.8. Conclusion against the NT EPA objective

With the implementation of the proponent's commitments and NT EPA recommendations for the draft Environmental Approval identified above, the NT EPA considers that the proposal could be conducted in such a manner that its objective for the key environmental factor Cultural and heritage is likely to be met.

6.3. Terrestrial environmental quality

6.3.1. Environmental values and existing environment

The NT EPA acknowledges the desire of the Kungarakan and Warai people that rehabilitation at the former Rum Jungle Mine site allows for the return to traditional ceremony, culture and subsistence use of natural resources.

The proposal is located within a geological area known as the Rum Jungle mineral field that is bordered by the Giants Reef Fault to the south and ridges to the north, and intersected by northerly trending faults. The mineral deposits associated with the proposal occur typically within the Whites Formation near its contact with Coomalie Dolostone and are strongly associated with fault zones. The mineral deposits are polymetallic, containing uranium, copper, cobalt, nickel and zinc (RCG & Jones 2019). Mineralisation is hosted by graphitic or chloritic pyritic phyllite.

The predominant land systems in the proposal area are sandstone and granite plains and rises, and alluvial floodplains adjacent to the Finniss River. Elevations in the proposal area range from 70 to 135 m AHD. Soils mainly consist of kandosols on gently undulating plains, rises and plateaus. Alluvium occurs near Fitch Creek and the upper EBFR. Soil profiles are deeply weathered, with laterite or saprolite found over bedrock.

The proposal area has extensive legacy contamination from former mining that would be addressed through site remediation and rehabilitation including construction, stabilisation and monitoring of physically and chemically stable landforms that can support self-sustaining vegetation systems and future land uses.

6.3.2. Investigations and surveys

Investigations and surveys undertaken by the proponent and reported as part of the Draft EIS, Supplement and additional information responses informed the NT EPA's assessment of potential impacts to terrestrial environmental quality (Appendix 5 – Investigations and surveys).

6.3.3. Consultation

Matters raised during government authority consultation relating to potential significant impacts to terrestrial environmental quality are summarised below:

• DEPWS raised concerns regarding the suitability of borrow material for WSF capping, uncertainty about WSF integrity and treatment of PAF material, the lack of field trials to

inform WSF design and erodibility, the lack of clear rehabilitation and closure criteria and the need for long-term monitoring to identify any residual impacts

• DCCEEW raised concerns about the erosion and flood modelling, the rehabilitation strategy, and the lack of a basal geoliner in the WSF design and the need for expert oversight during proposal implementation.

Matters raised during public consultation relating to potential significant impacts to terrestrial environmental quality include:

- the need to consider previous site rehabilitation failures, how WSF cover failure would be avoided and strategies for improved performance of capping and seepage management, and that learnings from previous unsuccessful uranium and nuclear site remediation in Australia should be incorporated into the proposal
- that a conceptual site model should be developed prior to, during and post-rehabilitation to identify uncertainties in relation to the disturbance footprint, waste classes and volumes, environmental processes (sediment, water and solute balance) with state variables and fluxes
- that the National Strategy for Ecologically Sustainable Development should be used to provide context and a basis for understanding best practice as applied to the proposal
- the need to consider potential cumulative impacts related to the adjacent Browns Oxide site
- concern about the level of uncertainty in the final design and potential issues related to the WSF ability to withstand high intensity rainfall events
- concern about the lack of detail on radiological contamination
- concern about a lack of quantitative rehabilitation criteria and the need for scientifically defensible and measurable criteria such as biodiversity recovery, erosion stability, reduction in oxidation rates (e.g., temperature, oxygen concentrations, moisture in covers)
- concern that the proposed five-year duration of post-rehabilitation monitoring is insufficient, and that monitoring should be required for at least 50 years
- that the proposal design should aim to contain PAF and radioactive materials for at least 10,000 years.

6.3.4. Potential significant impacts and benefits

A significant benefit of the proposal is to restore a degraded environment through a remediation approach (including the proposed treatment of contaminated mine wastes, treatment and management of groundwater and design of the WSFs) to provide:

- chemically and physically stable landforms for the secure containment and isolation of reactive mine waste (including treated PAF, AMD-affected soils, radioactive material and asbestos material)
- physical environmental conditions that support future land use.

Potential significant impacts to terrestrial environmental quality that could occur as a result of the proposal are:

- failure of remediation approach leading to ongoing poor environmental conditions and further AMD contamination, including from:
 - insufficient long-term management of WSFs resulting in a loss of integrity or failure of the cover system

• a lack of landform stability and integrity due to a lack of establishment of self-sustaining native vegetation cover.

6.3.5. Avoidance and mitigation of impacts

The NT EPA notes that the proposal aims to enhance and restore terrestrial environmental quality through remediation and rehabilitation to improve onsite environmental conditions. The proponent's application of the management hierarchies includes the following measures to avoid and mitigate potential significant impacts on terrestrial environmental quality:

- undertake remediation to address long-term legacy site contamination from previous mining activities
- submerge and store the most reactive mine waste in Main Pit beneath a permanent water cover system
- isolate and contain contaminated soils through excavation, transport, treatment and placement of waste material into new purpose built WSFs
 - treatment of PAF material and AMD affected soils through application of lime
 - compacted WSF foundation layer with construction in 0.5 m compacted layers, and capped with an engineered cover system
 - o isolation of radioactive material and asbestos material in WSF cells
 - geotechnical and geochemical quality assurance and quality control (QA/QC) program to ensure materials meets requirements and works are carried out in accordance with technical specifications
 - maximum WSF batter slope of 1:4 (25%) with a concave curvature
- implement and maintain measures to control soil erosion and sedimentation in accordance with an Erosion and Sediment Control Plan (ESCP)
- identify suitable cover materials from borrow areas and required quantities for the cover system layers
- progressive stabilisation and revegetation of disturbed areas
- avoid and then minimise handling of radioactive material
- develop site-specific modified health investigation levels (HILs) for soil contaminants as preliminary acceptance criteria for future land uses (GHD 2019d Modified health investigation levels for soils appended to Draft EIS)
- implement management plans including a Construction Environmental Management Plan, Revegetation Management Plan, Landfill Management Plan, and Radiation Management Plan.

6.3.6. Assessment of impacts to environmental values

6.3.6.1. Remediation approach

The remediation strategy for the management of legacy site contamination from mine waste was a key consideration during the NT EPA's assessment. The remediation approach involves treatment or containment of existing sources of contamination, including mine waste rock and tailings, contaminated soil and radioactive material, and the treatment and discharge of pit lake water and groundwater:

• Main Pit backfill: ~ 1.5 Mm³ waste material with the highest acid forming potential (from Intermediate WRD, Dysons backfilled pit and part of Main WRD) would be lime

neutralised and placed into the Main Pit for permanent storage under a capping layer and water cover

- WSFs: lime treatment and placement of remaining 6.1 Mm³ waste rock into two new WSFs with a cover system; radioactive material would be isolated in a containment cell at the bottom of the WSF
- Pit lake water and groundwater: contaminated groundwater and pit lake water would be extracted, treated in an onsite WTP and discharged to the receiving environment after the discharge criteria is met.

The NT EPA and submissions from DCCEEW and DEPWS identified concerns and information gaps with the remediation approach described in the Draft EIS. The proponent carried out further investigations to refine the strategy. Issues raised were partially addressed in the Supplement and two further additional information submissions. DCCEEW raised concern about the lack of a basal geoliner. The proponent's remediation approach has been designed to meet the high-level objective of improving the environmental conditions onsite and downstream to support future land use, including cultural values.

The proponent engaged an independent accredited contaminated land auditor (a qualified person under the *Waste Management and Pollution Control Act 1998*), to assess the adequacy of the Draft EIS in the context of contaminated land rehabilitation. The auditor verified that the EIS contains the necessary detail (or is satisfied that further information will be contained within subsequent design or management plans) to enable the former Rum Jungle mine (and associated sites) to be rehabilitated such that the environmental values that have been precluded by pollution will be restored, or will be restored to the extent practicable.

The NT EPA recommends a condition requiring that a site auditor be engaged throughout the remediation works to independently review the implementation and validation of remediation works and prepare a site audit report for the proponent to provide to the Minister on successful completion of the remediation works.

To ensure remediation is undertaken consistent with national best practice the NT EPA recommends a condition requiring that the proposed remediation works be conducted in line with the National Remediation Framework (NRF) (CRC CARE 2018) guidance and the *National Environment Protection (Assessment of Site Contamination) Measure 1999* (ASC NEPM 1999). Site remediation in accordance with best practice guidance would provide adequate protection of human health and the environment during proposal implementation and post-rehabilitation.

The NT EPA considers that uncertainty remains about the intensity, magnitude and extent of AMD and radiation pollution, and whether the proposed mine waste storages would effectively isolate contaminants from the receiving environment in the long-term. However, it considers that these uncertainties would be resolved by undertaking remediation in accordance with the recommended conditions, ASC NEPM and best practice NRF guidance, including requirements for remediation works to be validated and independently audited, and the performance of mine waste storages to be monitored and managed in the long-term.

To ensure site contamination issues are addressed, the NT EPA recommends a condition requiring that the proponent prepare a Remediation Action Plan (RAP) that is subject to review and endorsement by an accredited site auditor and an independent peer review, and that the approved RAP is implemented. In addition to ensuring a high level of rigour in the RAP, the appointment of the site auditor and peer reviewer would provide improved collective technical knowledge and increased scrutiny of the areas of uncertainty in comparison to review and endorsement by a single auditor.

The NT EPA's recommended conditions require that the site auditor and peer reviewer would be selected based on their professional and technical qualifications and experience in relevant fields of expertise including legacy mine remediation, civil engineering, AMD, mine rehabilitation,

hydrogeology and long-term environmental monitoring and management. The RAP would set the remediation objectives and document the site remediation process in detail, including for treatment, containment, validation, monitoring and long-term management. A simplified diagram of remediation roles and responsibilities under the environmental approval is shown at **Figure 4**.

Flow chart – draft environmental approval roles and condition requirements – Rum Jungle					
	Approval holder	Peer reviewer	Site Auditor		
Pre-construction	Suitably qualified and experienced person(s) prepares Remediation Action Plan (RAP) including subplans: • Long Term Environmental Management Plan (LTEMP) • Erosion & Sediment Control Plan by CPESC • Revegetation plan • Receiving environment monitoring program (REMP) • Water Management Plan • Cultural Heritage Management Plan (CHMP) • Mine waste storages design and construction verification	Independent peer review of RAP	Endorses RAP and subplans Certifies mine waste storages design plans & construction report		
Construction	 Implements RAP (including all subplans): Undertakes all remediation work Conducts REMP monitoring Refines LTEMP 		Oversees remediation works		
Stabilisation	 Validates remediation works Prepares Validation Report Implements LTEMP 		 Endorses Validation Report Prepares Site Audit Report 		
Post-action	 Implements LTEMP 		Oversees long term monitoring works		

Figure 4 Remediation roles and responsibilities under the environmental approval.

Treatment of mine waste

The proponent considered options for neutralising waste rock to control AMD production reactions and thus halt or significantly limit the rate and intensity of subsequent contamination in the receiving environment. Investigations were conducted by specialist consultants on behalf of the proponent to determine the physical and geochemical characteristics of mine waste. This included work to estimate neutralisation requirements, determine the effectiveness of lime application to reduce leaching, and make recommendations for a QA/QC program to demonstrate treatment against design parameters and performance criteria during treatment of mine wastes (RGC & Jones 2019).

The proposed treatment approach involves excavation, movement and placement of waste material in 0.5 m lifts into two new WSFs, with each layer consisting of blocks of 2500 m³ (50 m x 100 m x 0.5 m). Ten individual grab samples from each block would be analysed in situ for paste pH and results used to determine the correct lime dosing rate in accordance with the proponent's general site and civil earthworks work package technical specification. The proponent would engage a certified professional with experience in geochemical and geotechnical QA/QC to oversee the neutralisation treatment and validation process.

Lime would be applied to each block at the required dosing rate and appropriate equipment used to mix a homogenous blend of lime and waste rock within each block which is crucial for the overall success of remediation works. The proponent would document and record the mass of lime applied to each block as part of the QA/QC process. Following mixing, the moisture content would be adjusted, and material compacted in accordance with geotechnical specifications. A verification program would be required for one in every ten blocks to confirm whether the field paste pH method is performing as expected. This would involve determining total acidity using tests for titratable acidity, water-soluble sulfate and total extractable sulfate in accordance with technical specifications.

The remediation works, including mine waste treatment, would be subject to the site audit process. The proponent would be required to validate the remediation works and produce a report detailing how the remediation works were undertaken in accordance with the RAP, including the use of lime to treat waste material before containment within the WSF.

The NT EPA has recommended a condition requiring that the suitably qualified and experienced person appointed to document and validate the remediation works, and prepare the validation report, is certified under either the Environment Institute of Australia and New Zealand's Certified Environmental Practitioner (Site Contamination) scheme (CEnvP (SC)) or the Soil Science Australia Certified Professional Soil Scientist Contaminated Site Assessment and Management (CPSS/CSAM) scheme. This would increase the level of certainty for the NT EPA and other stakeholders that validation processes would be conducted with adequate rigour and thoroughly documented and reported by an experienced certified professional.

Management of contaminated groundwater and leachate

The remediation approach includes pumping and extraction of contaminated groundwater and pit water for treatment via a WTP, where required to meet discharge water quality criteria, before discharge to the EBFR in accordance with a Waste Discharge Licence (WDL) issued under the *Water Act 1992*, to prevent further leaching and migration of contaminants.

The NT EPA's assessment of potential impacts of the proposed groundwater remediation is detailed in section 6.4.

Main pit backfilling

Remediation works involve using the available capacity within the Main Pit to backfill mine waste material with the highest acid forming potential. Waste material to be backfilled to the Main Pit would be segregated, stockpiled, tested, treated with lime and validated prior to subaqueous

placement in the pit, in accordance with the proponent's Main Pit backfill specification. The backfilled layer of waste rock would then be capped with a 2 m layer of inert fill underlying a permanent, shallow (2 m) water cover, and the pit rim side slopes would be re-profiled and erosion protection installed to improve stability.

The NT EPA's assessment of potential impacts of the proposed Main Pit backfilling is detailed in section 6.4.

Design of WSF and Main pit backfill

The WSFs would be constructed in two stages to limit mine waste exposure to oxygen and the amount of leachate generated during construction, with the West WSF constructed first and the remaining mine waste contained in the East WSF. The NT EPA considers that there is some uncertainty with respect to the WSF design, including limited justification for site selection, geotechnical stability, QA/QC for construction, contingency measures in the event of cover system failure or leaching of contaminants, and long-term management requirements.

Information on WSF site selection in the EIS identified that the proposed WSF location is partially underlain by Coomalie Dolostone which comprises about 60% of the eastern WSF footprint, and that this geology may be subject to collapse under loading which could compromise the integrity of the WSF landform and capping. Geotechnical tests of suitable WSF sites investigated foundation subsurface materials, including strength of bedrock up to 4.5 m deep. Further targeted geotechnical investigation was recommended to validate the findings. The NT EPA considers that the WSF must be designed with sufficient consideration of the competence of foundation geology and its ability to support the proposed WSF landform in perpetuity. The NT EPA recommends a condition requiring that the design and construction of mine waste storages, including the WSFs and the backfilled Main pit, are certified by the site auditor.

The proponent's additional information to the EIS submitted in 2022 included a detailed engineering design report and technical specification for WSF construction and Main pit backfill that outlined the methodology and QA/QC processes for each stage of construction. The NT EPA acknowledges that the WSF landform and Main Pit backfill may undergo minor changes from the final design presented in the EIS due to changes in material assumptions, site conditions and erosion requirements during finalisation.

The WSF design incorporates a 2.5 m thick cover system for the WSF plateau, consisting of a 0.5 m compacted clay liner, then a 1.5 mm linear low-density polyethylene (LLDPE) liner over a protective geotextile layer, covered with 2 m of growth medium overlain with topsoil. The cover system for the WSF batter slopes is similar to that of the plateau but does not include the LLDPE and geotextile layers. The cover system on the plateau and slopes would also incorporate an additional layer of inert waste rock beneath the cover system up to 2 m deep to provide an additional barrier to reduce oxygen influx to the WSF, if sufficient material is available. The WSF surface would be revegetated with native plant cover.

The WSF design does not include a basal geoliner to prevent or delay seepage to groundwater as the proponent deemed it unnecessary based on the established hierarchy of proposed seepage control measures, including a water-shedding design, use of compacted clay layers in the cover system to reduce infiltration, compaction of all WSF waste layers to 95% standard maximum dry density, and revegetation of the WSF surface. The proposed foundation preparation includes ripping and compacting of the top 300 mm to an equivalent density of 98% standard maximum dry density, and within the range of \pm 3% standard optimum moisture content.

To manage the risk of leachate seepage to as low as reasonably practicable (ALARP), the geochemical, geotechnical and structural integrity of the WSF must be maintained. This includes designing and constructing the foundation and floor of the WSFs to be geotechnically stable in the long-term, with consideration of the potential for adverse physical or chemical reactions

between the PAF material, foundation and underlying groundwater. The NT EPA expects the design and construction to be consistent with contemporary best practice such as with use of liner materials or low permeability materials to limit or manage seepage. The NT EPA notes that the proponent's technical specification for construction of the WSFs provides for verification and testing during construction to ensure the specified requirements are met.

In response to DCCEEW comments on the Draft EIS, the proponent included a geo-liner in the plateau of the WSF cover system design. Advice from DCCEEW raised concern that the WSF design did not include a basal liner and considered that the geo-liner proposed as part of the WSF cover system would not be a suitable long-term option to limit the rate of seepage. The NT EPA considers that the WSF design should be consistent with the NRF guidance related to containment, and chemical immobilisation and stabilisation. The NT EPA has recommended a condition requiring that remediation works conform to the NRF guidance and the ASC NEPM, as a minimum standard.

The proponent engaged SLR Consulting to prepare an erosion assessment report for the proposed WSFs, which recommended dual concave batter slopes of 9°-14° and presented modelling to simulate the erosion performance. The modelling predicted that erosion of the WSF cover system is not likely to reach a depth of 2 m after 500 years. The NT EPA notes the modelling is based on limited data and incorporates assumptions and simplifications to determine the results. These assumptions relate to the WSF shape, cover system material properties, vegetation cover, and the intensity, frequency and duration of rain events.

The NT EPA notes that modelling of cover performance must incorporate rigorous checks of the assumptions made about material properties and reactivity, especially those to be used in the low-permeability layers (Taylor et. al 2003). A study in the EIS on the reasons for deterioration and failure of previous waste rock dump cover systems at Rum Jungle concluded that the design approach for a long-term cover needs to take into account the probable changes in material properties over time. This includes changes to material properties from exposure to acid, saline and other extreme solutes, and changes due to unavoidable pedological and biological processes.

Comprehensive physical and geochemical testing of cover materials would be required to ensure that specifications are met, particularly with respect to permeability and desiccation shrinkage. The NT EPA notes that the proponent's laboratory-based flume testing of the borrow material that would be used in the cover system was based on a single random sample of each type of material that would be extracted including laterite growth medium (1,600,000 m³ required) and low permeability clays (450,000 m³ required). The proponent assumed that the borrow material properties were uniform and that the singular samples were representative of materials across the site. The EIS did not state whether the samples were composite samples.

The proponent's erosion assessment report noted that the surface roughness and compaction of material in flume testing may vary to that on site. The NT EPA supports the erosion assessment report recommendation that geotechnical parameters be reassessed via flume testing or field tests prior to construction to ensure that specifications could be met, or alternatively that materials be conditioned to meet the specifications or the erosion modelling be updated, or both.

The WSF long-term erosion modelling results indicate that, under vegetated conditions the WSF cover system is unlikely to experience erosion incision depths of more than 2.5 m after 500 years. The NT EPA notes the modelling used a vegetative cover factor of \geq 80% in the dry season and \geq 95% in the wet season, which may not be practicable to achieve and maintain in the long-term. Flume testing results showed that the WSF surface would be highly erodible without vegetation or a surface cover, even at low slopes. The erosion assessment report noted that the type and rate of revegetation is critical to controlling WSF erosion and recommended that revegetation planning should be representative of the data established in the erosion assessment report. Alternatively, if revegetation planning proposes application of different revegetation cover percentages or rates, the report recommended that further modelling be undertaken to estimate likely erosion rates under the proposed revegetation plan.

The NT EPA requested further information in relation to additional erosion control measures that could be applied to the WSF surface if sufficient vegetative cover could not be achieved, or if erosion monitoring identified areas of failure. The proponent response stated that it would consider use of engineered covers such as rock armour if necessary to safeguard long-term stability.

The WSF long-term (500 year) erosion modelling used the 1-in-2 year storm as the most geomorphically active rainfall event to simulate how runoff relates to rainfall, based on site specific intensity-frequency-duration average annual data, as is standard for the model used (Siberia). Siberia simulations use an average area-discharge relationship for a whole wet season rather than time series hydrology of a single rainfall event or series of events. Consequently, the proponent's erosion assessment has not implicitly addressed the impact of an extreme rainfall event (1-in-10 year or 1-in-100 year) or a series of events comprising an extreme wet season, which would potentially result in increased soil loss rates.

Climate change concerns have strengthened the need to understand the effect of extreme rainfall events on the stability of mine rehabilitation works. The proponent's climate change assessment did not consider the effect of storm events other than the 1-in-2 year event on long-term WSF capping erosion. It cited a study by Lowry et al. (2020) which used alternate modelling (CAESAR) to consider how an extreme rainfall event (>1-in-100 year) affected denudation rates of a conceptual rehabilitated landform compared to denudation rates using average annual rainfall at Ranger Uranium Mine. The study found that extreme rainfall events can significantly increase mine waste landform denudation rates, depending on how stable the landform is at the time of the event with respect to settlement, initial fine sediment removal, drainage line incision and vegetation growth that occurs during the catchment conditioning phase which is expected to take about five years.

The erosion assessment report noted that QA/QC is crucial in terms of WSF material placement including for foundation preparation, density and compaction, layer thickness, organic material content and other specifications to assure short and long-term WSF integrity and stability. The NT EPA notes that failure to implement such QA/QC processes during construction would potentially result in failure of the WSF, considering that a small-scale failure such as material settlement for example, could act as an initial condition to deteriorate the entire WSF cover system. The NT EPA considers that the long-term integrity and stability of the WSF is critical to the overall success of the proposal, taking into account learnings from the failure of previous Rum Jungle rehabilitation in the 1980s and that even a minor loss of integrity or stability could significantly affect the performance of the WSF and lead to accelerated and intensified AMD generation and transport.

The NT EPA notes that there are residual uncertainties around the adequacy of the WSF design and whether the structures would effectively limit the rate of release of stored contaminants to the receiving environment such that environmental conditions onsite and downstream would be improved in the future. This uncertainty stems from a lack of available geotechnical test results for borrow materials, failure to demonstrate that the nominated vegetation cover percentages and establishment rates are realistic and achievable, that model inputs used to predict long-term erosion rates are representative of site conditions, and that the proposed QA/QC measures for WSF construction are sufficient to assure long-term integrity and stability.

The NT EPA is of the view that, although erosion modelling results indicate that the erosional performance is acceptable, the modelling relies on assumptions and simplification to obtain results, therefore there is a need to evaluate modelling procedures and validate model results against field data. The NT EPA considers that further work is required during finalisation of the proposed WSF and Main pit backfill design to ensure that the modelling and data that supports the WSF basis of design is sufficiently robust and appropriate for long-term environmental performance.
The NT EPA recommends conditions requiring ongoing updates to groundwater and surface water modelling, and certification of the mine waste storages design and construction. The RAP would also be subject to review and endorsement by the site auditor and an independent peer review by another accredited site auditor. The peer review would identify any adjustments required and make necessary recommendations regarding the finalisation of the mine waste storages design. Any recommendations of the site auditor and peer reviewer would need to be addressed by the proponent prior to finalising the RAP.

The NT EPA reviewed the overall remediation approach and proponent's WSF design and specification documents. Concerns raised in public and government authority submissions have been addressed through the provision of additional information, or would be addressed through implementation of the recommended conditions. The NT EPA recommends conditions requiring that remediation works, including WSF construction to the required specifications, would be validated by a suitably qualified and experienced certified professional and audited by the independent site auditor. The NT EPA concludes the proposed remediation approach, subject to the recommended conditions, would ensure that mine waste placed within the WSF and Main pit is adequately contained and isolated to limit AMD generation and the rate of release of contaminants to the receiving environment.

6.3.6.2. Long-term management of WSF and backfilled Main pit

Reactive AMD generating mine wastes would be contained in the WSFs and Main pit in the long-term, therefore ongoing monitoring and management would be essential to maintain compliance with the ASC NEPM and NRF and to ensure the cover systems and WSF landform remain capable of protecting terrestrial environmental quality into the future. This section discusses the NT EPA's assessment of the effectiveness of proposed measures to provide for long-term monitoring and maintenance of the WSF.

The proposal involves the implementation of physical works over a 10-year period (5 years construction, plus 5 years stabilisation and monitoring) to complete the planned rehabilitation. Long-term monitoring beyond the proposed 10-year duration of works is not part of the proposal scope. The proponent acknowledged that following proposal implementation, a period of site maintenance alongside a long-term monitoring program to measure environmental performance (future Stages 4 and 5) would be required and is planned.

During the course of the assessment, the NT EPA raised concern that long-term monitoring and maintenance had not been accounted for. The NT EPA notes that the financial details of the Federation Funding Agreement between the Australian and NT governments are currently classified as 'not for publication'. Submissions received on the EIS raised concern about the lack of available detailed financial costings and budget, noting the importance of appropriate resourcing to ensure the project is successful, and to avoid the risk of repeating the errors of the 1980s rehabilitation, which would potentially result in ongoing environmental legacy issues and liability for future generations.

The NT EPA accepts that long-term management of the WSF beyond the 10-year schedule is not within the proposal scope and acknowledges the proponent is constrained by timeframe and budget. The NT EPA also acknowledges that there is a risk that the proposal could result in significant cost and ongoing liability for the Australian and NT governments and the affected community if the remediation objectives are not met. The NT EPA considers that the design, construction, maintenance and monitoring of the WSF in accordance with the NRF and ASC NEPM would be sufficient to ensure that long-term environmental risks are minimised, and a strong framework is in place for future care of the WSFs and backfilled Main pit to provide financial protection for the Australian and NT governments and community in the long-term.

The NT EPA's assessment of the proposed rehabilitation design considered the need for ongoing site management beyond the stabilisation and monitoring phase of stage 3. The NT EPA recommends a condition requiring that the proponent prepare a Long-Term Environmental

Management Plan (LTEMP) that would be reviewed and endorsed by the site auditor as part of the RAP, independently peer reviewed, and then updated with the outcomes of the site audit report for review and approval prior to proposal completion. The recommended condition requires implementation of the approved LTEMP to ensure the physical and chemical stability of the final WSF landforms in the long-term. With these conditions in place, the NT EPA is satisfied the WSF would be appropriately managed to ensure that any ongoing risks to human health and the environment are minimised.

6.3.6.3. Revegetation

Significant impacts to land and soil quality could occur if the proposed site revegetation is either unsuccessful, or is not conducted as described in the EIS. The proponent addressed revegetation through development of a revegetation strategy framework (Top End Seeds 2020), draft revegetation management plan (Top End Seeds 2022), draft monitoring plan (DIPR 2020), growth medium investigations (SLR 2020e) and consultation with the Kungarakan and Warai people about their vision for the future land use of Rum Jungle. The draft revegetation management plan provided with the EIS identified three domains for ecological restoration and described how each domain would be prepared, the native seed mixes that would be used and the ongoing management, monitoring and performance criteria to evaluate revegetation success. Site revegetation and maintenance of cover in the long-term is an important component of the site stabilisation process, particularly to prevent erosion of the constructed landforms and drainage.

Revegetation serves many purposes in rehabilitation ranging from the restoration of habitat to erosion control, and helps to maintain the stability and the integrity of constructed landforms. The NT EPA supports the proposed progressive revegetation of disturbed areas with native vegetation, and notes that if site revegetation is not designed, implemented and managed adequately, there is a risk of increased erosion of the constructed landforms due to a lack of surface cover. At Rum Jungle, the NT EPA identified that in the context of remediation works, the priority for revegetation is to support physical landform stability. Considerations for successful revegetation include the capacity of the final landforms to sustain plant growth, interactions with the surrounding environment and the desired future land uses.

The proponent's erosion assessment report noted that the type and rate of revegetation is critical to controlling erosion and that the revegetation plan should either be representative of the data presented in the erosion assessment report modelling (cover percentages and revegetation rates), or that further modelling be undertaken to estimate likely erosion rates based on the detail provided in the revegetation plan. Flume testing (Aquaterra International 2019 in SLR 2020k) identified that soils are prone to erosion without vegetation cover. The early stages of revegetation, and after fire events, will be particularly susceptible to erosion when soils will have limited groundcover.

The draft revegetation management plan provided with the EIS (Appendix 9 in Additional Information 2) did not reflect the vegetation cover requirements of the erosion assessment which underpins the WSF design. The NT EPA notes that the draft Revegetation Management Plan would be refined and updated by the proponent during proposal implementation.

The NT EPA identified uncertainties around the potential for revegetation to impact landform stability, in particular the risk of root system intrusion into the stored mine waste material beneath the WSF capping layer. The EIS noted that the selection of appropriate vegetation is of prime importance in stabilising cover surfaces. Learnings from previous waste rock cover system failure following the 1980s rehabilitation at Rum Jungle indicate that communities dominated by native grasses and shrubs (rather than pasture species) would lead to greater sustainability over longer periods.

The EIS stated that it is probably unrealistic to expect to be able to completely prevent volunteer tree species roots from penetrating the covers unless very deep, impervious covers are

constructed. Similarly, while it would be impossible to prevent colonisation of the covers by termites and ants, a thicker storage-release layer may reduce invasion of the underlying low-permeability layer by these animals. The EIS stated that deep-rooted plants, such as large trees, would be avoided on the WSF to support cover integrity. The NT EPA notes that this may require ongoing maintenance to remove large trees colonising the WSF through natural recruitment processes.

The NT EPA considers that long-term revegetation trials and further testing of growth medium would be beneficial to ensure that revegetation planning is supported by field data and that any requirements for soil amelioration are determined.

Taking into account the above considerations, the NT EPA recommends a condition requiring that site revegetation establishes an ecosystem with species composition, structure and function that is comparable to surrounding undisturbed vegetation, and is capable of supporting final landform stability in the long-term. To support long-term revegetation success the NT EPA recommends an assessment of the proposed revegetation's 'climate readiness' in line with the National Ecological Restoration Standards (SERA 2018), to maximise the long-term success of the revegetation under a changing climate without compromising the revegetation's establishment under the current local climate.

The proponent's revegetation management plan would provide for ongoing adaptive management throughout the revegetation process, and regular assessment of revegetation progress to align with critical revegetation stages and milestones to address any issues that arise. The NT EPA's recommended condition requires that revegetation assessments be conducted by a suitably qualified and experienced person with expertise in local revegetation and mine rehabilitation.

6.3.7. Summary of factor assessment and recommended regulation

The NT EPA has considered the potential significant impacts of the proposal on terrestrial environmental quality. In doing so, the NT EPA has considered whether reasonable conditions could be imposed, or whether other statutory decision-making processes could ensure the NT EPA's factor objective is likely to be met. The NT EPA assessment findings are presented in **Table 6**.

The NT EPA has also considered the objects and principles of the EA Act and EP Act (Appendix 2) in assessing whether the residual impacts will meet its environmental factor objective and whether reasonable conditions can be imposed.

Residual impact to environmental value	Assessment finding	Recommended conditions and regulation by other statutory decision-makers
Impacts on land or soil quality due to failure of remediation	The NT EPA has recommended conditions requiring that remediation works are undertaken in line with the ASC NEPM and the NRF guidelines to ensure that the remediation works meet the objectives. It also recommended an independent site auditor be engaged throughout the proposal, a remediation action plan be endorsed by the site auditor, and subject to an	 Regulated through recommended conditions: Condition 7 - remediation works Condition 8 - site auditor Condition 9 - remediation action plan Condition 10 - independent peer review
	independent peer review, validation	of endorsed RAP

Table 6 Summary of assessment for terrestrial environmental quality

Residual impact to environmental value	Assessment finding	Recommended conditions and regulation by other statutory decision-makers
	of remediation and a site audit report.	 Condition 11 – validation of remediation works
		 Condition 12 – validation report
		• Condition 13 – site audit report
		 Condition 14 – certifying design and construction plans for mine waste storages
Impacts on land or soil quality due to a failure of new mine waste storages to	The NT EPA has recommended a condition requiring certification of the design and construction of mine waste storages (WSFs and Main Pit	Regulated through recommended conditions: • Condition 10 – independent peer review of endorsed RAP
provide physically and chemically stable landforms.	review of the RAP, which would include a review of the mine waste storages design.	 Condition 14 – certifying design and construction plans for mine waste storages
Insufficient long- term management of WSFs resulting in a loss of integrity or failure of the cover system, leading to further site contamination	The NT EPA has recommended a condition requiring that an LTEMP be prepared and reviewed as part of the RAP, to ensure that long-term WSF management requirements are addressed.	 Regulated through recommended conditions: Condition 15 - long- term environmental management plan Condition 16 - erosion and sediment control Condition 17 - revegetation.
A lack of revegetation success results in landform instability or compromised integrity resulting in further site contamination.	The NT EPA has recommended conditions requiring that disturbed areas are revegetated with self- sustaining native vegetation, and that revegetation assessments are carried out by a suitably qualified and experienced person.	Regulated through recommended conditions: • Condition 17 – revegetation.

6.3.8. Conclusion against NT EPA's environmental factor objective

With the implementation of the proposed management measures, the recommended conditions, and regulation under other statutory decision-making processes, the NT EPA considers that the proposal could be conducted in such a manner that its objective for terrestrial environmental quality is likely to be met.

6.4. Inland water environmental quality, Hydrological processes and Aquatic ecosystems

6.4.1. Environmental values and existing environment

The proposal area is located within the headwaters of the Finniss River, with the EBFR flowing through the former Rum Jungle mine site. The EBFR is an ephemeral waterway, joining the perennial Finniss River approximately 8.5 km downstream of Rum Jungle. Approximately 57 km downstream of Rum Jungle, the Finniss River enters the Finniss River coastal floodplain and flows into the Timor Sea in the Fog Bay area, which are internationally recognised sites of conservation significance (SoCS). Fog Bay, including the Finniss River catchment has a Beneficial Use Declaration under the *Water Act 1992* for aquatic ecosystem protection and recreation water quality aesthetics.

The proponent describes the EBFR as an intermittent stream within a distinct channel that dries to a series 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 up to 3.0 m high, and sandy to rocky mid-stream shoals are a common feature. The riparian corridor merges rapidly with surrounding Eucalypt woodland areas, and there are few surrounding floodplain areas.

The proponent undertook community and stakeholder engagement (Hydrobiology 2013) to evaluate the environmental values downstream of Rum Jungle. The consultation was in accordance with ANZECC/ARMCANZ guidelines and methodology (now superseded by the ANZG (2018) water quality guidelines) and identified the community values of the EBFR and the Finniss River system as aquatic ecosystems, wildlife habitat, human consumer, primary, secondary and visual recreation, cultural/spiritual, drinking water, irrigation, stock water and farm supply.

There are a number of significant and sensitive vegetation types in the proposal area that are likely to depend on access to temporary or permanent water sources, such as 69 ha riparian and wetland vegetation (surface water), a 16 ha vine forest at Rum Jungle (potential groundwater dependant ecosystem) and a 20 ha rainforest at Mt Burton (spring water).

The EBFR and Finniss River have important cultural and spiritual values that relate to a range of uses and issues including spiritual relationships, language, stories, sacred sites, customary use, and the plants and animals associated with water. Previous mining activity diverted the EBFR away from the orebodies at the Main Pit and Intermediate Pit. Currently, environmental flows along the EBFR's original alignment, through Main Pit and Intermediate Pit, occur only during wet season high flow events.

Groundwater resources from the regional Coomalie Dolostone formation are extracted for water supply in the township of Batchelor, and downstream of Rum Jungle for small scale irrigation supply, farm and stock water. At Rum Jungle groundwater occurs within the structurally controlled and mineralised Rum Jungle Complex (granites, metasediments and dolostone). Groundwater quality at Rum Jungle has been significantly impacted by AMD leachate to the extent that contaminant plumes have developed below existing mine waste landforms. Immediately downstream of Rum Jungle, contaminated groundwater discharges to the EBFR in the wet season. The close interaction of the EBFR with groundwater sustains a series of instream pools during the dry season.

As a result of AMD from historic mining, surface water at and downstream of Rum Jungle is contaminated, resulting in significant pollutant loads to both the EBFR and the Finniss River. The proponent's investigations identified an aquatic species protection level of less than 1% in the EBFR immediately downstream of Rum Jungle. The condition of the EBFR improves further downstream to 8% in the dry season and 28% species protection level in the wet season. In the

Finniss River downstream of the EBFR confluence, water quality improves to a species protection level of 91% in the dry season and 50% in the wet season (**Table 7 Current level of species protection (at 95%ile concentration) and proposed LDWQO (adopted from Hydrobiology, 2022)**).

Long-term water quality and flow monitoring is conducted by the proponent at three locations in zones 2 and 3 of the EBFR downstream of Rum Jungle. The data collected from these gauging stations informed the proponent's site conceptual model.

6.4.2. Investigations and surveys

Investigations and surveys undertaken by the proponent and reported as part of the Draft EIS, Supplement and additional information responses, informed the NT EPA's assessment of potential impacts to inland water environmental quality, hydrological processes and aquatic ecosystems (Appendix 5 – Investigations and surveys).

6.4.3. Consultation

Matters raised during the NT EPA's public consultation relating to water (combining inland water environmental quality, aquatic ecosystems and hydrological processes) include:

- the need to describe assessment and monitoring for downstream water objectives
- clearly defining and assessing the extent of contaminant transport downstream prior, during and post-rehabilitation
- concern about Rum Jungle Creek South and how it relates to the proposal
- assessment of elevated uranium levels in zones of the Finniss River that are in close proximity to communities
- potential for discharge of contaminated water in the dry season
- uncertainty about the proposal's final design and key elements of the project including:
 - re-directing flows through the main pit presenting an AMD risk to the EBFR and
 - uncertainty if a water cover over the tailings located within the pit can be maintained
- concern that the realignment of the EBFR through the pits is considered an increased environmental risk that should not take place as proposed, and that cultural considerations of the realignment should be revisited when the environmental risks are better understood and can be appropriately mitigated
- concern that the levels for contaminated soil assessment and Locally Derived Water Quality Standards are too high and would allow for direct discharge of AMD
- highlighting that the neighbouring Browns Oxide mine (currently under care and maintenance) is a significant risk to the successful rehabilitation of the Rum Jungle, and access to existing infrastructure (e.g. water treatment plant, offices, ablutions, bulk fuel and reagent storage and source of potable water and water for dust suppression) would benefit the proposal.

Matters raised during Australian and NT government authority consultation relating to potential significant impacts on water (combining inland water environmental quality, aquatic ecosystems and hydrological processes) include:

• describing the extent of contamination to the downstream environment and the process for deriving LDWQOs, and relationship to the long-term (adaptive) management strategy to protect environment values

- concern about the quality of data used to derive LDWQOs
- concern about lack of detail regarding the proposed water treatment methods and remediation of contaminated water to comply with LDWQO and disposal of residual waste products
- the application of surface and groundwater models in simulating current conditions, and in predictions of metal loads in surface water and solute transport in groundwater
- the appropriateness of the proposed monitoring and reporting regime for the aquatic ecosystems
- concern about the re-instatement of the EBFR to its original flow path through the Main Pit
- discussion on the framework for regulating the discharge of treated water and inclusion in the adaptive management strategy for the proposal
- consideration of current and proposed development activities and the cumulative impacts to water quality
- highlighting the potential significant impact to groundwater dependent ecosystems such as the local stands of vine forests.

6.4.4. Potential significant impacts and benefits

The proposal aims to improve the environmental conditions onsite at Rum Jungle and downstream in the EBFR and Finniss River, enhance cultural values and support future use. The NT EPA acknowledges that implementation of the proposal could result in short-term or long-term significant impacts and benefits to receiving waters through remediation and rehabilitation, caused by changes to water quality, hydrological processes, and aquatic ecosystems.

Inland waters have the potential to be significantly impacted through:

- changes in surface water quality due to solutes or sediments in discharge water, stormwater runoff or realigned EBFR stream flows
- changes in groundwater quality due to seepage from mine waste stored in Main pit or WSFs
- altered surface water flows resulting in adverse physical changes to local or regional hydrology as a result of changes to flow velocities, erosion, flooding and sedimentation.

6.4.5. Avoidance and mitigation of impacts

The proponent proposes to remediate and rehabilitate the site to improve onsite environmental conditions to support future beneficial uses of inland waters. The proponent aims to avoid and mitigate potential significant impacts to inland waters in the short-term and long-term through design, implementation and adaptive management actions.

The proposal includes the following measures to avoid and mitigate impacts to inland water environmental quality, aquatic ecosystems, and hydrological processes:

- identify and control the sources of AMD and contamination of the EBFR and Finniss River and relocation of contaminated material taking cultural values into account
- address the physical aspects of the site that require remediation and rehabilitation and neutralising/isolating contaminant sources with a focus to improve, enhance or restore the quality of surface waters and groundwater
- placement of up to 1.5 Mm³ of PAF-1 waste into Main Pit that includes:

- sub-aqueous placement of a bedding layer to facilitate the backfilling of waste rock materials to the design elevations
- \circ $\:$ sub-aqueous placement of PAF waste rock above the bedding layer
- o placement of clean, inert cover materials over waste rock backfill
- material handling and placement to minimise mobilisation of contaminated materials, the impact and risk to water treatment, *in situ* geological features, and final landform requirements
- \circ $\,$ avoiding the remobilisation of contaminated materials within the tailings pile and chemocline, and
- re-contouring the crest of Main Pit to meet final landform objectives and facilitate revegetation and the placement of erosion protections
- restore the original alignment of the EBFR through Main and Intermediate pits with the aim to maintain a wet cap over PAF waste rock and tailings
- remediate contaminated groundwater by implementing a seepage interception system of pumping, and treatment of the contaminated groundwater prior to controlled discharge to the receiving environment
- treat contaminated water to the water quality rehabilitation target for the EBFR at Rum Jungle (70% LDWQO) before discharge to the EBFR
- implement management plans for erosion and sediment control, water management, and environmental monitoring with mitigating actions including:
 - \circ $\;$ installing erosion protection controls such as sediment dams
 - o treatment and discharge of contaminated water
 - monitoring water quality and behaviour of surface and groundwater and implementing management and mitigating actions when relevant triggers are met.

6.4.6. Assessment of impacts to environmental values

6.4.6.1. Changes in surface water quality due to solutes and/or sediments in discharge water, stormwater runoff and/or realigned EBFR

At Rum Jungle, mine wastes are currently producing AMD which is recognised as a complex, multi-factor pollutant that continues to significantly contaminate the downstream EBFR and Finniss River. The proposal includes remediation of known soil and water contamination within the proposal area, and aims to prevent future production of AMD to improve the downstream aquatic ecosystem condition in the EBFR and Finniss River to support beneficial uses.

The NT EPA recognises that the current ecosystem condition is substantially degraded and that the intent of the proposal is to improve ecosystem function. The NT EPA also recognises the potential for significant impacts to inland waters (including inland water environmental quality, hydrological processes, and aquatic ecosystems) from proposal implementation, particularly if the rehabilitation is not successful in achieving its long-term objectives.

Locally Derived Water Quality Objectives (LDWQOs)

The proponent developed LDWQOs in line with national water quality guideline (ANZG 2018) methods, for the purpose of setting water quality objectives for receiving waters downstream from the proposal. The proponent's approach involved dividing the downstream aquatic environments of the EBFR and Finniss River into eight zones according to ecological and geomorphological attributes, catchments and environmental values (Hydrobiology 2013b)

(Figure 5). The EIS stated that the LDWQOs represent targets of substantial improvement compared to the current downstream conditions of the EBFR and the Finniss River, and that they would be used to measure the success of the proposed rehabilitation.

The current seasonal conditions for each zone are shown in **Table 7**, alongside the target LDWQOs. In response to information requests from the NT EPA, the proponent provided a summary of surface water quality data, the current level of species protection provided by the ecosystem condition of each zone, refined LDWQOs for the Finniss River, and addressed concerns raised about the potential effects of wet season first flush events. The proponent states that key stakeholders, including the local community and traditional owners, were consulted in the development of the environmental values.

The EIS stated that a combination of field and biological effects data was used to develop the LDWQOs. Aquatic fauna distribution patterns were combined with water and sediment quality data to develop LDWQO for the zones of the EBFR downstream of Rum Jungle (zone 2-4) (Hydrobiology 2016b). The method establishes a relationship between toxicant concentrations in water and the number of taxa present in the aquatic ecosystem. Local aquatic ecology experts from Aquatic Health (DEPWS) and Supervising Scientist Branch (SSB), Australian Government DCCEEW endorsed the approach, and SSB recommended further refinements.

Zone	River reach	Current level of species protection		Target
		Wet season	Dry season	LDWQO
1	EBFR upstream of Rum Jungle	62%	91%	95%
2	EBFR at Rum Jungle	<1%	<1%	70%
3	EBFR downstream of Rum Jungle	6%	13%	80%
4	EBFR upstream of confluence with Finniss River	8%	28%	90%
5	Finniss River upstream of confluence with EBFR	10%	7%	95%
6	Finniss River downstream of confluence with EBFR	33%	69%	95%
7	Finniss River downstream of zone 6	50%	91%	95%
8	Finniss River Coastal Floodplain	n/a	n/a	99%
	Site of Conservation Significance			

Table 7 Current level of species protection (at 95% ile concentration) and proposed LDWQO (adopted from Hydrobiology, 2022)

Current levels of species protection demonstrate the severely degraded condition of the EBFR (e.g. less than 1% species protection in zone 2). The current conditions also indicate that other processes, such as the influence of natural mineralisation on concentrations of dissolved ions in water, are likely contributing to the contaminant load in the catchment. The current level of species protection upstream of Rum Jungle (zone 1), and upstream of the confluence of the EBFR (zone 5) are lower than would normally be expected of a slightly or moderately disturbed ecosystem.

Water quality objectives for the Finniss River (zones 5-8) and upstream of Rum Jungle (zone 1) were initially based on the national default guideline values (DGVs) (ANZG 2018) as previous biological monitoring indicated no significant effect on the investigated receptors. These were later refined to consider local variability (Hydrobiology 2022). The EIS proposes zone 5 as a reference condition zone, and data from this zone was used to derive compliance LDQWOs. SSB provided advice that use of zone 5 data to derive compliance LDWQOs is not appropriate as this would allow for significant deterioration of water quality in zones 6 and 7 while still meeting the compliance LDWQOs, given the higher concentrations of multiple pollutants in zone 5. It is noted by the NT EPA that for modified ecosystems, the ANZG recognises the best available reference sites to gather key indicators may provide the only choice to establish a baseline and the reference condition.



Figure 5 Zones of the aquatic environment upstream and downstream of the proposal area and sampling locations (source Hydrobiology 2016b)

Significant and extensive work has been undertaken by the proponent to develop the LDWQOs. Based on advice from SSB (DCCEEW) and Aquatic Health (DEPWS), the NT EPA is satisfied that the LDWQOs were developed in line with ANZG. DCCEEW raised concern about the lack of a peer review of the LDWQOs. The NT EPA notes that the ANZG recommends a minimum of 18 data values collected over a 2-year period to derive LDWQOs, and further sampling and data collection will be required to further refine the LDWQOs. The NT EPA notes that the proponent would continue to collect water quality monitoring data prior to, during, and post-construction.

The NT EPA considers that the proponent's compliance LDWQOs are suitable as future longterm targets for progressive improvement of downstream water quality over time, and also recognises that compliance LDWQOs may be unattainable within the foreseeable future given the highly disturbed ecosystem condition. The NT EPA understands that the proponent has limited control over catchment-wide natural and/or human induced processes that are likely to affect water quality, and that there is a need to take into account economic and practical considerations in setting guideline values for the highly disturbed EBFR. The NT EPA notes that the proponent's modelling predicts a significant reduction of total copper and sulfate loads to the EBFR following proposal implementation.

The NT EPA considers that the proponent's compliance LDWQOs are not likely to be practical for use as downstream water quality compliance limits during proposal implementation. The NT EPA acknowledges that the proponent intends to use the LDWQOs in conjunction with water quality monitoring data collected pre, during, and post proposal implementation to monitor whether the proposed rehabilitation will, or has, led to improvement of aquatic ecosystem conditions downstream of Rum Jungle. However, the NT EPA considers that there is a high level of uncertainty associated with the long-term achievement of the proposed LDWQOs as rehabilitation targets for each zone. The proposed water quality monitoring program would enable the proponent to assess the effectiveness of the proposal in improving water quality in the receiving environment over time.

The NT EPA notes that current sampling of aquatic biota takes considerable time and resources and recommends developing a more simplified monitoring approach once the systems responses and assimilation capacity in relation to natural mineralisation are understood. The proponent may also consider additional lines of evidence, as recommended by ANZG and CRC CARE (2019), to enhance the capability and the sensitivity of the receiving environment monitoring program.

The NT EPA supports use of the LDWQOs as long-term water quality targets. The NT EPA notes the proponent's prediction that in the short-term, the condition of the EBFR may temporarily decline before it improves. The NT EPA agrees that the excavation and increased exposure of large volumes of reactive mine wastes to atmospheric oxygen and moisture during site remediation could lead to increased AMD generation in the short-term, and that this could impact downstream water quality. The NT EPA considers that a reasonable target is progressive improvement of the downstream ecosystem condition towards the LDWQOs in the long-term.

Water treatment and discharge to the EBFR

The proponent proposes to treat contaminated surface water and groundwater at Rum Jungle as part of the site remediation to improve environmental conditions onsite and downstream. Contaminated water would be treated in a water treatment plant to an acceptable standard that meets the required discharge values and then discharged to the EBFR. Controlled water discharge to a waterway would require regulation through a WDL granted under the *Water Act* 1992.

The EIS stated that the proponent assessed various technologies and options for water treatment, including a High Density Sludge (HDS) two stage lime precipitation process in combination with Greensands/DMI65 catalytic filtration media and ion-exchange resins (Geco process). Electro-coagulation and reverse osmosis processes were also considered. DCCEEW raised concern that the WTP type and design had not been finalised during the assessment process. The proponent stated that the final water treatment method and design would be identified through the procurement process.

The EIS stated that the water treatment plant would need to deliver effective, continuous treatment of water all year round for the duration of the five-year construction phase. Treatment would be required for large volumes of pit water with low levels of contamination (surface water from Main and Intermediate Pits) and smaller volumes of groundwater with higher levels of contamination. The management of any residual listed waste from water treatment would meet the requirements of the *Waste Management and Pollution Control Act 1998*.

The proponent intends to discharge an initial volume of untreated water from Intermediate and Main pits to the EBFR to achieve the required safe working levels for the backfilling of Main Pit. The NT EPA recognises that this discharge of untreated water is a critical step in the timely delivery of the backfill works. The NT EPA acknowledges the proponent's commitment that all discharges to the EBFR, including the untreated discharges from the pit, would be 70% LDWQOs or better.

The proponent proposed water quality discharge values equivalent to a 70% level of species protection based on the LDWQOs. Discharge to the EBFR is proposed to be continuous, including during the dry season when there would be no natural surface flows. The EBFR is an ephemeral waterway which joins the perennial Finniss River about 8.5 km downstream from Rum Jungle. The EIS included a detailed justification for the proposed use of the 70% LDWQO discharge values, as opposed to alternative discharge value that would be consistent with a higher level of species protection (i.e. 90% or 95%).

The NT EPA recognises that the achievement of LDWQO water quality compliance criteria at certain points downstream in the receiving environment is unlikely to be achievable due to the highly disturbed condition of the EBFR and Finniss River, and may be beyond the proponent's control considering the complexity of catchment-wide processes, hydrological pathways, natural geological inputs and contaminant transport variability. The NT EPA considers that the most practical and achievable option for controlling the impact of discharges is for the proponent to implement discharge values as limits not to be exceeded at the point of discharge (end-of-pipe), rather than using a downstream compliance point with limits based on the compliance LDWQOs.

The NT EPA acknowledges that the proposed adoption of a 70% LDWQO discharge water quality limit was endorsed in-principle by the SSB and DEPWS Aquatic Health. Considering expert advice received, ANZG requirements, the current ecosystem condition of the EBFR, and the proponent's justification, the NT EPA is satisfied that the proposed 70% LDWQOs are acceptable for use as discharge values, and that the proponent's downstream water quality monitoring would allow for early detection of any discharge-related impacts. If required, mitigation measures would be implemented through the NT EPA's requirements for monitoring, adaptive management and auditing to protect the values of the Finniss River during the construction phase.

The NT EPA considers that the proposed approach for water treatment and discharge is generally acceptable, and that it would be unlikely to result in further significant degradation downstream, given the low levels of species protection provided by the current highly disturbed ecosystem condition. The NT EPA notes that under the ANZG there are options for a range of discharge values to be determined and assigned based on flow and water quality conditions in the receiving environment using a water quality to flow relationship. The NT EPA expects that the rate and quality of all discharges would be managed to ensure that discharges do not cause a decline in downstream water quality.

The NT EPA considers that the adopted water treatment must be aimed at gradual and progressive improvement in the condition of the EBFR and Finniss River over time, and additional monitoring and mitigating actions through an Adaptive Management Strategy (AMS) should be developed in accordance with the <u>NT EPA Guidance for Adaptive Management</u>.

The proponent stated that there is a high level of uncertainty in relation to the volume of groundwater that would require treatment, the duration of groundwater treatment, and whether ongoing treatment would be required beyond the 5-year construction period. The proponent identified the need for long-term monitoring of downstream surface water quality to determine whether the proposal has an improvement effect on the health of the EBFR and Finniss River.

The NT EPA expects that water treatment and discharge would result in a long-term improvement in EBFR water quality (i.e. post-rehabilitation), in line with the proponent's modelled predictions. A condition is recommended for ongoing updates to surface water and groundwater modelling.

The NT EPA recommends a condition that the proponent implement the proposal in a manner which supports long-term improvement of the downstream EBFR and Finniss River ecosystem. The proponent must also ensure that any waste water discharged from the action must not result in a decline in the ecosystem condition of the Finniss River downstream of the confluence with the EBFR in zones 6, 7 and 8. The NT EPA recommends a condition that the water quality of discharges must meet, as a minimum, the 70% LDWQO species protection level at end-of-pipe during Main pit backfilling, and 80% LDWQO species protection level following completion of Main pit backfilling.

The NT EPA recommends a condition requiring that the proponent implement a receiving environment monitoring program to determine whether there are any significant changes to water quality due to the proposal, compared to the pre-construction water quality and level of species protection. The recommended condition requires that the proponent report annually (and publicly) on the findings and outcomes of the monitoring program.

Soil erosion and stormwater management

The general site civil works and the remediation works have the potential to contaminate stormwater with sediment and leachate from the existing WRDs and proposed WSFs during construction, which would potentially impact the receiving environment and EBFR. The proposed stormwater management strategy would divert clean stormwater away from disturbed areas, and site runoff would be diverted into dedicated sediment basins via drains. The proponent proposes to manage stormwater impacts through implementation of an erosion and sediment control plan, which divides the site into catchments for management controls including sediment ponds, sediment fences and diversion channels.

Following completion of remediation works and site rehabilitation, the proponent does not propose ongoing stormwater quality monitoring at the WSFs as contaminants would be securely encapsulated and the WSF cover system has been designed to divert surface water away from the capped surface to reduce infiltration through the WSF. Implementation of the LTEMP would ensure ongoing integrity of the WSFs and cover systems. The EIS advised the WSF sites are located above the 1-in-1000 AEP flood level. As such the WSFs would be protected from flood waters.

The NT EPA recommends conditions requiring that the proponent install erosion and sediment control measures prior to the commencement of remediation works and that these controls be maintained for the duration of soil disturbance.

With implementation of the recommended conditions requiring an ESCP and stormwater management controls, the NT EPA considers potential impacts of soil erosion and sedimentation on downstream water quality in the EBFR and Finniss River would not be significant.

6.4.6.2. Changes in groundwater quality due to AMD leachate from mine waste storages

<u>Main pit backfill</u>

Main pit currently holds uranium tailings under a permanent water cover, where the water level in the pit has been observed to range from a 58.95 m in the dry season level to 61.59 m AHD in the wet season. Above the tailings from about 22.0 m AHD, an impacted layer of water (chemocline) estimated to be about 4.0 m thick is present.

At Rum Jungle, about 1.5 Mm³ of PAF waste rock with the highest acid forming potential would be placed in the Main Pit void as backfill, including waste rock from the Intermediate and Main WRDs, and backfilled Dysons Pit. The proponent's Main Pit backfill specification outlines that the waste rock would be lime treated and mixed for sub-aqueous placement into Main Pit.

The proposed backfilling operations will involve dewatering the Main Pit to a safe operating level and placing a 3.0 m thick graded sand bedding layer over the tailings to improve bearing capacity and reduce the risk of capping instability occurring over the soft tailings. Lime neutralised waste rock would be placed over the protected in-pit tailings pile e.g. via a floating barge and conveyor system through the water column. The backfill of PAF material is expected to be to a maximum RL of 56.0 m AHD and overlain with a minimum 2.0 m thickness capping layer to a level no greater than 58.0 m AHD.

The NT EPA supports the proponent's commitment that the overlaying waste rock materials will comply with the inert capping material specifications for Atterberg Limits, Emerson Class, layer minimum thickness and maximum elevation, and material testing will be according to Australian Standard AS1289 3.6.1. The NT EPA supports the implementation of a Main Pit Trigger Action Response Plan (TARP) to manage water levels and water quality in the pit during the backfill operations.

The oversight of this activity, to ensure compliance with detailed engineering design and specification is discussed above in section 6.3.6.1 requiring that remediation works described in the proponent's Technical Specification – Main Pit Backfill (SLR 2020) will conform to the NRF guidance and the ASC NEPM.

The NT EPA notes the level of uncertainty in the proposal regarding the backfill placement methods which are to be further developed and refined, the limited control to achieve uniform bedding surfaces for layers due to sub-aqueous placement over the sloping profile of the in-pit tailings pile, and the extent of expected subsidence and compaction.

The NT EPA also notes the level of uncertainty regarding behaviour of groundwater level fluctuations in the long-term due to climate change, and the risk of breaching the inert capping layer through erosion and exposure of stored PAF waste rock to oxidising processes. The proponent proposes to mitigate erosion of the capping surface through design, installing erosion protection upstream and downstream of the Main Pit, monitoring settlement rates and implementing corrective actions.

The NT EPA acknowledges that the backfill design would ensure that all PAF waste rock placed in the Main Pit for storage is protected by a non-acid forming capping of clean inert cover material, and would remain below the water cover to achieve long-term physical and geochemical stability, and is non-polluting to downstream environments.

Groundwater modelling and solute transport

To assess the behaviour and solute transport in groundwater during and after the construction phase of the proposal, dissolved SO₄ and Cu were modelled by the proponent due to the conservative nature of SO₄, and the reactive nature of Cu. The purpose of the modelling was to identify the likely behaviour of existing plumes, the development of new contaminant plumes (e.g. from the WSF and backfilled Main Pit) as a result of the action, and to estimate the amounts of metal loads that would impact the EBFR and the Finniss River.

As the plumes are strongly influenced by the local groundwater flow field, underlying geology, geological structures, and the geological controls on processes such as sorption, the groundwater model simulations assumed that natural attenuation of SO₄ and Cu concentrations would be moderate based on a comparison of simulated and observed spatial distribution of copper concentrations in groundwater and load estimates of copper in the EBFR.

The NT EPA notes that the spatial extent of the simulated SO₄ and Cu plumes is expected to reduce after the active AMD sources onsite (the WRDs and shallow backfill materials in Dysons backfilled Pit) have been removed. The proponent's modelling predicts a significant reduction in copper concentrations in groundwater compared to current conditions. The groundwater model was modified in 2019 to simulate groundwater conditions during the construction phase of rehabilitation, and includes a numerical water and load balance (GoldSim) model to:

- validate simulated SO₄ and Cu loads from the groundwater model to the EBFR
- simulate flows to the water treatment system and the EBFR during the construction phase of rehabilitation, and
- provide preliminary predictions of the timing and degree of future improvement in EBFR water quality (i.e. post-rehabilitation).

The NT EPA notes the uncertainties in the modelling and considers that the recommended conditions for a receiving environment monitoring program and updates to the surface water and groundwater models would allow the proponent to assess:

- the attenuation capacities of the underlying rock types, and the attenuation and behaviour of metals in addition to SO₄ and Cu.
- interaction of seepage with the backfilled Main Pit, filter cake and the radiological soils in the foundation of the WSFs, and the pyrite bearing Whites Formation
- behaviour and concentrations of contaminants of concern other than SO₄ and Cu
- potential impact of SO₄ on the environmental values of the EBFR and Finniss River.

6.4.6.3. Altered surface water flows resulting in adverse physical changes to local or regional hydrology from increased flow velocities, erosion, flooding and sedimentation

The proposed discharge of treated and untreated pit water to the EBFR would alter natural surface flows and potentially change natural hydrological processes and physically impact geomorphology and sediment transport within the EBFR and Finniss River. Potential changes include an increase to the natural stream flows and velocities causing bank erosion, flooding, and mobilisation of contaminated sediments.

The NT EPA notes that the proponent's management of the quality and rate of water discharges would prevent a significant decline in the downstream ecosystem condition, and ensure that the proposed discharges do not result in significant erosion or river geomorphological impacts. The NT EPA considers, based on advice received in submissions from SSB and DEPWS Aquatic Health, that the potential impacts of temporary additional unseasonal flows on the EBFR are not likely to be significant given the highly disturbed ecosystem condition downstream.

The proponent has committed (as far as practicable) to restoring the EBFR to its original (premining) alignment and flow path through the Main and Intermediate pits to restore cultural values associated with the flow of the EBFR.

The proponent's remediation and rehabilitation objectives for the realignment are to:

• ensure no increase in flood levels upstream of the Main Pit

- convert the Main Pit into a permanent shallow lake and retain the Intermediate Pit as a deep lake
- restore environmental flows that provide refuge and facilitate the passage of aquatic organisms
- include a defined (natural) low flow channel which follows the original alignment
- backfill and remediate the EBFR diversion channel after restoring the EBFR to its original alignment though the Main and Intermediate Pits.

The NT EPA received public and government authority submissions which raised concern about the potential impacts associated with returning the EBFR to its original alignment, interactions with mine waste backfilled to the Main Pit and the potential for increased pollution to the EBFR following the realignment.

The NT EPA recommends a condition that the EBFR, when restored to its original (pre-mining) alignment and flowpath through the Main and Intermediate Pits, must not result in a decline in downstream water quality. The condition requires that construction of the realignment is in accordance with the designs provided in the EIS and that the diversion is constructed to prevent the release of contaminants from the backfilled Main pit to the receiving environment.

6.4.7. Summary of factor assessment and recommended regulation

The NT EPA has considered the potential significant impacts of the proposal to inland water environmental quality, aquatic ecosystems, and hydrological processes. In doing so, the NT EPA has considered whether reasonable conditions could be imposed, or whether other statutory decision-making processes could ensure the NT EPA's factor objective is likely to be met. The NT EPA assessment findings are presented in **Table 8**.

The NT EPA has also taken into account the objects and principles of the EA Act and EP Act (**Appendix 2**) in assessing whether the residual impacts will meet its environmental factor objective and whether reasonable conditions can be imposed.

Residual impact to environmental value	Assessment finding	Recommended conditions and regulation by other statutory decision-makers
Impacts on downstream water quality	The NT EPA recommends site remediation, improvement of onsite environmental conditions to support improved downstream water quality, discharge water quality limits, a receiving environment monitoring program, modelling of impacts on water resources, a water management plan and an erosion and sediment control plan. Subject to these conditions, and other statutory decision-making processes under the <i>Water Act 1992</i> , the proposal is likely to be implemented consistent with the NT EPA's objective for inland water environmental quality, aquatic	 Regulated through: Condition 2 - overarching objectives Condition 7 - remediation works Condition 19 - discharge water quality Condition 20 - receiving environment monitoring Condition 21 - water management plan Condition 18 - modelling impacts on water resources Condition 16 - erosion and sediment control

Table 8 Summary of assessment for water factors (Inland water environmental quality, aquatic ecosystems, and hydrological processes)

Residual impact to environmental value	Assessment finding	Recommended conditions and regulation by other statutory decision-makers
	ecosystems, and hydrological processes.	 other statutory decision- making processes under the Water Act 1992 (Waste Discharge Licence).
Impacts of EBFR realignment on water quality, flow and geomorphology.	The NT EPA recommends that the EBFR realignment is conducted in accordance with the proposed design in the EIS. Subject to this condition the proposal is likely to be implemented consistent with the NT EPA's objective for inland water environmental quality, aquatic ecosystems, and hydrological processes.	Regulated through: • Condition 23 – EBFR realignment.
Impacts on water quality post- remediation	The NT EPA recommends long-term environmental management post- remediation to evaluate remediation success and provide for ongoing site management. Subject to this condition the proposal is likely to be implemented consistent with the NT EPA's objective for inland water environmental quality, aquatic ecosystems, and hydrological processes.	Regulated through: • Condition 15 – long term environmental management.

6.4.8. Conclusion against the NT EPA objective

With the implementation of the proposed management measures, the recommended conditions, and regulation under other statutory decision-making processes, the NT EPA considers that the proposal could be conducted in such a manner that its objectives for inland water environmental quality, aquatic ecosystems hydrological processes are likely to be met.

6.5. Terrestrial ecosystems

6.5.1. Environmental values and existing environment

The proposal area is within the Pine Creek bioregion and consists of a range of terrestrial ecosystems, with the majority disturbed by historic mining or other land uses. There are no nationally listed threatened ecological communities under the EPBC Act within the proposal area.

Weeds and feral animals are widespread within disturbed and undisturbed parts of the proposal area, and in the region. Species recorded during surveys include:

- Weeds of National Significance
- declared weeds under the Weeds Management Act 2020

- feral animals listed as Key Threatening Process under the EPBC Act (DAWE 2020c), such as cane toad, feral cat and feral pig
- exotic grasses listed as Key Threatening Process (DAWE 2020c) and subject to a Threat Abatement Plan under the EPBC Act (DSEWPC 2012), such as gamba grass.

Rum Jungle

Detailed vegetation mapping (Eco Logical 2014) identified significant and sensitive vegetation types at Rum Jungle including 69 ha of riparian and wetland vegetation types, and a 16 ha vine forest patch north of Intermediate Pit. The flora surveys recorded seven endemic plant species, including the culturally significant and NT listed threatened Darwin Cycad (*Cycas armstrongii*) (Eco Logical 2014). Areas disturbed by historic mining activities have poor regrowth and consist mostly of weedy grasslands dominated by gamba grass.

Borrow Area A (Granular material)

The borrow area for granular material mainly consists of eucalypt woodland to open forest, with evidence of previous disturbance by sand mining. The borrow area also includes significant and sensitive vegetation type Melaleuca mid woodland, which occurs in three first order drainage lines that are heavily infested with gamba grass (EcOz 2019).

Borrow Area B (Low permeability material)

The majority of the borrow area for low permeability material consists of Corymbia open woodland and Eucalyptus woodland with dense gamba grass in the understorey. A sensitive and significant vegetation type, Melaleuca closed forest, borders the area to the south and fringes Meneling Creek. EcOz (2019c) stated that the occurrence of threatened species is unlikely due to the high density of gamba grass (terrestrial) and guinea grass (riparian). The area has been previously disturbed by buffalo farming.

Mt Burton

The proposal area at Mt Burton consists mainly of one barren WRD. It is bordered to the north and east by approximately 20 ha vine forest, which is associated with a permanent spring and is a sensitive and significant vegetation type (EcOz 2019c). Vine forests are considered to have high value due to their relative rarity and habitat value for forest-dependent and threatened species. The WRD and adjacent vine forest are weed free, but the surrounding former mine site has moderate levels of weeds, including gamba grass and four other declared weeds (Class B) under the *Weed Management Act 2001*.

Mt Fitch

The proposal area at Mt Fitch encompasses the wider area around the former Mt Fitch mine and consists mainly of Eucalyptus and Corymbia open woodland. A congregation of dry vine thicket patches occurs to the north of the pit (GHD 2008), which is a sensitive and significant vegetation type. High densities of weeds, including gamba grass and other declared weed species, are widespread and the area is grazed by cattle.

Threatened species

Targeted flora and fauna surveys of the proposal area and desktop assessment identified 11 fauna and one plant species listed as threatened under the *Territory Parks and Wildlife Conservation Act 1976* (TPWC Act), of which seven are also listed under the EPBC Act (see **Table 9**).

Table 9 Threatened species recorded during targeted surveys for the EIS, recorded during previous surveys or likely to occur within the proposal area (sources Eco Logical 2014, EcOz 2019, advice from Flora and Fauna Division, DENR)

Common name	Scientific name	TPWC Act	EPBC Act	Recorded	Known	Likely
Plants						
Darwin Cycad	Cycas armstrongii	Vulnerable		RJ, G		
Animals						
Black-footed Tree- rat	Mesembriomys gouldii	Vulnerable	Endangered	RJ, G		MB, MF
Merten's Water Monitor	Varanus mertensi	Vulnerable		RJ, MF		
Partridge Pigeon (Eastern)	Geophaps smithii	Vulnerable	Vulnerable	RJ, G		
Fawn Antechinus	Antechinus bellus	Endangered	Vulnerable		RJ 2008	
Masked Owl	Tyto novaehollandiae kimberli	Vulnerable	Vulnerable		MF 2008	RJ
Northern Quoll	Dasyurus hallucatus	Critically endangered	Endangered		RJ 2008	
Yellow-spotted Monitor (floodplain monitor)	Varanus panoptes	Vulnerable			RJ 2002	
Mitchell's Water Monitor	Varanus mitchelli	Vulnerable				RJ, MB
Pale Field Rat	Rattus tunneyi	Vulnerable				RJ
Plains Death Adder	Acanthophis hawkei	Vulnerable	Vulnerable			RJ
Red Goshawk	Erythrotriorchis radiatus	Vulnerable	Vulnerable			RJ

RJ = Rum Jungle, G = Borrow Area A, MB = Mt Burton, MF = Mt Fitch

6.5.2. Investigations and surveys

Investigations and surveys undertaken by the proponent and reported as part of the Draft EIS, Supplement and additional information responses, informed the NT EPA's assessment of potential impacts to terrestrial ecosystems (Appendix 5 – Investigations and surveys).

In order to identify habitats and the presence of threatened flora and fauna species, the proponent commissioned multiple terrestrial flora and fauna, aquatic fauna, and ecosystem investigations and surveys. The investigations and surveys included vegetation mapping and also assessed the likelihood of species to occur based on previous records and known distributions, and habitat information.

6.5.3. Consultation

Public Submissions

Matters raised during the NT EPA's public consultation relating to terrestrial ecosystems included:

- Rehabilitation should follow the National Strategy for Ecologically Sustainable Development. Rehabilitation targets are not clearly defined. Rehabilitation capacity is not demonstrated, and success is uncertain.
- Proposal provides a unique opportunity to study gamba grass.
- Revegetation monitoring should be extended to 50 years, which would also provide a long-term economic and employment opportunity for Aboriginal ranger groups in the region.
- Responsibilities and funding arrangements for post-rehabilitation monitoring and maintenance programs need to be identified.

The proponent's stakeholder consultations identified concerns about the rehabilitation of the land and the return of the environmental quality.

NT Government agencies

Matters raised by DEPWS, Flora and Fauna Division:

- Flora and fauna surveys are adequate.
- Recommends that uncertainties around the risks/impacts of pit de-watering on adjacent vine forest be mitigated through a monitoring program.
- Recommends any salvage procedure of the Darwin Cycad should be managed in accordance with the principles outlined in the Management Program for Cycads in the Northern Territory of Australia 2009-2014 (Liddle 2009).
- The direct loss of potential habitat for TPWC Act and EPBC Act listed threatened species is relatively small and unlikely to contain important habitat or support significant populations of these species. Risks to threatened flora and fauna have been properly assessed with appropriate mitigation and management measures proposed. The proposed action, if successful, would result in new areas made available as potential habitats. Proposed weed and fire management would alleviate the main threats of habitat degradation and improve habitat conditions.
- The proposed action will not have a significant residual impact on the values associated with terrestrial flora and fauna and considers that the risks can be appropriately mitigated through the implementation of management plans committed to in the EIS.

6.5.4. Impacts that do not have the potential to be significant

The NT EPA has found that the following potential impacts to terrestrial ecosystems do not have the potential to be significant. As a result of this finding, they have not been considered further in this report.

Table 10 Impacts that do not have the potential to be significant

Potential impact	Assessment finding		
	The proposed vegetation clearing of 490.9 ha would include 4.5 ha sensitive and significant vegetation types and 7.1 ha Eucalyptus woodland/open forest. The clearing is unlikely to have a significant impact on terrestrial ecosystem values for the following reasons:		
	 The majority of the area has been previously disturbed, is impacted by gamba grass and consists of common vegetation communities. 		
Temporary loss of native vegetation from clearing	 The disturbance of high value habitat has been limited as practicable and is required to remove contamination sources (WRDs and contaminated soils). 		
	 Native vegetation buffers, in line with the Land Clearing Guidelines (DENR 2019), would protect watercourses within and adjacent to the borrow areas. 		
	• The clearing of native vegetation on unzoned land would require a clearing permit under the <i>Planning Act</i> 1999.		
	• The proponent committed to rehabilitate and revegetate all disturbed areas.		
Exposure to contamination – fauna	The proposed rehabilitation aims to reduce the existing exposure in the long-term; however, if implemented inadequately, the proposed activities may have the potential to increase the exposure to hazardous materials during construction. The NT EPA supports the proposed avoidance and mitigation measures, including the scheduling of hazardous material movements in the dry season, dust management, surface water monitoring and the contaminated land remediation framework, to lower the risk of exposure to hazardous materials during construction. The NT EPA notes that the management of hazardous materials (e.g. used during construction) is regulated by other statutory decision makers, legislation and Australian Standards.		
Vehicle strike – threatened fauna species	The proposed increase in traffic of 27 vehicles per day is unlikely to significantly increase the potential for threatened fauna mortality or injury from vehicle strikes. Proposed approach of recording of mortalities and injuries, assessment and, if required, respond with increased mitigation, is adequate to protect fauna populations.		
Short term loss of habitat - Black-footed Tree-rat	Approximately 9 ha (7 ha for the Eastern WSF and 2 ha for Borrow Area A) of the proposed clearing would constitute potential habitat for the black-footed tree-rat. The EIS identified that these areas are not important habitat and are bordered by suitable alternative habitat the highly mobile species could occupy. Based on advice from DEPWS Flora and Fauna Division, the NT EPA concludes that risks to the regional population of Black-footed Tree-rat are low from the proposed activities. The potential for fauna mortality or injury during land clearing would be minimised by the vegetation clearing procedure. In addition, the proposed rehabilitation and revegetation would facilitate a gain of potential habitat, and the proposed management of the invasive gamba		

Potential impact	Assessment finding
	grass, feral animals and fire would improve habitat conditions (Hill 2012, Threatened Species Scientific Committee 2015).
Short term loss of habitat - Mertens' Water Monitor, Mitchell's Water Monitor	The two monitor species have been identified as occupying suitable habitat along the East Finniss River downstream of the site. Both monitor species have declined significantly due to impacts from cane toads. The proposed rehabilitation works are unlikely to exacerbate existing threats and will improve the water quality and riparian habitat quality at the mine sites and along the East Finniss River
Short term loss of habitat - Northern Quoll, Pale Field Rat, Partridge Pigeon, Fawn Antechinus, Yellow- spotted Monitor, Masked Owl and likely species	The assessment identified potentially suitable habitat at Rum Jungle, with some species also recorded at other proposed areas (Table 9). However, the area impacted by the proposal is relatively small and unlikely to contain important habitat or support significant populations of these species.
Potential impacts to the regional population - Darwin cycad	Risks to the regional population of Darwin Cycads are low as the species is present at low densities. The DEPWS Flora and Fauna Division supports the commitment in the EIS to implement a cycad salvage program. Any salvage procedure should be managed in accordance with the principles outlined in the Management Program for Cycads in the Northern Territory of Australia 2009-2014 (Liddle 2009). This could include on-site conservation or salvage from the area during development and may require appropriate permits if salvage for commercial purposes is proposed.

6.5.5. Potential significant impacts and benefits

The proposed remediation and rehabilitation of contaminated land, and revegetation of disturbed land would have potential significant benefits for terrestrial ecosystem values within the proposal area and surrounding environments, including:

- reduction of present and future pollution
- enhancement of terrestrial habitats and environmental values
- a net increase in quality and area of terrestrial habitat.

If not designed, implemented and managed adequately, the proposed rehabilitation activities would have the potential to impact terrestrial ecosystem values within the proposal area and surrounding environments through:

- increased habitat degradation as a result of:
 - \circ $\;$ weeds establishing in revegetation areas, leading to changes to fire regime
 - o failure to control feral animals
 - temporary groundwater drawdown (groundwater dependant ecosystems (GDEs)
 - o temporary edge effects (Mt Burton vine forest)
- potential for a net loss of native vegetation and habitat from clearing if revegetation is not successful
- cumulative impacts.

6.5.6. Avoidance and mitigation of impacts

The proponent's management and mitigation measures would include:

- for loss of native vegetation and habitat from clearing of native vegetation:
 - o avoidance and minimisation through layout and design
 - o translocation of threatened and culturally significant multi-stemmed Darwin cycads
 - clearing permits under the *Planning Act* 1999
 - vegetation clearing procedure
 - o revegetation of all disturbed areas (Revegetation Management Plan)
- for loss of GDEs from groundwater drawdown
 - Intermediate Pit operating level set in consideration of maintaining groundwater to the GDE (Water Management Plan)
 - o monitoring (vegetation water stress using remote sensing, photo points)
 - o irrigation and infill planting (if required)
- for habitat degradation:
 - weeds:
 - statutory weed management plans for gamba grass, grader grass and mimosa*
 - weed management plan (EcOz 2022)
 - 15 m gamba grass free buffer around perimeter of all land parcels and infrastructure
 - hygiene and quarantine measures to avoid weed spread
 - monitoring
 - o fire
 - develop and implement a Bushfire Management Plan
 - fire breaks, a fuel load reduction program, emergency response procedures
 - o feral animals
 - develop and implement a Feral Animal Management Plan
 - monitoring for impact to revegetation, commitment for a targeted response, if required (Draft Environmental Monitoring Plan, DITT 2022).

6.5.7. Assessment of potential significant impacts

The NT EPA supports the proposal's intent to remediate and rehabilitate currently polluted and degraded terrestrial landforms, and to revegetate the remediated landform, which has the potential to significantly improve terrestrial habitat quality and environmental values.

The NT EPA recognises that the proposal will have temporary impacts on terrestrial ecology while works are active. The duration of these impacts will depend on the proponent managing its operational impacts and successfully implementing rehabilitation and revegetation actions. The NT EPA agrees that if successful, the proposal is likely to result in terrestrial habitat quality and environmental values on the site being significantly improved compared to the current condition.

However, if not designed, implemented and managed adequately, there is potential for further degradation of the site. Impacts have the potential to be long-term, particularly if exacerbated by

the presence of the aggressive exotic gamba grass and the associated increase in fire regime. Each potential impact is assessed in greater detail below.

6.5.7.1. Potential for net increase of degraded habitat

The NT EPA recognises that the proposal works has the potential to degrade terrestrial environmental values in the short term. This is expected and accepted for a remediation and restoration project. However, in the long-term, the terrestrial environmental values must be returned to better condition. The NT EPA has identified the following habitat degradation risks that have the potential to result in the long-term restoration objective not being achieved.

Weeds, fire and feral animals

Weeds, including gamba grass, are already extensively established across the region. Weed management is essential for fire management, as fire intensity is closely linked to the density of high fuel load producing species, such as gamba grass. An increase in the frequency and intensity of the fire regime would result in significant changes to the floristic composition and diversity of terrestrial ecosystems, especially for fire sensitive early stages of revegetation, and sensitive and significant vegetation communities. It would also lead to a decrease in overall biodiversity and ecosystem function (Anderson et al. 2012, Lawes et al. 2015). The proponent has statutory management obligations for gamba grass and other declared weed species under the *Weeds Management Act* 2001.

The proposed weed and fire management approaches are in line with the NT's legal requirements and support the protection of early stages of revegetation, and sensitive and significant vegetation communities.

The NT EPA supports the proponent's commitment to the development and implementation of a Bushfire Management Plan and notes the proposed preventative measures are in line with common practice in the region.

Feral animals are present across the proposal area. Their continued presence has the potential to limit the success of the restoration. Three of the feral animals recorded on site (cane toad, feral cat and feral pig) are listed as Key Threatening Process under the EPBC Act (DAWE 2020c) for their impact on biodiversity. If not controlled, there is the potential that the benefits of the proposal, to restore environmental values, may not be fully realised. Feral pigs and buffalos can also cause physical damage to the revegetation and the integrity of the final landforms. If not controlled, there is the potential to be delayed. The NT EPA supports the proponent's commitment to develop and implement a Feral Animal Management Plan to reduce the impact on vegetation and constructed landforms. The NT EPA notes that the proposed approach is to monitor impacts from feral animals and then identify a targeted response.

The NT EPA notes that control of aggressive weeds (e.g. gamba grass), fire and feral animals (e.g. pigs) requires a regional approach to be effective and long-lasting. Without a regional solution, the proposed revegetation of native vegetation communities would require substantial ongoing weed and fire management to succeed in the presence of aggressive weed species. See section 6.2 for the NT EPA's recommendations for long-term management requirements. However, the proponent must take all reasonably practical measures to avoid and mitigate potential impacts from the proposed action.

Temporary degradation of groundwater dependant ecosystems from groundwater drawdown

Intermediate Pit is hydraulically connected to the groundwater to the north. Dewatering of Intermediate Pit over the three year Main pit backfilling process is predicted to cause a groundwater drawdown of 1.5 to 5.5 m under the 16 ha vine forest area, which is a potential groundwater dependant ecosystem.

The NT EPA found that the groundwater drawdown is required for the successful backfilling of the Main Pit (proposed rehabilitation option). The groundwater drawdown is temporary and, if required, habitat conditions would be maintained through irrigation and infill planting, and are likely to recover once the groundwater drawdown has ceased. The DEPWS Flora and Fauna Division supports the proposed monitoring of the health of the potentially groundwater dependent vine forest at Rum Jungle and proposed mitigation measures. The NT EPA is satisfied that the proposed measures are adequate to protect the potential GDE from the predicted groundwater drawdown.

Temporary degradation of Mt Burton vine forest due to edge effects

At Mt Burton, removal of the approx. 1.5 ha WRD has the potential to impact the microclimate of the bordering 20 ha vine forest and may lead to habitat degradation through the incursion of weeds and habitat decline through exposure to fires. The proposed mitigation measures (immediate revegetation, weed and fire management of the WRD base) are supported but it may take time for the revegetation to provide sufficient sheltering to restore the microclimate in the vine forest. To ensure the values of the significant and sensitive vegetation type are protected, the NT EPA recommends a requirement to monitor the health and condition of the vine forest and, if required, significant impacts be mitigated.

6.5.7.2. Potential for a net loss of native vegetation and habitat from clearing if revegetation is not successful

The rehabilitation would require approximately 490.9 ha clearing of native vegetation, including 4.5 ha of sensitive and significant vegetation types for the remediation of riparian areas of the EBFR (4 ha) and a vine forest (0.5 ha). Once remediation and rehabilitation groundworks are completed, the proposal proposes to revegetate the cleared areas and areas disturbed by previous mining.

The extent of the proposed revegetation would be approximately 652 ha in total, comprising of 338 ha at Rum Jungle (145 ha at Borrow Area A, 162 ha at Borrow Area B, 5 ha at Mt Fitch and 2 ha at Mt Burton. If the revegetation is successful, it would result in a net gain of 392 ha native vegetation. The NT EPA supports the proponent's commitments and recommends a condition that requires rehabilitation and revegetation of all areas disturbed by the proposed activity.

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Figure 6 Revegetation of areas disturbed by proposed rehabilitation and historic mining activities at Rum Jungle

Revegetation serves many purposes in rehabilitation ranging from the restoration of habitat for wildlife to erosion control, stability and the integrity of the constructed landform. The NT EPA supports the proposed progressive revegetation of all disturbed areas with native vegetation. However, if the revegetation is not designed, implemented and managed adequately it can cause a degradation of the constructed landforms as well as the surrounding terrestrial ecosystem values. For example, a failure of the proposed native revegetation may lead to the growth and spread of aggressive weeds species, such as gamba grass, which outcompete native flora, increase fuel loads, intensify the local fire regime, which would reduce groundcover and could lead to erosion and sedimentation.

If revegetation is not successful, the NT EPA assessed that the net loss of native vegetation from the proposed clearing would have no potential significant impact on threatened species (EPBC Act and TPWC Act) (Table 11).

Environmental value	Residual impact if revegetation fails
Black-footed Tree-rat	Black-footed Tree-rat (<i>Mesembriomys gouldii</i>) occurs in woodland habitats in the region. This species is widely but patchily distributed across the northern Top End and uses a range of habitats but is predominately associated with Eucalypt woodland and open forest. Potential impacts on the Black-footed Tree-rat associated with the proposal would be mainly from the removal of potential woodland habitat.

Environmental value	Residual impact if revegetation fails		
	Taking into account the current condition and degradation from previous disturbance and gamba grass invasion, approximately 9 ha (7 ha for the Eastern WSF and 2 ha for the Borrow Area A) of the proposed clearing would constitute potential habitat for the black-footed tree-rat. The EIS identified that these areas are not important habitat and are bordered by suitable alternative habitat the highly mobile species could occupy.		
Mertens' Water Monitor, Mitchell's Water Monitor	The two monitor species have been identified as occupying suitable habitat along the EBFR downstream of the Rum Jungle. The proposed vegetation clearing and revegetation works will generally avoid riparian habitats.		
Northern Quoll, Pale Field Rat, Partridge Pigeon, Fawn Antechinus, Yellow-spotted Monitor, Masked Owl and likely species	The assessment identified potentially suitable habitat at Rum Jungle, with some species also recorded at other proposed areas (Table 9). However, the area impacted by the proposal is relatively small and unlikely to contain important habitat or support significant populations of these species.		

The NT EPA's assessment and recommendation related to ensuring effective revegetation is addressed in section 6.2.

6.5.7.3. Cumulative impacts

The potential impacts identified in the assessment are unlikely to be significant individually, but cumulative impacts can affect the success of revegetation, potentially resulting in revegetation failure and failure to realise the benefits of a net increase in threatened species habitat. The NT EPA assessed that the proposed mitigation measures, the above recommended conditions and the proponent's legal obligations under NT legislation are adequate to ensure avoidance, management and mitigation measures are implemented effectively, and to avoid a significant Summary of factor assessment and recommended regulation

The NT EPA has considered the potential significant impacts and benefits of the proposal on Terrestrial ecosystem values and has taken into account the objects and principles of the EP Act (Appendix 2) and the wishes of traditional owners. In doing so, the NT EPA has considered whether reasonable conditions could be imposed, or whether other statutory decision making processes could ensure the NT EPA's factor objective is likely to be met. The NT EPA's assessment findings are presented in **Table 12**.

Table 12 Summary o	fassessment	for terrestria	ecology

Residual impact to environmental value	Assessment finding	Recommended conditions and regulation by other statutory decision makers
Habitat degradation impacts from weeds, fire, feral animals	The proposed revegetation with native species would improve the degraded habitats of the proposal area. If not managed adequately, aggressive weed species, such as the regionally common gamba grass, and fire and feral animals may have a significant impact on terrestrial ecosystem values and the success of the proposed revegetation. A regional approach would be required for management measures to be effective and	 Regulated through: Weed Management Act 2001. Bushfires Management Act 2016.

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Residual impact to environmental value	Assessment finding	Recommended conditions and regulation by other statutory decision makers
	long-lasting. If not, the proposed rehabilitation would require ongoing weed, fire and possibly feral animal management.	
Habitat degradation or loss of GDEs from groundwater drawdown	At Rum Jungle, a temporary groundwater drawdown is unavoidable under the proposed rehabilitation option (backfilling the Main Pit). The potential impacts on the potential GDE (16 ha vine forest) are temporary and would be adequately monitored and mitigated to protect the environmental values of this significant and sensitive vegetation type.	No condition recommended.
Habitat degradation (Mt Burton vine forest) from edge effects	The removal of the WRD at Mt Burton may impact on the adjacent vine forest. Monitoring of the health and condition is required to implement mitigation measures timely and to ensure environmental values are protected.	No condition recommended.
Revegetation failure	If the revegetation is not designed, implemented and managed adequately it can cause a degradation of the constructed landforms as well as the surrounding terrestrial ecosystem values. Revegetation failure would result in benefits of a net increase of threatened species habitat not being realised.	Regulated through: • condition 17 - revegetation.

6.5.8. Conclusion against the NT EPA objective

The NT EPA assessed that risks to the regional populations of TPWC Act and EPBC listed threatened species are low from the proposed activities. Loss of potential habitat is relatively small and unlikely to contain important habitat or support significant populations of these species. In addition, the proposed rehabilitation and revegetation would facilitate a net gain of potential habitat, and the proposed management of the invasive gamba grass, feral animals and fire would alleviate these threats and improve habitat conditions.

With the implementation of the proponent's commitments and NT EPA's recommendations for the draft Environmental Approval identified above, the NT EPA considers that the proposal could be conducted in such a manner that its objective for the key environmental factor Terrestrial ecology is likely to be met.

6.6. Community and economy

6.6.1. Environmental values

The proposal is in the Coomalie Community Government Council (CCGC) area which covers about 1500 km² and includes the towns of Batchelor (6 km south), Lake Bennett (17 km north east), and Adelaide River (29 km south). Batchelor, the nearest town, has a population of 537

residents, 35% of which are Aboriginal people. Darwin, Palmerston and surrounding areas are likely to be a key source of technical services for the proposal.

A socio-economic baseline was prepared to develop an understanding of the existing socioeconomic situation within the locality and the region. The social and economic impact assessment (SEIA) report prepared by GHD on behalf of the proponent assessed social and economic impacts under six categories of social and economic values, including culture and wellbeing of traditional owners, economy and employment, amenity, housing and accommodation, community services and historical community values.

The economy of the Coomalie region has diversified in recent years, expanding to include education, aviation, horticulture and tourism as the key sectors.

6.6.2. Investigations and surveys

Investigations and surveys undertaken by the proponent and reported as part of the Draft EIS, Supplement and additional information responses, informed the NT EPA's assessment of potential impacts to community and economy (Appendix 5 – Investigations and surveys).

6.6.3. Consultation

Matters raised during Australian and NT government authority consultation relating to potential significant impacts on community and economy include:

- the potential for the proposal to affect the community and stakeholders through generation of dust and noise, visual impacts, and land access restrictions for recreational and cultural activities
- the requirement for implementation of traffic management measures to account for the heavy vehicle increase on the public road network prior to commencement of the proposal
- the need to consider the impacts and benefits of royalty payments for the extraction of borrow material on communities
- the need for an assessment of costs arising from the proposal to allow consideration of the social and economic impacts and benefits.

Matters raised during public consultation relating to potential significant impacts on community and economy include:

- the need to consider potentially negative impacts such as increased heavy vehicle movements, impacts on road integrity, traffic safety concerns and impacts to small local businesses; together with potential benefits such as employment, training and economic advantages
- potential public safety risks from the proposal post-remediation, including potential risks associated with recreational use of the Main Pit
- the need for a complete financial analysis of the proposal to understand the costs of rehabilitation and any ongoing monitoring and remediation works, and potential costs for future generations
- the need for the proposal to improve environmental conditions and restore socially significant landforms and places to support a future land use and value of the site by the community
- the importance of stakeholder engagement and consultation to ensure the knowledge held by stakeholders in incorporated into the proposal design and outcomes.

6.6.4. Potential significant impacts and benefits

The following opportunities and impacts on community and economy may occur as a result of proposal implementation:

- opportunities for increased employment, business and training in the locality and region
- impacts to stakeholders and/or community members, including traditional owners, due to:
 - o changes in noise, dust and vibration levels, and visual amenity
 - changes in the availability and affordability of housing and accommodation
 - \circ $\,$ changes related to an increased demand for local community services
 - \circ $\,$ increased local road traffic leading to a reduced sense of road safety and wellbeing
 - potential to impact cultural and/or historic community values.

6.6.5. Avoidance and mitigation of impacts

The proponent has proposed the following measures to maximise opportunities for the community and economy:

- prioritise local procurement, employment and training in accordance with a Local Industry Participation Plan, Workforce Management Plan and Opportunity Plan
- prioritise employment, business, skills development, training and support programs for traditional owners in accordance with the Indigenous Development Plan and Traineeship program

The proponent has proposed the following measures to avoid and mitigate impacts to the community and economy:

- establish a Stakeholder Advisory Group and implement a Stakeholder Communication and Engagement Strategy, to provide for early engagement and ongoing consultation with the community and stakeholders, including traditional owners
- manage noise, dust, vibration and visual impacts, and perceived radiation risks within acceptable levels as outlined in the EIS, and provide early notification and regular updates to potentially affected persons about proposed works
- implement processes to manage traffic movements, road safety and complaints
- manage accommodation demand for the proposal in accordance with an Accommodation Strategy to minimise impacts on the local community and tourism industry
- implement an Emergency Response Plan in consultation with local emergency service providers.

6.6.6. Assessment of impacts to environmental values

Opportunities for increased employment, business and training in the locality and region

The NT EPA acknowledges that the proposal could provide significant benefit to the local community through opportunities for employment, increased economic activity and training programs, if approval is granted.

The SEIA report provided an assessment of the potential social impacts and opportunities of the proposal on potentially affected communities, including Aboriginal communities. The SEIA also outlined the Stakeholder Communication and Engagement Strategy, the consultation methods

used, stakeholders that were contacted, how they were provided with information about the proposal, the key issues that were raised, and the proposed measures for managing social and economic impacts.

The proponent's commitment to prioritise employment, training and economic development for local residents and businesses could generate opportunities in the Coomalie region and Greater Darwin region during proposal implementation which is scheduled to include 5 years of remediation and construction, and a further 5 years of stabilisation, revegetation and monitoring to evaluate the extent to which remediation achieves its objectives.

The proponent anticipates that the proposal would generate up to 45 jobs in the peak construction phase, reducing to about 15 jobs in the last year of construction and about 7 jobs during stabilisation. At least three traineeship positions would be made available during proposal implementation. The proposal will require products and services such as bulk lime for AMD waste rock treatment, bulk fuel for vehicles and equipment, borrow material, contractor services for earthmoving, bore drilling, water treatment, maintenance, accommodation, meals and support services.

The proponent committed to continue actively engaging with traditional owners and Aboriginal employment and training providers to identify opportunities for employment and participation for local Aboriginal people, and to raise awareness about the potential roles so that training programs may be offered to align with proposal skills requirements. The proponent considered that NT government procurement policies and the capacity of existing local service providers would ensure that the majority of proposal expenditure remains in the NT.

The proponent has made a commitment to establish a working group for traditional owners and custodians of sacred sites to provide opportunities for engagement of Aboriginal communities, consultation on proposal implementation, the planning of business and employment opportunities, and planning for ongoing stakeholder communication. The CHMP and the working group for traditional owners would be developed within the framework of the proponent's Stakeholder Communication and Engagement Strategy. The NT EPA supports the proponent's commitment to engage and consult with traditional owners and has recommended a condition requiring that traditional owners and the NLC be consulted throughout implementation of the proposed action.

Impacts to stakeholders and community members, including traditional owners, during proposal implementation

The proposal would cause localised changes in noise, dust and vibration levels during construction, and the final waste landforms would potentially have a minor local impact on visual amenity. The proponent assessed the baseline condition for air, noise and vibration (GHD 2019b) and conducted impact assessments for air quality (GHD 2019a), noise and vibration (GHD 2019c) and landscape and visual impacts (SLR 2019).

The proponent's air quality modelling indicated that proposal-related increases in dust emissions would exceed nationally recognised ambient air quality objectives at eight sensitive residential receptors in close proximity to the Rum Jungle site and satellite sites. Measures to mitigate dust impacts on nearby residents include standard operational controls such as dust suppression with water sprays, and to reduce or cease operations during strong wind conditions. The proponent would also provide for temporary short-term (i.e. a few days) relocation of potentially affected residents adjacent to Mt Burton during operations, compliance dust concentration, dust deposition monitoring, or real-time reactive air quality monitoring.

Noise modelling results show that the recommended assigned noise levels adopted from the NT Noise Management Framework Guideline (NT EPA 2018) would potentially be exceeded at two residential receptors. However, the proponent concluded that implementation of proposed mitigation measures detailed in the Noise and Vibration Impact Assessment Report (GHD 2019c)

would reduce noise to within acceptable levels. Vibration generated during construction is not expected to cause structural damage to any nearby dwellings or structures. The proponent's visual impact assessment concluded that the proposal would have a minor impact on landscape views in the area, and that visual amenity would be maintained.

The SEIA considered potential changes in the availability and affordability of housing and accommodation due to the proposal, and recognised that workers not local to the area would likely require accommodation in Batchelor which could result in economic benefits through rental or business income, as well as negative impacts to local renters and tourists if workforce demand led to housing or accommodation shortages. The proponent considered the non-residential workforce increase in demand for accommodation would be small, and that other accommodation options, including increasing the capacity of existing temporary accommodation facilities, or use of the Batchelor Institute education campus accommodation facilities, could be considered.

The proponent recognised that the proposal may increase demand for local community services, including emergency, health and education services. The proponent would implement an Emergency Response Plan which would provide strategies to deal with emergencies and health-related needs that arise from the proposal. The proponent understands from consultation with community service providers in Batchelor that the anticipated additional demand could be accommodated and would be acceptable.

The proposal would result in increased truck movements on several routes of the local public road network, mainly through haulage of low permeability cover materials from the potential CCGC low permeability material borrow pit. The proponent's traffic impact assessment estimated that the proposal would result in 35 additional truck movements per day on Rum Jungle Road and Batchelor Road, and 15 additional movements per day on Crater Lake Road. The EIS stated that traffic management requirements as set by DIPL would be incorporated into the proposal design and implementation. A Road Use Management Plan and Traffic Management Plan would be prepared and implemented to manage traffic impacts.

The environment and culture are important local community values, for both Aboriginal and non-Aboriginal people. The community has a strong expectation that the proposal will improve environmental conditions and culturally significant sites through remediation of contamination, and enhance or restore cultural values associated with sacred sites. A failure to deliver improved environmental and cultural outcomes would have the potential to negatively impact local community values. The NT EPA's assessment of potential biophysical impacts of the proposal are discussed in the land and water factors in this report.

The proponent recognised the potential for negative social impacts due to community perception of potential risk related to radiation impacts on human health. Section 6.7 of this report provides detail about potential radiation impacts and the proposed measures and regulatory framework to manage those impacts.

The NT EPA has recommended a condition requiring that the proposal be implemented in a manner that ensures opportunities for potentially affected communities are maximised, and adverse social and economic impacts arising from the proposal are avoided and then mitigated, so that the environmental outcomes meet the NT EPA's objective for Community and economy.

A further condition has been recommended that requires social impact reporting during proposal implementation to ensure regular reporting of social impact mitigation measures and the success of the proposed strategies to manage impacts and the benefits on the local community. Summary of factor assessment and recommended regulation

The NT EPA has considered the potential significant impacts of the proposal on the community and economy. In doing so, the NT EPA has considered whether reasonable conditions could be

imposed, or whether other statutory decision-making processes could ensure the NT EPA's factor objective is likely to be met. The NT EPA assessment findings are presented in **Table 13**.

The NT EPA has also taken into account the objects and principles of the EP Act (Appendix 2) in assessing whether the residual impacts will meet its environmental factor objective and whether reasonable conditions can be imposed.

Residual impact to environmental value	Assessment finding	Recommended conditions and regulation by other statutory decision-makers
Amenity: Changes in noise, dust and vibration levels, and visual amenity	The NT EPA concludes that implementation of the proposal will not result in significant amenity impacts.	 Regulated through: condition 24 - community and economy outcomes condition 25 - public reporting to the community.
Changes in the availability and affordability of housing and accommodation	The NT EPA concludes that implementation of the proposal will not significantly impact the availability or affordability of housing in the region.	 Regulated through: condition 24 - community and economy outcomes condition 25 - public reporting to the community.
Changes related to an increased demand for local community services	The NT EPA concludes that implementation of the proposal will not significantly impact on local community services.	 Regulated through: condition 24 - community and economy outcomes condition 25 - public reporting to the community.
Traffic: Increased local road traffic leading to a reduced sense of road safety and wellbeing	The NT EPA considers that potential significant impacts on traffic and road use would be appropriately avoided through statutory provisions under the <i>Control of Roads Act</i> 1953 and the <i>Traffic Act</i> 1987.	Regulated through other statutory decision-making processes under the Control of Roads Act 1953 and the Traffic Act 1987.

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6.6.7. Conclusion against the NT EPA objective

With the implementation of the proponent's commitments, the NT EPA's recommended conditions in Appendix 1, and regulation under the *Control of Roads Act 1953* and the *Traffic Act 1987*, the NT EPA considers that the proposal could be conducted in such a manner that its objective for community and economy is likely to be met.

6.7. Human health

6.7.1. Environmental values

Radiological safety for site workers, visitors, people living close to the proposal and members of the public is the key value that needs to be protected under the Human health factor. Rum

Jungle and its associated satellite sites of Mt Burton and Mt Fitch contain radioactive material² in areas where previous uranium and polymetallic mineral exploration, mining and processing activities were undertaken between 1953 and 1971. Radioactive material from these activities has also migrated downstream into the EBFR through sedimentation, runoff and seepage.

Elevated radiation levels at the Rum Jungle site currently pose a low risk to human health because the site is a restricted use area with site access limitations. Radiation levels at Mt Burton are generally low with the exception of a stockpile of material in the southwest corner of the site, which would potentially pose a risk to human health under a long-term exposure scenario i.e. >30 days working on the stockpile. The distance between Mount Burton and the nearest residence is 0.2km. Radiation levels are elevated in some stripped overburden stockpiles at Mt Fitch that would be backfilled during the proposal.

The proposal area has elevated background radiation levels and concentrations of radionuclides (in soil and air) compared with the Australian average, due to the natural uranium mineralisation of the area.

Traditional owners have requested that the rehabilitated future land use of Rum Jungle be suitable for occasional site visits and temporary occupation for recreational, ceremonial or cultural events, and maintenance work.

6.7.2. Investigations and surveys

Investigations and surveys undertaken by the proponent and reported as part of the Draft EIS, Supplement and additional information responses, informed the NT EPA's assessment of potential impacts to human health (Appendix 5 – Investigations and surveys).

6.7.3. Consultation

Matters raised during public and government authority consultation relating to potential significant impacts to human health include:

- NT Worksafe commented on the need for radiation monitoring requirements under the Work Health and Safety (National Uniform Legislation) Act 2011 and its Regulations
- NT Health noted the need to conduct further studies for the radiological risk assessment to inform dose assessments and determine whether any restrictions would be required for post-rehabilitation land use
- Supervising Scientist Branch raised concern about the lack of modelling of radionuclide uptake in food species and a lack of modelling of radiation does to the public, including traditional owners.
- DCCEEW (formerly DAWE) recommended the proponent's radiation protection measures for human health align with the International Commission on Radiological Protection (ICRP) optimisation principle so that the number of people exposed and the magnitude of individual doses are as low as reasonably achievable (ALARA)
- A member of the public raised concern about the lack of assessment of radiological conditions across the site and downstream, and the need to set radiological limits for the proposal.

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²Radioactive material is material that has an activity concentration greater than 1 Bq/g for any radionuclide in the uranium decay chain or the thorium decay chain, or greater than 10 Bq/g for ⁴⁰K.

6.7.4. Potential significant impacts and benefits

Potential significant impacts to human health could occur as a result of people (including workers, site visitors, traditional owners, residents and members of the general public) being exposed to harmful radiation doses during proposal implementation or post-rehabilitation through one or more of the following pathways:

- external gamma radiation
- inhalation of radon decay products
- inhalation of long-lived alpha emitting radionuclides
- ingestion of radionuclides.

6.7.5. Avoidance and mitigation of impacts

The proponent's application of the management hierarchies includes measures to avoid and mitigate potential significant impacts on human health, including:

- site access and shift restrictions during proposal implementation to manage radiation exposure levels within dose constraints
- isolation and encapsulation of radiological soils within the first year of the proposal prior to commencement of waste rock handling activities
- avoid and minimise the handling and exposure of radioactive material
- implementation of a Radiation Management Plan
- induction and training for employees and visitors on radiation
- access restrictions for areas that are a radiation source
- relocation of potentially affected residents during waste rock movement from Mt Burton
- further investigation of potential impacts of radiation on human health via the ingestion pathway post-rehabilitation
- exclusion of bush tucker plants from the WSF revegetation species.

6.7.6. Assessment of impacts to environmental values

The NT EPA notes that the proponent has considered the radiation policy and guidance that is relevant for this factor in the EIS documents.

The Draft EIS (section 7.5.3) documents the proponent's plan to deal with radiological soil hazards. In the first year of the proposal, radiological soils outside of the Western WSF footprint would be excavated, placed over existing radiological soils within that footprint and covered with a low permeability barrier blanket. The WSF would then be constructed over this cell of radioactive material. The relocation and burial of radioactive material early in the first year of the earthworks schedule is intended to reduce the potential radiation doses to exposed persons to as low as reasonably achievable, which is considered to be beneficial to human health and the environment and is therefore justified in line with national and international radiation standards.

Management of radioactive material during proposal implementation has the potential to temporarily increase the cumulative dose of radiation for workers, people living close to the proposal and members of the public. Exposure may occur through inhalation of radionuclides in dust and radon decay products, ingestion of radioactive material, and absorption of gamma radiation.

Previous studies undertaken on behalf of the proponent have informed an estimate of the volume and extent of radioactive material that requires remediation within the proposal area,

and the potential for human health impacts. Radioactive soils at the Rum Jungle and Mt Burton sites would be isolated from human receptors, by relocation to the proposed new WSF. The proponent committed to regular monitoring during placement of mine waste to provide early detection of any radiological contaminants, as well as monitoring of surface water and groundwater to detect mobilisation of any radiological contaminants into the downstream receiving environment.

The proponent undertook investigations and surveys to determine radiation exposure to workers, traditional owners, and members of the public at the Rum Jungle mine site. Radiation levels were measured at the associated satellite sites of Mt Burton and Mt Fitch. The proponent estimated the radiation doses at areas containing known radioactive material at Rum Jungle from gamma radiation, radon decay products and dust containing radionuclides which may be inhaled. Dose estimates did not include the dose from radionuclides that may be ingested as the proponent considered there was insufficient data available for this evaluation.

The proponent prepared a Radiation Management Plan to address the potential radiological risks and necessary mitigation measures associated with the excavation, transport and placement of radiologically contaminated materials. The Radiation Management Plan provides for the management and control of radiological exposures likely to impact humans, non-human biota and the environment during the proposal, and outlines the systems and processes that will be put in place to ensure compliance with standards (guidelines and codes) and regulatory requirements relating to radiation protection.

6.7.6.1. Radiation regulatory and assessment framework

The NT EPA notes that there is a comprehensive technical guidance framework for assessing radiological impacts to human health. The framework involves the development of international guidance which is then integrated into national, state and territory documents relevant to that jurisdiction and environment. Regarding the adequacy of the proponent's radiological assessments undertaken to determine radiation exposure, the Department of Health advised that there is a need to conduct further studies to inform the dose assessments and whether restrictions would be required for post-rehabilitation land use and access.

The proponent has proposed an "as low as reasonably achievable, taking into account economic, environmental and social factors" (ALARA) approach to limit radiation exposure to workers and members of the public, which is consistent with international and national standards for managing radiation health impacts. Doses to workers on site would be monitored and managed so that regulatory dose limits are not exceeded. Consistent with the RPS C-1 Code for Radiation Protection in Planned Exposure Situations, the proponent committed to an ALARA approach through best practice design optimisation, operational procedures and monitoring to control exposure to radiation. The Australian Government DCCEEW recommended that the proponent implement dose constraints to align with the International Commission of Radiological Protection (ICRP) optimisation principle and identify whether mitigation measures meet expected outcomes.

The proposal area in its current state may be considered an existing exposure situation, for which an intermediate reference level of 10 millisieverts per year (mSv/yr) is appropriate in line with the RPS G-2 Guide for Radiation Protection in Existing Exposure Situations (ARPANSA 2017). During proposal implementation, it is warranted to treat the proposal as a planned situation so that the proposal would be subject to dose limits and constraints, including for the workforce involved in remediation of the existing legacy situation, and potentially affected members of the public.

Radioactive material is subject to regulatory control under current radiation protection legislation, including requirements for occupational and public radiation dose limits and the handling and storage of radioactive material. Regulation of radiation in the NT is through the *Radiation Protection Act 2004* (RP Act) which aims to protect the health of people in the Territory and their environment from the harmful effects of radiation. It requires that persons carrying out
a radiation practice hold a licence and implement an approved radiation protection plan to ensure radiation doses to workers and members of the public are below relevant limits, and ALARA. Regulation involves compliance with the National Directory for Radiation Protection and relevant ARPANSA documents.³

The NT EPA notes that average natural background radiation exposure to people living in Australia is 1.7 millisieverts per year (mSv/yr). Radiation dose limits used in Australia are those recommended by the ICRP and incorporated into the Radiation Protection Series (RPS) C-1 Code for Radiation Protection in Planned Exposure Situations (ARPANSA 2020). These are 20 mSv/y above background for workers, averaged over 5 years (maximum of 50 mSv in one year); and 1mSv/y above background for members of the public.

6.7.6.2. Radiological impacts during proposal implementation

Worker radiation exposure

Onsite workers involved in the excavation, transport and encapsulation of radioactive material would be exposed to radiation. The proponent estimated the average annual dose to site workers at Rum Jungle from radiological exposure pathways including external gamma radiation, inhalation of radon decay products, inhalation of long-lived alpha emitting radionuclides in dust. It also acknowledged that the dose would change during the excavation, transport and encapsulation of radioactive material, and prepared a Radiation Management Plan to assist in meeting its regulatory obligations for radiation management.

The averaged dose rate over the three most radioactive areas of Rum Jungle (the footprint of the dump area west of Dysons, Acid Dam and Old Tailings Dam) was 0.6 μ Gy/hr. The dump west of Dysons is ranked the highest radiologically contaminated area, with measurements of >30 μ Sv/hr readings across the area containing large rocks with evidence of uranium mineralisation.

At Rum Jungle, the estimated average annual dose for a site worker is 0.15 – 0.3 mSv/yr based on investigations by Bollhöfer et al. (2007) and Radiation Advice and Solutions (2015). The NT EPA notes that this is below the regulatory occupational dose limit of 20 mSv/yr. The proponent identified areas of radioactive material within the Rum Jungle site where prolonged, uncontrolled exposure could result in higher doses to workers, ranging from 2.64 -14.64 mSv/yr, as outlined in the proponent's Rum Jungle Radiological Hazard Assessment Report (EcOz 2019).

The NT EPA considers that there is inherent uncertainty in the proponent's estimation of occupational dose, due to the limited available data on which the estimates are based, and the unknown level of change in radioactivity that the proposal would result in during the construction phase. However, this uncertainty would be resolved through monitoring radiation levels and worker exposure during proposal implementation. The EIS stated that real-time RDP, dust and gamma monitors could be used alongside PPE, filtered air in mobile equipment and shift controls to minimise dose if required. Implementation of the Radiation Management Plan would assist in ensuring that radiological hazards are effectively controlled in a manner that complies with international best practice and regulatory requirements.

The proponent did not provide an estimate of the average annual dose for site workers at Mt Burton or Mt Fitch. However, it is noted that neither of these areas are likely to pose a significant occupational health risk, provided the Radiation Management Plan is implemented.

³ Fundamentals for Protection Against Ionising Radiation (2014) (RPS F-1); Code for Radiation Protection in Planned Exposure Situations (2016) (RPS C-1); and Guide for Radiation Protection in Existing Exposure Situations (2017) (RPS G-2).

The radiation hazard assessment report prepared by EcOz on behalf on the proponent found gamma radiation levels at Mt Burton in 1988 were generally below 3 μ Gy/hr (26.3 mSv/yr); however, an area north of the open cut mine had gamma radiation levels up to 35 μ Gy/hr (307 mSv/yr)⁴. In 2016, a survey conducted by the proponent found the average background gamma radiation level at Mt Burton was about 0.07 μ Sv/hr (0.6 mSv/yr). The highest gamma radiation result was about 4.3 μ Sv/hr (37.7 mSv/yr) at the Area C stockpile. The proponent noted the potential risk to worker health under a long-term (>30 days) exposure scenario.

At Mt Fitch, waste rock showed an average gamma radiation level of <0.5 μ Gy/hr (4.4 mSv) with some areas showing up to 2 μ Gy/hr (17.5 mSv/yr).

The NT EPA notes that the radiation related component of the proposal would be carried out under a staged process consistent with the National Environmental Protection (Assessment of Site Contamination) Measure 1999 (ASC NEPM) and the national remediation framework. While the ASC NEPM and national remediation framework do not include radiation-specific guidance, they are consistent with the general process for assessment, management and remediation of land contaminated by radioactive material.

The NT EPA notes that the proponent would implement shift controls and monitor and manage worker exposure to ensure dose limits are not exceeded, in accordance with the Radiation Management Plan. The NT EPA notes that compliance with the RPS C-1 Code for Radiation Protection in Planned Exposure Situations would ensure that dose constraints are set and implemented to support the prevention of exceedances and assist in optimising protection.

Noting that the estimated radiation doses to site workers are lower than the regulatory dose limits, the approach taken to assess radiological impacts is considered appropriate, noting that further monitoring and assessment would be required. The NT EPA is of the view that radiation exposure from the proposal to workers is within acceptable limits for human health.

Public radiation exposure

Investigations conducted on behalf of the proponent estimated that the average annual dose for general members of the public from the Rum Jungle site during proposal implementation is <1 mSv/yr.

The distance between the nearest residence and the Mt Burton site is 0.2 km. The average annual dose for the nearest resident was not estimated in the EIS. The proponent considered that the excavation and transport of radioactive material from Mt Burton to the Rum Jungle Mine site would potentially cause an exceedance of the regulatory dose limit of 1 mSv/yr at the nearest residence. To minimise the risk of exposure, the EIS recommended those residents not be present for the duration of those works. The findings of the radiological hazard assessment also recommended that the nearest residents at Mt Burton be advised to avoid the Area C stockpile at Mt Burton and that signage be installed to warn of elevated radiation levels until the material is relocated to the new WSF.

As radiation decreases with distance from the source, the NT EPA expects that with implementation of the proposed radiation monitoring and management measures, the total dose of radiation to individual members of the public to be compliant with the regulatory public dose limit. However, it notes that the proponent would be required to undertake the required monitoring and implement controls where necessary to comply with the public dose limit and ensure radiation exposure to members of the public is minimised and kept ALARA.

⁴ CG, 1988, Rehabilitation proposals for abandoned uranium mines in the Northern Territory. Prepared by Construction Group for Commonwealth Department of Administrative Services on Behalf of Department of Primary Industries & Energy (DPIE), Canberra, ACT, April 1988 (cited in EcOz 2019).

The proponent's transport of radioactive material would be undertaken in a manner that complies with the RPS C-2 Code for the Safe Transport of Radioactive Material (ARPANSA 2019). The NT EPA notes that this would provide for the safe transport of radioactive material by road during proposal implementation.

Noting that the estimated radiation doses to members of the public are below the regulatory dose limits, the approach taken to assess radiological impacts is considered appropriate, noting that further monitoring and assessment would be required. The NT EPA is of the view that radiation exposure from the proposal to members of the public is within acceptable limits for human health.

6.7.6.3. Radiological impacts post-rehabilitation

Investigations conducted on behalf of the proponent estimated that the average annual dose for traditional owners occupying the site for one month per year post-rehabilitation would be 0.5 mSv/yr, and for five months of the year would be ~5 mSv/yr, although it is noted that a five month occupancy is considered unlikely and a one month occupancy period is more realistic. This estimate excludes the ingestion pathway dose. The NT EPA notes that the estimated doses are below the reference level for remediation of legacy sites in line with the RPS-G2 Guide for Radiation Protection in Existing Exposure Situations (ARPANSA 2017).

Future land use of Rum Jungle depends on the traditional owner expectations, and may include ceremonial uses, customary harvesting activities including hunting and stock grazing and tourism ventures. The process and timeframe for handing over the site after the proposal is complete is not yet established. The proponent would prepare a final Land Use Plan that would be endorsed by a Contaminated Sites Auditor to confirm that the land condition is safe for any of the proposed uses. The radiation dose calculated at the completion of rehabilitation works, will determine the type and duration of activities that can be carried out safely at the site.

Post-rehabilitation, additional radiological studies may be needed to inform potential impacts regarding ingestion pathways. Those studies, and the interpretation of their results, will be informed by the final Land Use Plan. Certain land use activities may be restricted or modified depending on the outcomes of those studies.

6.7.7. Summary of factor assessment and recommended regulation

The NT EPA has considered the potential significant impacts of the proposal on human health values. In doing so, the NT EPA has considered whether reasonable conditions could be imposed, or whether other statutory decision-making processes could ensure the NT EPA's factor objective is likely to be met. The NT EPA assessment findings are presented in Table 14.

The NT EPA has also taken into account the objects and principles of the EA Act and EP Act (Appendix 2) in assessing whether the residual impacts will meet its environmental factor objective and whether reasonable conditions can be imposed.

Residual impact to environmental value	Assessment finding	Recommended conditions and regulation by other statutory decision-makers
Occupational radiation exposure during proposal implementation	The estimated radiation dose to workers is below the regulatory occupational dose limit of 20 mSv/yr averaged over a period of five consecutive years, with the further provision that the effective dose	Regulated by other statutory decision making processes under the <i>Radiation Protection Act</i> 2004 (NT).

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Residual impact to environmental value	Assessment finding	Recommended conditions and regulation by other statutory decision-makers
	must not exceed 50 mSv in any single year.	
Public radiation exposure during proposal implementation	The estimated radiation dose to members of the public from Rum Jungle is below the regulatory public dose limit of 1 mSv/yr (Noting that in special circumstances, a higher value of effective dose could be allowed in a single year, provided that the average over five years does not exceed 1 mSv/yr.	Regulated by other statutory decision making processes under the <i>Radiation Protection Act</i> 2004 (NT).
	The effective dose to members of the public from satellite sites was not determined. Dose would be monitored and managed during implementation in accordance with a Radiation Management Plan.	
Public radiation exposure post- rehabilitation	Radiation exposure to members of the public (including nearby residents and traditional owners accessing the site) post-rehabilitation, is expected to be below the regulatory public dose limit and lower than current radiation levels from the existing exposure situation. This is due to radioactive material being encapsulated in cells of the WSF.	Regulated by other statutory decision making processes under the <i>Radiation Protection Act</i> 2004 (NT).

6.7.8. Conclusion against NT EPA's environmental factor objective

With the implementation of the proponent's proposed management measures and regulation under other statutory decision-making processes, the NT EPA considers that the proposal could be conducted in such a manner that its objective for human health is likely to be met. Whole of environment considerations

The NT EPA considered in the assessment of each key environmental factor its natural relationships and potential interactions with other parts of the environment. This section provides an overview of the main connections and interactions between parts of the environment to inform a holistic view of impacts to the whole of the environment. The acceptability of the proposal against the principles of ecologically sustainable development are discussed in Appendix 2 – Matters taken into account during the assessment.

6.8. Physical, chemical and biological environmental interactions

The EIS identified a strong interaction of the key environmental factors Hydrological processes, Inland water quality and Aquatic health at Rum Jungle, where the contaminated groundwater connects to the surface waters and contributes significantly to the contamination of the EBFR and the degraded status of the downstream aquatic ecosystems. The three factors have therefore been combined in the NT EPA's assessment of potential impacts and benefits of the proposal to the receiving downstream environments of the EBFR and Finniss River (section 6.4).

Surface water and potentially groundwater are also linked to the factor Terrestrial ecosystems, supporting a number of significant and sensitive vegetation types at Rum Jungle, which are high value fauna habitats including habitats for threatened species known or likely to occur at Rum Jungle. The NT EPA considered potential impacts of changes in the surface hydrology and groundwater drawdown on these vegetation types, habitats and threatened species in section 6.5.

The NT EPA considered the interactions of the factor Terrestrial Environmental Quality with the combined Water factors, whereby erosion and sediment of the proposed final landforms, and the development of AMD in the WSF have the potential to cause significant impacts on the groundwater and surface water quality, and aquatic ecosystem health of downstream environments. This is assessed in section 6.2.

Interactions of the physical, chemical and biological environments are complex at Rum Jungle with multiple sources of contaminants and biological pressures currently impacting the terrestrial and aquatic ecosystems. The proposed rehabilitation intends to remediate the main contamination sources and to manage biological pressures such as weeds, with the aim to significantly improve the condition of the terrestrial and aquatic ecosystems at and downstream of Rum Jungle. The NT EPA took the contaminated status and the anticipated improvement of the environmental conditions into account when assessing the short and long-term potential impacts of the proposal across the key environmental factors. While the proponent's predictions are reassuring, the NT EPA concluded that long-term monitoring, mitigation and adaptive management within a framework of effective governance and auditing are required to ensure the long-term improvement of the environmental values across the key environmental factors.

6.9. Biophysical environment – culture – human health – communities and economy

The NT EPA recognises that Rum Jungle and surrounds are significant to the Warai and Kungarakan peoples, who are the traditional owners of the land. A number of sacred sites are located at Rum Jungle, of which one was destroyed by previous mining activities. The EIS indicated that the cultural values are intrinsically connected with the natural environment and that an improvement of environmental conditions would also be an improvement of the cultural values.

The proponent has co-designed the restoration of cultural features and values associated with sacred and culturally significant sites and landscapes into the rehabilitation, such as the realignment of the EBFR through the pits and the removal of a WRD near cultural sites. The rehabilitation aims to improve the physical, chemical and cultural environment of Rum Jungle to a state that enables traditional owners to return to these culturally important sites and practice cultural activities. A final site audit would determine the extent of these activities taking into consideration potential impacts on human health for example from exposure to residual radiation, bushfoods and inhalation of dust (section 6.7).

The NT EPA supports the restoration of cultural values and re-connection to country and has recommended conditions to ensure traditional owners are consulted throughout the rehabilitation (section **Error! Reference source not found.**). The NT EPA assessed that the focus of the rehabilitation must be to establish a physically and chemically stable landform that does not pollute its receiving environments, with the restoration of cultural landscape features and values incorporated as practicable.

Community and economy values are intrinsically linked to environmental values associated with water quality and availability, aquatic and terrestrial ecosystem health and terrestrial environmental quality. The impact assessment has considered these strong connections, the potential impact the proposal may have on these and the intended improvement of these values from the proposed rehabilitation. The NT EPA acknowledges that the proposal could provide significant economic and social benefits to the small local community and recommended conditions to ensure that opportunities are maximised and adverse impacts are avoided.

6.10. Conclusion

When the separate environmental factors of the proposal were considered together in a whole of environment assessment, the NT EPA formed the view that the impacts from the proposal would not alter its views about whether the proposal could meet its factor objectives.

The NT EPA considers that the contaminated site remediation approach with a framework of validation, auditing and adaptive management would provide adequate processes to deal with actual impacts on environmental values over the life of the project compared to those predicted during the environmental impact assessment process.

The NT EPA is of the view that the potential impacts of the proposal on the 'whole of environment', with consideration of the intrinsic interactions between environmental factors, would not lead to any substantial detrimental effect on achievement of the NT EPA's environmental objectives.

7. Matters of National Environmental Significance

On 4 August 2016, the Australian Government Minister for the Environment determined that the proposed action was a controlled action and required assessment and approval under the EPBC Act as it is likely to have a significant impact on one or more Matters of National Environmental Significance (MNES) protected under the EPBC Act. The controlling provisions are:

- listed threatened species and communities (sections 18 and 18A)
- protection of the environment from nuclear actions (sections 21 and 22A).

7.1. Listed threatened species and communities

The EPBC Act requires the protection and conservation of listed threatened native species and communities (sections 18 and 18A). The potential for impact on relevant threatened species has been assessed in detail in section 6.5 of this report. This section provides an overview of the assessment specific to EPBC listed threatened species.

Targeted seasonal surveys and likelihood assessments identified seven threatened fauna species listed under the EPBC Act to occur or likely to occur within the proposal area and immediately adjacent (**Table 15**).

Table 15 EPBC Act listed threatened species recorded during targeted surveys for the EIS, recorded during previous surveys (known) or likely to occur within the proposal area (sources Eco Logical 2014, EcOz 2019, advice from Flora and Fauna Division, DEPWS)

Common name	Scientific name	EPBC Act	Recorded	Known	Likely
Black-footed Tree-rat	Mesembriomys gouldii	Endangered	RJ, G		MB, MF
Partridge Pigeon (Eastern)	Geophaps smithii	Vulnerable	RJ, G		
Northern Quoll	Dasyurus hallucatus	Endangered		RJ 2008	

Fawn Antechinus	Antechinus bellus	Vulnerable	RJ 2008	
Masked Owl	Tyto novaehollandiae kimberli	Vulnerable	MF 2008	RJ
Plains Death Adder	Acanthophis hawkei	Vulnerable		RJ
Red Goshawk	Erythrotriorchis radiatus	Vulnerable		RJ

RJ = Rum Jungle, G = Borrow Area A, MB = Mt Burton, MF = Mt Fitch

There are no EPBC Act listed threatened communities within the proposal area.

No public comments have been received in regards to MNES.

The NT EPA's assessment of the recorded, known and likely to occur EPBC listed threatened species (**Table 15**) found that the area impacted by the proposal is relatively small, partly degraded by previous disturbance and gamba grass, and unlikely to contain important habitat or support significant populations of these species.

Mitigation measures are proposed and recommended to avoid, mitigate and manage potential mortality or injury of individuals from the proposed activities such as land clearing, contamination and vehicle strikes.

Based on advice from the Flora and Fauna Division (DEPWS), the NT EPA concludes that risks to the regional populations of EPBC listed threatened species (**Table 15**) are low from the proposed activities. In addition, the proposed rehabilitation and revegetation would facilitate a net gain of potential habitat, and the proposed management of the invasive gamba grass, feral animals and fire would improve habitat conditions (Hill 2012, Threatened Species Scientific Committee 2015). Any residual impacts to these species are likely to be acceptable.

7.2. Protection of the environment from nuclear actions

This proposal was determined to be a nuclear action under section 22(1) of the EPBC Act, which requires the protection of the environment from nuclear actions (sections 21 and 22A). In this case, the MNES is 'the environment' (sections 22(1)(a) and (e), EPBC Act). Section 528 of the EPBC Act defines environment as including:

- a) ecosystems and their constituent parts, including people and communities; and
- b) natural and physical resources; and
- c) the qualities and characteristics of locations, places and areas; and
- d) heritage values of places; and
- e) the social, economic and cultural aspects of a thing mentioned in paragraph (a), (b), or (c).

The NT EPA's assessment of the potential significant impacts of the proposal on all aspects of the environment through this assessment report, adequately addresses the 'whole of environment' assessment required under the EPBC Act.

8. Conclusion and recommendation

The NT EPA has considered the proposal by DITT to rehabilitate the former Rum Jungle mine site. The NT EPA's assessment of the proposal recognises that the potential benefits associated with restoring the degraded environment will likely lead to significant improvements to the site and EBFR. These benefits have the potential to also result in achieving cultural outcomes that are the long held wishes of past and present traditional owners. The NT EPA identified risks to achieving the benefits, with potential significant environmental impacts associated with the environmental factors of inland water environmental quality, hydrological processes, aquatic ecosystems, terrestrial environmental quality, terrestrial ecosystems, culture and heritage, community and economy, and human health. The NT EPA's assessment concludes that the proposal would remove a long-term source of contamination caused by operation of the former Rum Jungle Mine and would enable the proponent to make the site suitable for future land uses. The recommended conditions would ensure the mine waste storages are managed in the long-term to minimise residual risks to the environment. The NT EPA considers that site contamination knowledge gaps and risks can be addressed under a site remediation framework, and through this process the proposal can be implemented and managed in a manner that is environmentally acceptable and therefore recommends that environmental approval be granted subject to implementation of the proponent's commitments and the conditions recommended in Appendix 1.

9. Definitions and acronyms

Acronyms	Full form
AHD	Australian height datum
ALARA	As low as reasonably achievable
AMD	acid and metalliferous drainage (including neutral and saline drainage)
ARPANSA	Australian Radiation Protection and Nuclear Safety Agency
ASC NEPM	National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended)
CCGC	Coomalie Community Government Council
CRC CARE	Cooperative Research Centre for Contamination Assessment and Remediation of the Environment
CSM	conceptual site model
DITT	Department of Industry, Tourism and Trade (formerly Department of Primary Industry and Resources)
EA Act	Environmental Assessment Act 1982 (replaced by Environment Protection Act 2019 on 28/06/2020)
EBFR	East Branch of Finniss River
EFDC	East Finniss Diversion Channel
EMP	Environment Management Plan
EIS	environmental impact statement
EP Act	Environment Protection Act 2019
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
EP Regulations	Environment Protection Regulations 2020
HIL	health investigation level
LDWQO	locally derived water quality objectives
NAF	non-acid forming
NRF	National Remediation Framework
RAP	Remediation Action Plan
NT	Northern Territory
NT EPA	Northern Territory Environment Protection Authority
NTG	Northern Territory Government
OTD	Old Tailings Dam
PAF	potential acid forming
SEIA	Social and Economic Impact Assessment

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TPWC Act	Territory Parks and Wildlife Conservation Act 1976
WRD	waste rock dumps
WSF	waste storage facility
WTP	water treatment plant

Terms	Definition
Adaptive management	A continuous cycle of improvement based on setting goals and priorities, developing strategies, taking action and measuring results, and then feeding the results of monitoring back into new goals, priorities, strategies and actions (State of the Environment 2016 in ANZG 2018). The effectiveness of an adaptive management approach relies on the support of appropriately designed management interventions and related monitoring and assessment programs. The focus in the context of this approval is on mitigating and managing the harmful impacts of the activities on the environment in line with the NT EPA's guideline on adaptive management.
Administering authority	The Regulation Branch within the Environment Division of the Department of Environment, Parks and Water Security, or its successor, is the administering authority. The administering authority is appointed under Administrative Arrangements Order by the government of the Northern Territory.
Approved extent	Maximum footprint of the proposed area.
Attenuation	The reduction in mass, toxicity, mobility, volume or concentration of contaminants by physical, chemical and biological processes (CRC CARE 2019).
Audit	In the context of the CRC CARE National Remediation Framework, an audit is 'an independent review of the assessment and/or remediation work carried out by environmental consultants and to provide independent expert opinion regarding any potential impacts to human health and/or the environment relating to site contamination, and the suitability of land for its intended use.' (CRC CARE 2019).
Beneficial use	Beneficial uses describe how a water resource benefits the community. Beneficial uses and water quality objectives or guidelines can be declared under the <u>Water Act 1992</u> . In the Northern Territory (NT) beneficial uses or values have been set for major aquifers and river catchments. These values are then used to set water quality targets. <u>Beneficial water use NT.GOV.AU</u>
Bushfood	The edible tissues of wild plants and animals traditionally hunted and gathered from the environment (Doering, Bollhofer & Medley 2017)
Certified practitioner – site contamination	An accredited professional active in the private sector of site contamination assessment and/or remediation. Two relevant schemes are recognised in the land industry – Environment Institute of Australia and New Zealand's Certified Environmental Practitioner (Site Contamination) scheme (CEnvP(SC)) or the Soil Science Australia Certified Professional Soil Scientist Contaminated Site Assessment and Management (CPSS/CSAM) scheme.
Certified Professional in	A professional in erosion and sediment control certified by the International Erosion Control Association.

Terms	Definition
Erosion and Sediment Control (CPESC)	
Conceptual site model (CSM)	A representation of site-related information including the environmental setting, geological, hydrogeological and soil characteristics together with the nature and distribution of contaminants. Contamination sources, exposure pathways and potentially affected receptors are identified. Presentation is usually graphical or tabular with accompanying explanatory text (CRC CARE 2019)
Construction phase	The first phase of stage 3 of the Rum Jungle rehabilitation framework. It is proposed to take five years and includes all the earthworks, remediation action and water treatment.
Contamination	Condition of land or water where any chemical substance or waste has been added as a direct or indirect result of human activity at above background level and represents, or potentially represents, an adverse health or environmental impact (ASC NEPM 1999).
Clean up to the extent practicable (CUTEP)	If it is impracticable to clean up groundwater to the level needed to restore beneficial uses, the CEO may accept that clean up to the extent practicable has occurred and that, subject to appropriate ongoing management, further clean-up is not required (EPA Victoria Publication 840).
Days	means business days
Downstream environment	Biophysical environment receiving surface water flows connected to the proposal.
Receiving environments	Biophysical environments down gradient of the proposal including land, groundwater, and downstream environments such as the EBFR and Finniss River.
End-point	Targets (preferably numerical values) that need to be achieved to demonstrate that remediation has been effective. Also known as technology or remediation end-points or remediation clean-up criteria. A multiple lines of evidence approach may be used to demonstrate the effectiveness of remediation (CRC CARE 2019).
Groundwater	Water stored in the pores and crevices of the material below the land surface, including soil, rock and fill material (CRC CARE 2019).
Investigation and screening levels	The concentrations of a contaminant above which further appropriate investigation and evaluation will be required.
Long-Term Environmental Management Plan (LTEMP)	Contains information on the necessary management required to manage ongoing issues at a site following remediation activities.
Multiple lines of evidence	Uses a combination of information from several independent sources (or lines of evidence) to provide sufficient support to demonstrate success in situations where no one individual line of evidence provides sufficient certainty. Also known as a weight of evidence approach (CRC CARE 2019).
Natural background	The condition of soil and/or water derived/originating from natural processes in the environment as close as possible to natural conditions,

Terms	Definition
	exclusive of specific anthropogenic activities or sources (ASC NEPM 1999, sch. B6).
National Remediation Framework (NRF)	Cooperative Research Centre for Contamination Assessment and Remediation of the Environment (CRC CARE), <i>National Remediation</i> <i>Framework</i> , August 2019, as amended. The NRF was developed by CRC CARE to enable a nationally consistent approach to the remediation and management of contaminated sites. The NRF complements the <i>National Environment Protection</i> (Assessment of Site <i>Contamination) Measure 1999</i> . The NRF is endorsed by NT EPA and complements jurisdictional legislative requirements.
Proposal area	The proposal area consists of the areas disturbed by historic mining activities at Rum Jungle, Mt Burton and Mt Fitch, and which are subject to rehabilitation, as well as two borrow material areas and associated haul roads. The proposal area is in Appendix 1.
Radiation dose constraint	All sources of potential radiation exposure on the former Rum Jungle mine site, below which use or occupancy of the site, as prescribed in the Land Use Plan, is safe. The end land use for the former Rum Jungle mine site must be determined by the dose constraint applied to the site upon completion of the rehabilitation works.
Rehabilitation	Rehabilitation comprises the design and construction of landforms as well as the establishment of sustainable ecosystems or alternative vegetation, depending upon desired post-operational land use (Australian Government 2016). In the context of the Rum Jungle rehabilitation project and approval, rehabilitation also includes remediation.
Remediation	Remediation is taking steps towards remedying something, in particular of reversing or stopping environmental damage. It may be action designed to deliberately break the source-pathway-receptor linkage in order to reduce the risk to human health and/or the environment to an acceptable level (CRC CARE 2019
Remediation criteria	Targets (preferably numerical values) that need to be achieved to demonstrate that remediation has been effective. Also known as technology or remediation end-points or remediation clean-up criteria. A multiple lines of evidence approach may be used to demonstrate the effectiveness of remediation (CRC CARE 2019).
Remediation objective	An objective established for a specific site to be met by implementation of the RAP and, if appropriate, ingoing site management (CRC CARE 2019).
Residual contamination	Concentrations of the contaminants of concern remaining following completion of remediation
Risk	The probability that in a certain timeframe an adverse outcome will occur in a person, a group of people, plant, animals and/or the ecology of a specified area that is exposed to a particular dose or concentration of a specified substance, i.e. it depends on both the level of toxicity of the substance and the level of exposure. Risk differs from hazard primarily because risk considers probability (CRC CARE 2019).
Risk assessment	A process intended to calculate or estimate the risk to a given target organism, system, or sub-population, including the identification of attendant uncertainties, following exposure to a particular contaminant, taking into account the inherent characteristics of the

Terms	Definition
	agent of concern as well as the characteristics of the specific target system (ASC NEPM 1999, schedule B6, in NRF 2019).
Risk management	A decision-making process involving consideration of political, social, economic, and technical factors with relevant risk assessment information relating to a hazard to determine an appropriate course of action (CRC CARE 2019).
Site auditor	Under the NRF (CRC ARE 2019), the site auditor is defined as an "individual acting under statute is to carry out reviews of the assessment and/or remediation work carried out by environmental consultants and to provide independent expert opinion regarding any potential impacts to human health and/or the environment relating to site contamination, and the suitability of land for its intended use (ASC NEPM sch. 9)". In the absence of an auditor scheme under the EP Act, the site auditor must be accredited under section 68 of the <i>Waste Management and Pollution Control Act 1998</i> .
Stabilisation phase	The second phase of stage 3 of the Rum Jungle rehabilitation framework. It is proposed to follow the construction phase, take five years and includes intensive monitoring and maintenance.
Stakeholder	Stakeholders are people or entities who are, or have the potential to be, directly or indirectly affected by a proposal and with an interest or stake in the outcome of a decision and/or the ability to influence its outcome, either positively or negatively. Stakeholders of a proposal undergoing environmental assessment can include individuals, communities, groups, non-government organisations, land councils, government agencies, industries and industry associations, and interest groups.
Traditional owners	Has the same meaning as "traditional owners" in the Aboriginal Land Rights (Northern Territory) Act 1976 (ALR (NT) Act).
Validation	A process aimed at confirming that remediation objectives and targets in the Remediation Action Plan have been met (CRC CARE 2019).
Validation criteria	Concentration of a contaminant in air, soil, water, or sediment that is demonstrated to be protective of human health and the environment under specific conditions and must be achieved for a remediation action to be considered successful (CRC CARE 2019).
Validation report	A complete record of all remediation activities on site and data that characterises the site post-remediation, to support compliance with agreed remediation objectives and criteria (CRC CARE 2019).
Validation strategy	A strategy which describes the overall goals of the validation, including the criteria which must be validated against, and the lines of evidence that will be used to demonstrate the remediation objectives have been met (CRC CARE 2019).
Water quality	The physical, chemical and biological characteristics of water and the measure of its condition relative to the requirements for one or more biotic species and/or to any human need or purpose.

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Appendix 1 – Draft environmental approval

Draft Environmental Approval

PURSUANT TO SECTION 69 OF THE ENVIRONMENT PROTECTION ACT 2019

Approval number	EP2023/022-001
Approval holder	Chief Executive Officer of the Northern Territory Department of Industry, Tourism and Trade
Australian Business Number (ABN)	84 085 734 992
Registered business address	Manunda Place Level 3, 38 Cavenagh St Darwin NT 0800
Approval holder reference number	DITT-0001

Action: Rehabilitation of the former Rum Jungle mine site

Rehabilitate the former Rum Jungle mine site and associated satellite sites (Mt Fitch and Mt Burton) located 6 km north of Batchelor in the Northern Territory (NT) to address legacy site contamination issues:

- a construction phase followed by a monitoring and stabilisation phase
- clearing of up to 490.9 hectares (ha) of native vegetation including 4.5 ha sensitive or significant vegetation (4 ha riparian and 0.5 ha vine forest)
- excavation and relocation of ~6.1 million cubic metres (Mm³) mine waste material from existing sulfidic waste rock dumps and contaminated soil areas
- extraction and treatment of contaminated groundwater and pit lake water
- point source discharge of water to the East Branch of the Finniss River (EBFR)
- construction of two new waste storage facilities (WSF) to contain mine waste material that is potentially acid forming (PAF) and/or radioactive and/or contains asbestos
- backfilling and capping of Main Pit to contain ~ 1.5 Mm³ mine waste
- containment and disposal of waste generated by the water treatment plant
- potential realignment of the EBFR through Main Pit and Intermediate Pit
- rehabilitation and revegetation of disturbed land.

Advisory notes

- i. Approval is granted under section 69 of the *Environment Protection Act 2019* (EP Act) for the action to be undertaken in the manner described, including with implementation of the environmental management measures commitments and safeguards documented, in the Environmental Impact Statement (EIS) (comprising the Draft EIS, Supplement to the Draft EIS, and Additional Information submissions dated August 2019 and July 2022). If there is an inconsistency between the EIS and this environmental approval, the requirements of this environmental approval prevail.
- ii. This approval does not authorise the approval holder to undertake an activity that would otherwise be an offence under the *Water Act 1992*.
- iii. All statutory authorisations as required by law must be obtained and maintained as required for the action. No condition of this environmental approval removes any obligation to obtain, renew or comply with such statutory authorisations.

Draft Environmental Approval

- iv. Submission of all notices, reports, documents or other correspondence required by a condition of this approval must be provided in electronic form by emailing <u>environmentalregulation@nt.gov.au</u>
- v. The approval holder has a duty to notify the **CEO** of incidents in accordance with Part 9 Division 8 of the EP Act.

Address of action	Rum Jungle - Section 2968 Hundred of Goyder				
	Mount Burton - Section 998 Hundred of Goyder				
	Mount Fitch - NT Portion 3283				
	Borrow Area A - Section 2940 Hundred of Goyder				
	Borrow Area B - Section 2830 Hundred of Goyder				
NT EPA Assessment Report number	98				
Decision maker	NOT FOR SIGNING				
	Hon Lauren Jane Moss MLA,				
	Minister for Environment, Climate Change and Water Security				
Date of approval	NOT FOR APPROVAL				

Environmental conditions

1. Limitations and extent of action

1-1 When implementing the action, the approval holder must ensure the action does not exceed the extents shown in Table 1.

Table 1 Limitations and extent

Action element	Context	Limitation or maximum extent
Rum Jungle	Figure 2	No more than 276.5 ha in total to be cleared within the approved extent
Mt Burton	Figure 3	No more than 1.2 ha in total to be cleared within the approved extent
Mt Fitch	Figure 4	No more than 1.3 ha in total to be cleared within the approved extent
Borrow Area A	Figure 5	No more than 66.6 ha in total to be cleared within the approved extent
Borrow Area B	Figure 6	No more than 145.3 ha in total to be cleared within the approved extent
Total clearing	Figure 1	No more than 490.9 ha within the approved extent

2. Overarching objectives

- 2-1 The approval holder must implement the action to meet the following environmental objectives:
 - (1) Improve environmental conditions onsite to support long-term improvement in the downstream aquatic ecosystem condition; and
 - (2) Improve environmental conditions onsite to support future use of the land for traditional ceremony, culture and subsistence use of natural resources.

Culture and heritage

3. Cultural heritage outcomes

- 3-1 The approval holder shall implement the action to meet the following environmental outcomes:
 - (1) avoid where possible, and otherwise mitigate, further impacts on Aboriginal sacred sites within the **approved extent**;
 - (2) avoid, where possible, and otherwise mitigate, further impacts to Aboriginal archaeological places and objects within the **approved extent**;
 - (3) remediate **contamination** to aid in achieving improvements to cultural values associated with the **approved extent**.

4. Consultation with traditional owners

- 4-1 The approval holder must consult with, and have regard to the views of, traditional owners and the **NLC**:
 - (1) prior to the finalisation and implementation of the **RAP** required by condition 9-1;
 - (2) prior to the finalisation of the **site audit report** required by condition 13-1; and
 - (3) throughout implementation of the action.
- 4-2 If the **RAP** is prepared in stages, the consultation required by condition 4-1 must be undertaken for each stage.

5. Cultural Heritage Management Plan (CHMP)

- 5-1 The **RAP** that the approval holder is required to prepare under condition 9-1, must include a **CHMP** that has been prepared by a **suitably qualified and experienced person**, in consultation with traditional owners and the **NLC**, and must be endorsed by the **site auditor**.
- 5-2 If the **RAP** is prepared in stages, the consultation on the **CHMP** required by condition 5-1 must be undertaken for each stage.
- 5-3 The **CHMP** must include measures to provide for:
 - (1) protection of sacred sites within the **approved extent** and compliance with Authority Certificates issued to the approval holder under the *Northern Territory Aboriginal Sacred Sites Act* 1989;
 - (2) protection of known heritage places and objects within the **approved extent** and compliance with any statutory authorisations issued to the approval holder under the *Heritage Act 2011*;
 - (3) cultural heritage induction procedures for site personnel;
 - (4) an internal approval process prior to ground disturbing activities and use of visual barriers and signs where appropriate;
 - (5) further archaeological survey and assessment where required;
 - (6) procedures to mitigate risks to unidentified heritage places and objects;
 - stop work procedures to follow in the event suspected or actual unidentified human remains, or Aboriginal archaeological places or objects are encountered;
 - (8) measures for effective consultation and engagement with stakeholders, including traditional owners and the **NLC**; and
 - (9) detail of how compliance would be monitored and reported and how the outcomes of investigative and/or adaptive management actions would be notified to the relevant government authorities.
- 5-4 The approval holder must implement the **CHMP** for the **life of the action** with the objective of ensuring that the outcomes under condition 2-1 are achieved.
- 5-5 The approval holder may review and revise the **CHMP** in consultation with stakeholders, including traditional owners. If the CHMP is revised, the revised version must be provided to the **site auditor** for their written endorsement. Within 10 business days after obtaining written endorsement from the **site auditor** the endorsed version of the **CHMP** must be submitted to the **Minister**.

5-6 The approval holder shall implement, review and revise the **CHMP** as and when directed by the **site auditor** or the **Minister** by notice in writing, and in consultation with stakeholders.

6. Post-remediation land use

- 6-1 The approval holder must verify through the **site audit report** required by condition 13-1, whether any post-remediation land use restrictions would be required, including on traditional Aboriginal practices and land use such as hunting and gathering activities for native fauna and flora as bush foods within the proposal area and Zones 3, 4, 6 and 7 of the downstream aquatic ecosystem (Figure 7).
- 6-2 The **site audit report** must address potential impacts to human health with consideration of exposure to radiation and toxicants, informed by the advice of a **suitably qualified and experienced person** with demonstrated expertise in radiation protection.

Terrestrial environmental quality

7. Remediation works

- 7-1 To support achieving the outcomes under condition 2-1, **remediation works** must be carried out:
 - (1) in accordance with:
 - (a) the design specifications, criteria, requirements and quality assurance/quality control procedures detailed in the endorsed **remediation action plan (RAP)** required by condition 9-1;
 - (b) the National Environment Protection (Assessment of Site Contamination) Measure 1999 (**ASC NEPM**); and
 - (c) the relevant guidelines produced under the National Remediation Framework (**NRF**);
 - (2) to the satisfaction of the **site auditor** required by condition 8-1.

8. Site auditor

- 8-1 Prior to the commencement of **remediation works**, the approval holder must:
 - (1) appoint a **site auditor** to independently review and endorse:
 - (a) the **remediation action plan** required by condition 9-1; and
 - (b) the implementation and **validation** of the **remediation works** carried out under the **RAP**.
 - (2) The appointment of the **site auditor** required by condition 8-1 must be agreed to by the **Minister** in writing.

9. Remediation action plan

- 9-1 Prior to the commencement of **remediation works**, the approval holder must engage a **suitably qualified and experienced person** to prepare a **RAP** detailing the remediation objectives, work required to meet the remediation objectives, performance criteria for the remediation works, and corresponding contingency actions.
- 9-2 The **RAP** required by condition 9-1 must:

- (1) be informed by a health risk assessment and environmental risk assessment;
- (2) be prepared in accordance with the relevant guidelines produced or approved under the **ASC NEPM** and **NRF**; and
- (3) be reviewed and endorsed in writing by the **site auditor** appointed under condition 8-1
- (4) be revised to address any comments of the peer review required by condition 6, and approved by the site auditor.
- 9-3 The approval holder must implement the approved **RAP** (condition 9-1).
- 9-4 As part of the **RAP** required by condition 9-1 the approval holder must include the following:
 - (1) Cultural heritage management plan (see condition 5);
 - (2) Long-term environmental management plan (see condition 15);
 - (3) Erosion and sediment control plan (see condition 16);
 - (4) Revegetation management plan (see condition 17);
 - (5) Receiving environment monitoring program (see condition 20); and
 - (6) Water management plan (see condition 21).

10. Independent peer review of endorsed RAP

- 10-1 Prior to the commencement of **remediation works** the approval holder must appoint a **peer reviewer** to undertake an independent peer review of the site auditor endorsed **RAP.**
- 10-2 The appointment of the **peer reviewer** required by condition 10-1 must be agreed to by the **Minister** in writing.
- 10-3 The **peer reviewer** must provide written advice to the **approval holder** on whether the **site auditor** endorsed **RAP**:
 - (1) is suitable for the scope of remediation for the proposed action;
 - (2) is technically sound, based on appropriate data, and supported by the; conclusions of investigations and studies presented in the **EIS**; and
 - (3) is consistent with best practice standards in line with the **NRF**.
- 10-4 The written advice of the **peer reviewer** must be submitted to the **Minister** together with the approved **RAP** and details of how the **approval holder** has addressed any inadequacies or recommendations raised in the peer review.

11. Validation of remediation works

- 11-1 Prior to the commencement of **remediation works**, the approval holder must appoint a **suitably qualified and experienced person** to:
 - (1) document and validate the **remediation works** to demonstrate compliance with the **RAP**; and
 - (2) prepare the validation report required by condition 12-1

11-2 The **suitably qualified and experienced person** required by condition 11-1 must be certified under the **CEnvP(SC)** or **CPSS/CSAM** scheme, or be accredited under section 68 of the *Waste Management and Pollution Control Act 1998*.

12. Validation report

- 12-1 Following completion of **remediation works** the approval holder must submit a validation report to the **Minister.**
- 12-2 The validation report must:
 - (1) be prepared by the **suitably qualified and experienced person** required by condition 7 and endorsed by the **site auditor**;
 - (2) be prepared in accordance with the relevant guidelines produced or approved under the **ASC NEPM** and **NRF**;
 - (3) describe the remediation works, the validation carried out and the final condition of the site as informed by at least 12 months of post-construction monitoring data, collected in accordance with the REMP required by condition 20-2, and LTEMP required by condition 15-1;
 - (4) validate the **remediation works** against the remediation criteria set out in the **RAP**.

13. Site audit report

- 13-1 Within six months of submission of the **validation report** required by condition 12-1, or within a timeframe as otherwise agreed by the **Minister**, the approval holder must submit a **site audit report** to the **Minister**.
- 13-2 The **site audit report** must be prepared by the **site auditor** in accordance with the **ASC NEPM** and the relevant guidelines produced or approved under the **NRF** and must:
 - (1) summarise the information reviewed by the **site auditor** during the audit;
 - (2) include the **site auditor**'s written findings, evaluations and conclusions, including but not limited to:
 - (a) whether **remediation works** have been completed in accordance with the **RAP** and the risks to human health and the environment have been addressed in accordance with the objectives in the **RAP**;
 - (b) an evaluation of the suitability of the site for the intended future land uses, with or without recommended conditions on the use of the site; and
 - (c) an evaluation of the suitability of the **LTEMP** required by condition 15-1 to manage the **mine waste storages**.
- 13-3 The approval holder may progressively submit the **site audit report** required by condition 13-1 as series of reports for stages of the action, if the **remediation works** have been completed in accordance with the **RAP** for those stages of the action.
- 13-4 If the **site audit report** is submitted progressively as the **remediation works** for stages of the action are completed, the final **site audit report** is not required to cover those stages of the action for which site audit reports have already been submitted. However, the final **site audit report** must otherwise comply with the requirements under condition 13-2.
- 14. Certifying design and construction plans for mine waste storages

- 14-1 Prior to construction of the **mine waste storages**, the approval holder must:
 - (1) engage a **suitably qualified and experienced person** with demonstrated expertise in mine waste engineering, to prepare the design plans for the **mine waste storages** in accordance with an appropriate engineering standard and consistent with internationally accepted contemporary best practice guidance;
 - (2) obtain certification of the design plans for the **mine waste storages** from the **site auditor**; and
 - (3) submit the certified design plans for the **mine waste storages** to the **Minister**.
- 14-2 When the construction of the **mine waste storages** is complete, the environmental approval holder must:
 - (1) obtain written verification from the **suitably qualified and experienced person** required by condition 14-1, that the construction of the **mine waste storages** is in accordance with the certified design plans, and submit the written verification to the **site auditor**;
 - (2) obtain certification from the **site auditor** that the construction of the mine waste storages is in accordance with the certified design plans; and
 - (3) submit the construction certification to the **Minister**.
- 14-3 The **suitably qualified and experienced person** required by conditions 14-1 and 14-2, must be a professional engineer who is a member of Engineers Australia and has either a Chartered or National Engineering Register credential in civil, structural, and/or geotechnical engineering or holds equivalent professional qualifications and has the following:
 - (1) knowledge of engineering principles related to the structures, geomechanics, hydrology, hydraulics, chemistry and environmental impact of mine waste landforms; and
 - (2) at least a total of ten years of suitable experience and demonstrated expertise in the design, construction, operation and maintenance of mine waste landforms; geomechanics with particular emphasis on stability, geology and geochemistry; hydrology, sediment transport and deposition; erosion control; and hydrogeology with particular reference to seepage, groundwater, and solute transport processes and monitoring.

15. Long-term environmental management plan (LTEMP)

- 15-1 The **RAP** required by condition 9-1, must include an **LTEMP** for the **mine waste storages** detailing the long-term management objectives, work required to achieve the long-term objectives, monitoring and performance criteria, and corresponding contingency actions.
- 15-2 The **LTEMP** required by condition 15-1 must:
 - (a) be prepared by a **suitably qualified and experienced person** to the satisfaction of the **site auditor** required by condition 8-1;
 - (b) be prepared in accordance with the relevant guidelines produced or approved under the ASC NEPM and NRF
 - (c) include but not be limited to:
 - (i) identification of all relevant statutory and other obligations, including all approvals, licences, agreements and financial arrangements;

- (ii) details of ongoing management roles and responsibilities;
- (iii) details of all monitoring, inspections, environmental controls, requirements and measures to manage the ongoing integrity and performance of the **mine waste storages**;
- (iv) details of the contingency measures and responses to be implemented for any identified issues with the **mine waste storages**;
- (v) mechanisms for performance reporting and auditing in line with the relevant legislation and guidelines; and
- (vi) a program for ongoing review of the **LTEMP** to ensure it remains contemporary with relevant environmental standards.
- 15-3 Upon completion of the construction of the **mine waste storages**, the approval holder must:
 - (a) implement the approved **LTEMP**; and
 - (b) manage the **mine waste storages** in accordance with the approved **LTEMP.**

16. Erosion and sediment control

- 16-1 The **RAP** required by condition 9-1, must include an **ESCP** prepared by a suitably qualified and experienced **CPESC**, to the satisfaction of the **site auditor**;
- 16-2 The **ESCP** required by condition 16-1 must include measures to minimise erosion and the release of sediment to receiving waters and contamination of stormwater, and be implemented for all stages of the action;
- 16-3 The erosion and sediment control measures detailed in the **ESCP** required by condition 16-1 must be installed and maintained in accordance with the International Erosion Control Association Australasia (IECA) Best Practice Erosion and Sediment Control (BPESC) document;
- 16-4 The **ESCP** required by condition 16-1 must be revised annually by a suitably qualified and experienced **CPESC** prior to commencement of the **wet season** or at more frequent intervals if site conditions significantly change.

17. Revegetation

- 17-1 The **RAP** required by condition 9-1 must include a revegetation management plan that requires that the approval holder:
 - (1) revegetate land disturbed by the action where **exposed soil areas** would remain following completion of **remediation works**;
 - (2) revegetate land disturbed by the action to achieve a species composition, structure and diversity that is consistent with surrounding undisturbed vegetation;
 - (3) use suitable local native plant species in the revegetation, taking into account as practicable:
 - (a) predicted changes in climate;
 - (b) cultural significance;
 - (c) the potential effects of revegetation on the long-term stability of **mine waste storages**; and

- (4) implement **adaptive management** measures to ensure revegetation supports long-term landform stability and integrity.
- 17-2 Within 12 months after the completion of revegetation works, and within every 12 months thereafter for the **life of the action**, the approval holder must engage a **suitably qualified and experienced person** to:
 - (1) undertake an assessment of the performance of the revegetated areas against the revegetation performance criteria in the revegetation management plan;
 - (2) identify any measures that should be implemented to improve the performance of revegetation within **rehabilitation** areas; and
 - (3) if the revegetation completion criteria have not been met, or are not adequately trending towards being met, recommend additional measures to ensure that revegetation is sufficient to meet design criteria.
- 17-3 If the assessment by the **suitably qualified and experienced person** required by condition 17-2 recommends implementation of additional measures for revegetation, the approval holder must, within 6 months of completion of the assessment, implement the recommended measures, to the satisfaction of the **site auditor** required by condition 17-2.
- 17-4 The **suitably qualified and experienced person** required by condition 17-2 must have suitable regional experience and demonstrated expertise in mine site **revegetation** and **rehabilitation**.

Inland water environmental quality, Hydrological processes and Aquatic ecosystems

18. Environmental outcome

- 18-1 The approval holder must implement the action to meet the following environmental outcome:
 - (1) Over the long-term, improve the quality and hydrological regimes of groundwater and surface water to the maximum extent practicable to support the restoration of environmental values including ecological health, land uses and the welfare and amenity of people.

19. Discharge water quality

- 19-1 The approval holder must ensure that **point source discharge** from the action causes no decline in downstream **water quality** in the Finniss River during implementation of the action consistent with condition 18-1.
- 19-2 In meeting the requirements under condition 19-1, the approval holder must ensure that:
 - (1) **point source discharge** from the action to the **EBFR** does not exceed the **water quality** discharge requirements stated in **Table 2** at **end-of-pipe**;
 - (2) site-specific trigger values for discharge water quality are developed for pH, dissolved oxygen, turbidity and total dissolved solids (as required in Table 3), to the satisfaction of the Minister, and implemented prior to any discharge of water from the action to the EBFR;
 - (3) **point source discharge** from the action to the **EBFR** does not exceed the sitespecific guideline values stated in **Table 3** at **end-of-pipe**;

- (4) stream flow gauging stations are installed, operated and maintained to determine and record stream flows in each of the Zones 2, 3, 4, 6 and 7 (as shown in Figure 7) of the **EBFR** and Finniss River continuously (minimum daily recording frequency);
- (5) the rate of **point source discharge** to the EBFR is limited and controlled such that there is no decline in downstream **water quality** in Zones 6 and 7 (Figure 7) of the Finniss River;
- (6) the daily quantity of water discharged from each discharge point is measured and recorded; and
- (7) discharges to receiving waters are undertaken so as not to cause erosion of the bed and banks of the receiving waters, or cause a material build-up of sediment in such waters, in line with condition 16-4.

Activity	Species protection level (SPL)	Comment on SPL	Monitoring frequency	Monitoring Point	Receiving waters
Discharge of water during Main Pit backfill	≥ 70% (≥99% of the time)	Based on 99 th percentile of the rolling annual discharge water quality dataset	Commencement of discharge and thereafter	End-of-pipe	EBFR
Discharge of water following completion of Main Pit backfill	≥ 80% (≥90% of the time)	Based on 90 th percentile of the rolling annual discharge water quality dataset	weekly during discharge		

Table 2 Point source discharge water quality requirements at end-of-pipe

Table 3 Discharge water quality characteristic guideline values

SPL	EC	SO ₄	рН	DO	Turbid ity	TSS	AI	As	Se	Cd
%	μs/cm	mg /L	рН	% sat.	NTU	mg/L	µg/L	µg/L	μg/L	μg/L
70	2985	1192	TBC	TBC	TBC	TBC	236	140	2	4.3
80	2985	997	TBC	TBC	TBC	TBC	150	140	2	2.16
		1			1	1	1			
SPL	Cd	Cu	Co	Fe	Mg	Mn	Ni	Pb	Zn	U
SPL %	Cd µg/L	Cu µg/L	Co μg/L	Fe μg/L	Mg μg/L	Mn μg/L	Ni μg/L	Pb μg/L	Zn μg/L	U μg/L
SPL % 70	Cd μg/L 4.3	Cu μg/L 60.2	Co μg/L 89	Fe μg/L 300	Mg μg/L 86.6	Mn μg/L 759	Νi μg/L 130.4	Pb μg/L 12.9	Zn μg/L 210.5	U μg/L 31

NOTE:

1 - All metals and metalloids in this Table must be measured as total (unfiltered) and dissolved (filtered). Guideline values for metal/metalloids apply if dissolved results exceed value.

2 – Guideline values in this Table are adapted from the Compliance LDWQOs listed in Table 4-1 of Appendix 6 of the Main document - Second Request for Information Report (Compliance LDWQOs Hydrobiology Pty Ltd 2022), unless otherwise specified.

3 – SSTVs for dissolved oxygen (DO), turbidity and total suspended solids (TSS) must be provided by the approval holder prior to any discharge of water from the action to the EBFR as required by condition 15-2(2)

20. Receiving environment monitoring program (REMP)

- 20-1 The approval holder must monitor downstream **water quality** for the **life of the action** to identify changes in water quality and flow compared to the pre-construction aquatic ecosystem condition.
- 20-2 The **RAP** required by condition 9-1 must include a **REMP** which has been prepared by a **suitably qualified and experienced person.** The **REMP** must be implemented by the approval holder for the **life of the action** to monitor and record the effects of the discharge and seepage of contaminants from the action on the receiving environment, with the aims of identifying and describing the extent of any adverse impacts to local environmental values, and monitoring any changes in the downstream waters of the **EBFR** and the Finniss River.
- 20-3 A report outlining the findings of the **REMP**, including all monitoring results and interpretations for the period from 1 April to 31 March the following year (the reporting period), must be prepared by a **suitably qualified and experienced person** and submitted to the **site auditor** by 30 June each year;
- 20-4 The report required by condition 20-3 must include:
 - (1) an assessment of background water quality;
 - (2) any detected impact associated with contaminant **point source discharge**; and seepage from the action;
 - (3) an assessment of the suitability of contaminant **point source discharge** limits required by condition 19-2 to maintain or improve environmental values.
- 20-5 For the purpose of conditions 20 and 20-1, an improvement or decline in downstream **water quality** may be measured as a statistically significant change from preconstruction **water quality** and the level of species protection in each of the downstream zones (3,4,6 and 7) described in the Main Document of the Draft **EIS** (section 5.5.6)
- 20-6 The monitoring report required by condition 20-3 must include time series trend analysis of **water quality** data collected using appropriate monitoring techniques in the receiving environment, to determine the extent and duration of any improvement or decline in the ecosystem condition and whether the change is attributable to the action.

21. Water management plan

- 21-1 The **RAP** required by condition 9-1 must include a revised and updated version of the water management plan (Appendix 3 of the Draft **EIS** Water Management Plan Stage 3 Rum Jungle Rehabilitation Project version 4 dated 27 November 2019);
- 21-2 The approval holder must ensure that the water management plan required by condition 21-1 is revised and updated by a **suitably qualified and experienced person**, to the satisfaction of the **site auditor**;
- 21-3 The water management plan must provide for effective water management of actual and potential environmental impacts resulting from water management associated with the activities carried out under this environmental approval and must include at least the following components:

- (1) study of the source on contaminants
- (2) a water balance model for the site
- (3) a water management system for the site
- (4) measures to manage and prevent acid, metalliferous and/or saline drainage
- (5) contingency procedures for incidents and emergencies
- (6) a program for monitoring and review of the effectiveness of the water management plan.
- 21-4 The approved water management plan required by condition 21-1 must be revised, to the satisfaction of the **site auditor**, within every 12 months after the date of approval by the **site auditor** and implemented for the **life of the action**, or as otherwise agreed by the **site auditor**; and
- 21-5 The approval holder must continue to implement the last approved version of the water management plan required by condition 21-1 until the **site auditor** provides confirmation in writing that a revised version is approved.

22. Modelling impact on water resources

22-1 Unless otherwise specified in a water licence or permit issued under the Water Act 1992, the approval holder must undertake the following:

No later than 2 years after the commencement of **remediation works**, the proponent must review the adequacy of the groundwater and surface water modelling and update the groundwater and surface water models (Supplement to the draft EIS, Appendix 28 parts A and B; and Draft EIS Appendix Robertson GeoConsultants 2019 Groundwater and Surface Water Modelling Report, Rum Jungle Stage 2A Report 183008/1, November 2019) predicting changes in groundwater levels and surface water flow rates as a result of the action.

- (1) The updated model required by condition 22-1 must incorporate the results of the monitoring program required by condition 20.
- (2) The updated model required by condition 22-1 must be reviewed by a **suitably qualified and experienced person** to the satisfaction of the **site auditor**, to evaluate the appropriateness of the model used, evaluate the accuracy of the predicted changes in groundwater levels and surface water flow rates and recommend actions to ensure the accuracy of the model predictions.
- (3) No later than 2 years after the commencement of **remediation works**, a report on the model amendments and accuracy (including any recommendations) of the updated model must be submitted to the **site auditor**.
- (4) The groundwater and surface water models referred to in condition 22-1 must be updated at the following times:
 - (a) every five years from the commencement of remediation works; or
 - (b) at appropriate intervals specified by the **site auditor** in writing, when the observed water levels and surface water flow rates measured in accordance with condition 20 are not consistent with the groundwater levels and surface water flow rates predicted in the groundwater and surface water model.
- (5) Within three months of completion, a model update (required by condition and a report interpreting the results from the updated model must be submitted to the **site auditor**.

23. EBFR realignment

- 23-1 The realignment of any portion of **EBFR** flow through the backfilled Main Pit by the approval holder must not cause a decline in the downstream **water quality** in **Zone 6** and **Zone 7** of the Finniss River (Figure 7) at any time during the **life of the action**;
- 23-2 The approval holder must verify through the **site audit report** required by condition 13-1, that:
 - (1) the construction of the permanent **EBFR** diversion is consistent with the functional design/s that formed a part of the **EIS** for the action.
 - (1) the permanent **EBFR** diversion has been constructed to prevent the release of contaminants from backfilled mine waste to the receiving environment.

Community and economy

24. Community and economy outcomes

- 24-1 The approval holder shall implement the action to meet the following environmental outcomes:
 - (1) minimise negative impacts to potentially affected communities from the action; and
 - (2) maximise benefits for traditional owners, and local and regional communities and businesses.

25. Public reporting to the community

- 25-1 The approval holder must develop and maintain a website to communicate regularly with the community. On the website the approval holder must publicly report on the:
 - (1) actions to enhance local employment, training and development opportunities;
 - (2) actions to avoid, manage or mitigate action-related social impacts on local community services, infrastructure and community safety and wellbeing;
 - actions and adaptive management strategies to avoid, mitigate or manage action-related impacts on local and regional housing and accommodation markets;
 - (4) actions to inform the community and stakeholders, including traditional owners, about action-related impacts and show that community and stakeholder advice and concerns about action-related impacts have been taken into account when reaching decisions;
 - (5) actions to record, respond to, and manage community complaints; and
 - (6) results and outcomes of the monitoring and annual reporting required by the REMP under condition 20, including time series trend analysis of downstream water quality over time.

General conditions

26. Commencement of action

26-1 This approval expires five (5) years after the date on which it is granted, unless **substantial implementation** has commenced on or before that date.

26-2 Within 10 business days of **substantial implementation** of the action the approval holder must provide notification in writing to the **Minister**.

27. Completion of the action

27-1 The approval holder must provide notification in writing to the **Minister** within 10 business days of **completion of the action**.

28. Change of contact details

28-1 The approval holder must provide notification in writing to the **Minister** of any change of its name, physical address or postal address for the serving of notices or other correspondence within 10 business days of such change.

29. Plans, modelling and monitoring programs

- 29-1 All plans, modelling and monitoring programs required by the conditions of this approval must be certified by a **suitably qualified and experienced person**.
- 29-2 All plans and monitoring programs required under these conditions must be implemented.
- 29-3 All plans, modelling and monitoring programs required by the conditions of this approval must be provided to the **Minister** on request.
- 29-4 All plans, modelling and monitoring programs required by the conditions of this approval must be updated as and when requested by the **Minister**.

30. Staging, combining and updating plans or programs

- 30-1 With the approval of the **site auditor**, the approval holder may:
 - (1) prepare and submit any plan or program required by this approval on a staged basis (if a clear description is provided as to the specific stage and scope of the action to which the plan or program applies, the relationship of the stage to any future stages and the trigger for updating the plan or program);
 - (2) combine any plan or program required by this approval (if a clear relationship is demonstrated between the plans or programs that are proposed to be combined) and;
 - (3) update any plan or program required by this approval (to ensure the plans and programs required under this approval are updated on a regular basis and incorporate additional measures or amendments to improve the environmental performance of the action)
- 30-2 If approved by the **site auditor**, updated plans or programs supersede the previous versions of them and must be implemented in accordance with the conditions of this approval that require the plan or program.

31. Compliance reporting

- 31-1 The approval holder must:
 - (1) within six months of substantial disturbance, obtain from an **independent qualified person**, a report on compliance with the conditions of this environmental approval;

- (2) obtain further such reports at regular intervals not exceeding 12 months from the report referred to in condition 31-1(1), for the **life of the action**; and
- (3) submit each report required under condition 31-1(1) to the **Minister** within 90 days of its completion.
- 31-2 The reports required by conditions 31-1(1) and 31-1(2) must:
 - (1) be endorsed by the approval holder's Chief Executive Officer or a person delegated to sign on the approval holder's Chief Executive Officer's behalf;
 - (2) include a statement as to whether the approval holder has complied with the conditions of this approval; and
 - (3) identify all non-compliances and describe corrective and preventative actions taken.

32. Provision of environmental data

- 32-1 All environmental monitoring data, surveys, maps and other spatial and metadata (including sensitive data) required to be collected or obtained under this environmental approval must be retained by the approval holder for a period of not less than 50 years commencing from the date that the data is collected or obtained.
- 32-2 The approval holder must, as and when directed by the **Minister**, provide any validated environmental monitoring data (including sampling design, sampling methodologies, empirical data and derived information products), surveys, maps and other spatial and metadata (including sensitive data) relevant to the assessment of the action and implementation of this environmental approval, to the **Minister** in the form and manner, and at the intervals specified, in the direction. Culturally sensitive data held by the approval holder may be subject to access terms and conditions imposed by traditional owners which the approval holder is required to maintain.

Definitions

The terms used in this approval have the same meaning as the terms defined in the *Environment Protection Act* 2019 and Environment Protection Regulations 2020.

	Definition/full form
Term/acronym	
adaptive management	A systematic approach to improving environmental results and management practices during action implementation through the application of learning from monitoring of outcomes and management actions.
AMD	Acid and metalliferous drainage, including neutral and saline drainage
approved extent	The extent identified in Figures 1 to 5 and Table 1 of this approval which includes equipment, plant and structures, whether stationary or portable, and the land on which the action is situated.
ASC NEPM	National Environment Protection (Assessment of Site Contamination) Measure 1999.
CEnvP(SC)	A person who is certified under the Environment Institute of Australia and New Zealand's Certified Environmental Practitioner (Site Contamination) (CEnvP(SC)) scheme.
СНМР	Cultural heritage management plan
completion of the action	Completion of the stabilisation phase of the action.
construction phase	The first phase of the action, which is scheduled to be completed within a five-year period and includes earthworks, remediation works and water treatment.
contamination	A condition of land or water where any chemical substance or waste has been added as a direct or indirect result of human activity at above background level and represents, or potentially represents, an adverse health or environmental impact (ASC NEPM 1999).
CPESC	A person who is certified by EnviroCert International, Inc. as a Certified Professional in Erosion and Sediment Control (CPESC).
CPSS/CSAM	A person who is certified under the Soil Science Australia Certified Professional Soil Scientist / Contaminated Site Assessment and Management (CPSS/CSAM) scheme.
EBFR	East Branch of the Finniss River
EIS	Environmental Impact Statement (includes the Draft EIS , Supplement to the Draft EIS , and two additional information submissions).
end-of-pipe	The location at which water is discharged to waters or land in the receiving environment.
EP Act	Environment Protection Act 2019 (NT)

	Definition/full form		
Term/acronym			
ESCP	Erosion and sediment control plan		
exposed soil areas	All areas of the site where the vegetation (trees, shrubs, brush, grasses, etc.) or impervious surface has been removed, thus rendering the soil more prone to erosion.		
independent qualified person(s)	A qualified person (s) under the EP Act who is independent from the approval holder i.e.:		
	\circ was not involved in the preparation of the EIS ;		
	 is independent of the personnel involved in the design, construction and operation of the action; and 		
	 has obtained written approval from the CEO to be the a qualified person to satisfy the relevant requirements under this approval. 		
life of the action	The period of time from substantial implementation until the issue of a closure certificate under section 213 of the EP Act , or revocation of the environmental approval by the Minister at the request of the approval holder under section 114 of the EP Act .		
LTEMP	Long-Term Environmental Management Plan		
mine waste	Waste that includes, but is not limited to, waste rock, PAF material, tailings, radioactive material, asbestos-containing material, water treatment plant residues and filter cake associated with historical mining and proposed remediation and rehabilitation activities at Rum Jungle, Mt Burton and Mt Fitch.		
mine waste storages	Any structure, landform or residual void under this approval (including the east and west waste storage facilities and the backfilled Main Pit) that is designed and constructed to store mine waste as part of the remediation works .		
Minister	The Northern Territory Minister for Environment, Climate Change and Water Security.		
NLC	Northern Land Council.		
NRF	The National Remediation Framework (NRF) developed by Cooperative Research Centre for Contamination Assessment and Remediation of the Environment (CRC CARE 2019) to enable a nationally consistent approach to the remediation and management of contaminated sites. In November 2019, it was endorsed as best practice by all jurisdictions through the Heads of EPA (HEPA) forum.		
PAF	Potentially acid forming		
peer reviewer	A person(s) who is engaged by the proponent to provide an independent peer review of the site auditor endorsed RAP. The peer reviewer must:		

	Definition/full form		
Term/acronym			
	 be a qualified person(s) under the EP Act; 		
	• be accredited under section 68 of the Waste Management and Pollution Control Act 1998;		
	• be suitably qualified and experienced in mine site remediation and rehabilitation;		
	• be able to nominate an expert support team of specialised professionals on whom they would rely for site issues beyond their areas of expertise;		
	• demonstrate a sound ability and experience in forming and managing a multidisciplinary team for complex site assessment which contains the appropriate balance of expertise; and		
	• be independent from the approval holder i.e.:		
	\circ was not involved in the preparation of the EIS ;		
	 is independent of the personnel involved in the design, construction and operation of the action; and 		
	 has obtained written approval from the CEO to be the peer reviewer to satisfy the relevant requirements under this approval. 		
point source discharge(s)	A discharge or outflow of water from the action to a waterway, that comes from an identifiable location, such as a pipe, drain or spillway (does not include diffuse discharge which cannot be seen and is not easily attributed to a single source, or uncontrolled discharge)		
RAP	Remediation Action Plan.		
rehabilitation	The design and construction of landforms as well as the establishment of sustainable ecosystems or alternative vegetation, depending upon desired post-operational land use (Australian Government 2016).		
remediation	Remediation is taking steps towards remedying something, in particular of reversing or stopping environmental damage. It may be action designed to deliberately break the source-pathway-receptor linkage in order to reduce the risk to human health and/or the environment to an acceptable level (CRC CARE 2019)		
remediation works	Any works carried out under the approved RAP .		
sensitive or significant vegetation	As defined in the NT Planning Scheme and the NT Land Clearing guidelines		
site auditor(s)	A person(s) who is engaged by the proponent to:		
	• review and endorse all plans and reports required under the environmental approval		
	Definition/full form		
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Term/acronym			
	• review the investigation, remediation and validation undertaken during remediation works		
	• provide independent expert opinion regarding any potential impacts to human health and/or the environment relating to site contamination , and the suitability of land for its intended use (ASC NEPM sch. 9).		
	The site auditor(s) must:		
	• be a qualified person(s) under the EP Act ;		
	• be accredited under section 68 of the Waste Management and Pollution Control Act 1998;		
	• be suitably qualified and experienced in mine site remediation and rehabilitation ;		
	• be able to nominate an expert support team of specialised professionals on whom they would rely for site issues beyond their areas of expertise;		
	• demonstrate a sound ability and experience in forming and managing a multidisciplinary team for complex site assessment which contains the appropriate balance of expertise; and		
	• be independent from the approval holder i.e.:		
	\circ was not involved in the preparation of the EIS ;		
	 is independent of the personnel involved in the design, construction and operation of the action; and 		
	 has obtained written approval from the CEO to be the site auditor(s) to satisfy the relevant requirements under this approval. 		
stabilisation phase	The second phase of stage 3 of the Rum Jungle rehabilitation framework. It follows the construction phase , is anticipated to take five years to complete and includes intensive monitoring and maintenance.		
substantial implementation	The commencement of any ground disturbing activity undertaken to carry out the action.		
suitably qualified and experienced person(s)	 A person(s) who: has professional qualifications, training, skills and experience related to the nominated subject matter and can give authoritative assessment, advice and analysis on performance relative to the subject matter using the relevant protocols, standards, and methods. is engaged by the approval holder to prepare and implement plans, programs and/or reports required under this environmental approval is able to nominate an expert support team of specialised professionals on whom they would rely for site issues beyond their ences of expertises and 		

	Definition/full form		
Term/acronym			
	• demonstrates a sound ability and experience in forming and managing a multidisciplinary team for complex site assessment which contains the appropriate balance of expertise.		
validation	A process aimed at confirming that remediation objectives and targets in the RAP have been met (CRC CARE 2019).		
water quality	The physical, chemical and biological characteristics of water and the measure of its condition relative to the requirements for one or more biotic species and/or to any human need or purpose.		
wet season	The period from 1 October to 30 April in any calendar year.		
WSF	Waste storage facilities		
Zone 6	Zone 6 of the Finniss River as shown in Figure 7 and described in Appendix 5 to the Rehabilitation of the former Rum Jungle Mine - Supplement to the Draft EIS (Aquatic Ecosystem Survey, Early and Late Dry Season 2015. Prepared for the Department of Mines and Energy, Northern Territory Government) (Hydrobiology 2016b).		
Zone 7	Zone 7 of the Finniss River as shown in Figure 7 and described in Appendix 5 to the Rehabilitation of the former Rum Jungle Mine - Supplement to the Draft EIS (Aquatic Ecosystem Survey, Early and Late Dry Season 2015. Prepared for the Department of Mines and Energy, Northern Territory Government) (Hydrobiology 2016b).		

Location and approved extent of action

Spatial data depicting information provided in Table 1 and Figures 1 to 5 are held by the Department of Environment, Parks and Water Security within file NTEPA2016/0097-110: Spatial files (final) – Rum Jungle rehabilitation - DITT.

All coordinates are provided in the Universal Transverse Mercator map projection, Map Grid of Australia Zone 52 (MGA Zone 52) and datum Geocentric Datum of Australia 1994 (GDA94).

Approved extents are shown in Figures 2 to 6.



Figure 1 Regional context - Location of rehabilitation activities and haul roads.



Figure 2 Approved extent Rum Jungle – major disturbance (red) and haul roads (blue).



Figure 3 Approved extent Mt Burton - major disturbance (red).



Figure 4 Approved extent Mt Fitch - major disturbance (red) and haul road



Figure 5 Approved extent Borrow Area A - major disturbance (red).



Figure 6 Approved extent Borrow Area B - major disturbance (red) and haul road (blue).



Figure 7 Finniss River zones and monitoring sites

Appendix 2 -	- Matters	taken into	account	during	the	assessment
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Matters taken into account	NT EPA's consideration		
Object of Environmental Assessment Act 1982 (EA Act)			
 4 Subject to section 6, the object of this Act is to ensure, to the greatest extent practicable, that each matter affecting the environment which is, in the opinion of the NT EPA, a matter which could reasonably be considered to be capable of having a significant effect on the environment, is fully examined and taken into account in, and in relation to: (a) the formulation of proposals; (b) the carrying out of works and other projects; (c) the negotiation, operation and enforcement of agreements and arrangements (including agreements (including agreements and arrangements (including agreements (including agreements (including agreements (including agreements and arrangements (including agreements (including agreements and arrangements (including agreements (including agreements	The NT EPA's assessment of the proposal has considered the object of the EA Act. The proposal is to rehabilitate the site to address legacy contamination from the former mine. Following rehabilitation, the proponent wishes to ensure the land is made suitable for an appropriate future land use. If the land is not rehabilitated, there would be continued risk to the environment by potential leaching of contaminants and the site could not be used in the future. The NT EPA has taken into account the information provided by the proponent in the Environmental Impact Statement (EIS), which consists of the draft EIS, Supplement to the draft EIS, and additional information provided in relation to the draft EIS. Conditions have been recommended to manage the potential significant environmental impacts from the proposal. The NT EPA has also provided advice to the NT Minister for Environment, Climate Change and Water Security about the environmental acceptability of the proposal, for consideration in deciding whether to grant an environmental approval.		
Objects of the Environment Protection Act 2019 (EP Act)			
3(a) to protect the environment of the Territory.	The proposal would protect the environment of the Northern Territory, by remediating existing sources of contamination and preventing future contaminant sources to develop and to contaminate soil, surface water and groundwater and downstream environments such as the Finniss River. Rehabilitation works would enable the site to be used for a future land use.		
3(b) to promote ecologically sustainable development so that the wellbeing of the people of the Territory is	The NT EPA considers the proposal integrates the relevant environmental considerations and seeks to avoid potentially serious or irreversible environmental		

Matters taken into account	NT EPA's consideration
maintained or improved without adverse impact on the environment of the Territory.	damage. The NT EPA is satisfied the development can be carried out in a manner consistent with the principles of ecologically sustainable development (ESD) (refer below for further detail on how individual ESD principles have been taken into account by the proponent). The NT EPA considers the proposed rehabilitation would promote and facilitate future ecological sustainable development in the region.
3(c) to recognise the role of environmental impact assessment and environmental approval in promoting the protection and management of the environment of the Territory.	The NT EPA has assessed the proposal in accordance with the requirements of the EA Act and the relevant transitional provisions of the EP Act. The proponent has recognised the role of environmental impact assessment and the requirement to plan, design and implement the proposal in a manner that promotes the protection of the environment. The NT EPA's assessment concludes that with the imposition of conditions of approval and implementation of all recommended mitigation measures, any potentially significant environmental impacts would be adequately mitigated and managed.
3(d) to provide for broad community involvement during the process of environmental impact assessment and environmental approval.	The EIS was made available for public, and Australian and Northern Territory government authority consultation in accordance with the EA Act to facilitate community involvement and participation in the environmental impact assessment of the proposal. To provide for broad community involvement during the process of environmental impact assessment, the proponent also undertook its own broad community and stakeholder consultation to inform the proposal including to evaluate environmental values downstream of the proposal. The NT EPA has given due consideration to public submissions and the technical expertise and comments provided by government authorities in its assessment of the proposal.
3(e) to recognise the role that Aboriginal people have as stewards of their country as conferred under their traditions and recognised in law, and the importance of participation by Aboriginal people and communities in environmental decision-making processes.	The proposal would make the site suitable for future land use and would facilitate a potential future grant of the site to its traditional owners, the Kungarakan and Warai people, who have been extensively engaged and consulted with by the proponent. The NT EPA consulted with representatives of the Kungarakan and Warai people during a site visit and throughout the environmental impact assessment process through the public consultation process. The NT EPA's assessment concludes that compliance with the recommended conditions of approval and implementation of the

Matters taken into account	NT EPA's consideration
	proposed mitigation measures, would ensure that any potential significant impacts on Aboriginal cultural heritage values would be adequately managed.
Principles of ecologically sustainable development	
Decision-making principle (1) Decision-making processes should effectively integrate both long-term and short-term environmental and equitable considerations. (2) Decision-making processes should provide for community involvement in relation to decisions and actions that affect the community.	The NT EPA has considered the decision-making principle in its assessment and has had particular regard to this principle in its assessment of terrestrial environmental quality and inland water environmental quality. It also notes the interconnectedness between environmental factors and recognises that the mitigation measures to avoid and minimise impacts on terrestrial environmental quality is likely to reduce the significance of impacts on other factors inland water environmental quality. The NT EPA has recommended conditions for environment protection outcomes to be achieved during proposal implementation and in the long-term. The NT EPA considers that its environmental impact assessment and recommended conditions for an environmental approval have identified and mitigated both short-term and long-term environmental impacts, and that this has not resulted in any compromise between short-term and long-term environmental impact assessment process during the NT EPA's public consultation on the proposal. The community, including traditional owners, have maintained involvement with decision-making process through proponent-led engagement. All submissions received have been taken into account in the preparation of this report and the recommended conditions to inform the Minister's decision on environmental approval.
 Precautionary principle (1) If there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. (2) Decision-making should be guided by: 	The NT EPA has considered the precautionary principle in its assessment and has had particular regard to this principle in its assessment of the key issues including the rehabilitation approach of a contaminated former mine site, long-term management of the waste storage facilities and potential radiation impacts on human health. The NT EPA notes that the proposal would aim to improve the condition of the proposal area, contain existing and prevent the development of future sources of contamination. All these measures would lead to an improvement of the downstream

Matters taken into account	NT EPA's consideration
(a) a careful evaluation to avoid serious or irreversible damage to the environment wherever	receiving environments over time, which would otherwise continue to degrade through the ongoing contamination
practicable; and (b) an assessment of the risk-weighted consequences of various options.	Although the proposal has been designed to prevent further environmental damage and degradation and restore environmental quality, there is potential for the proposal to cause environmental harm given that it involves the excavation, movement and placement of large volumes of AMD-affected mine waste and radioactive material which could further contaminate the downstream receiving environment.
	The NT EPA notes that some uncertainty remains regarding the proposal's residual impacts and risks during remediation and in the long-term. The NT EPA has recommended conditions to ensure residual risk is accounted for in the remediation approach, and that the approval holder adheres to the National Remediation Framework (NRF) and the National Environment Protection (Assessment of Site Contamination) Measure (ASC NEPM) so that environmental values are protected, and the proposal provides a net community benefit. The NT EPA also notes that, in line with the Precautionary principle, lack of full scientific certainty is not a valid reason for postponing measures to prevent environmental degradation. The NT EPA considers that it has sufficient certainty that the proposal would improve environmental conditions on and downstream of the site and would be environmentally acceptable and meet the objects of the EA Act and the EP Act.
	The NT EPA notes that the proposal footprint was optimised through an iterative process to allow for design flexibility where environmental constraints were identified. The proposal layout was adjusted a number of times to avoid environmental values and sensitivities as far as practicable. Additional precautionary avoidance and mitigation measures to avoid potential serious or irreversible damage to the environment included:
	 Locating the proposal footprint to avoid areas of culturally important vegetation
	Adjustment of the footprint to avoid heritage places and objects
	 Incorporating cultural values and needs of traditional owners into the proposal design

Matters taken into account	NT EPA's consideration
	Relocation of existing mine waste landforms into new waste storage facilities to encapsulate contaminants
	• Ongoing consultation with traditional owners about the design and layout of the proposal to ensure that it is culturally appropriate and acceptable
	• Undertaking extensive technical studies and investigations to improve certainty about the nature, type, intensity, magnitude and extent of potential significant impacts that could arise from remediation of contamination during proposal implementation and in the long-term.
Principle of evidence-based decision-making Decisions should be based on the best available evidence in the circumstances that is relevant and reliable.	The NT EPA has considered the available evidence during the course of its assessment of the proposal, and that scientific and other evidence provided the foundation for its advice, decision-making and recommended conditions. The evidence made available to the NT EPA during the environmental impact assessment process was adequate to inform the recommendation to the Minister about the environmental acceptability of the proposal.
	Where the NT EPA considered that further evidence would be required to inform the management of potentially significant environmental impacts, the NT EPA recommended conditions requiring the proponent to demonstrate how impacts would be effectively avoided or mitigated.
Principle of intergenerational and intragenerational equity The present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of present and future generations.	The NT EPA acknowledges the importance of restoring or enhancing the ecological values of the proposal area and the downstream Finniss River for the benefit of future generations. It considers that the recommended conditions for an environmental approval would provide an appropriate degree of protection for these values and not constrain the ability of future generations to continue to access land and water resources for a range of beneficial uses, including cultural uses.
	downstream would enhance future use of the site for future generations.
	The NT EPA has considered the principle of intergenerational equity and intragenerational equity in its assessment. From the assessment of this proposal the NT EPA has concluded that the environmental values will be protected and that the

Matters taken into account	NT EPA's consideration
	health, diversity and productivity of the environment will be maintained for the benefit of future generations.
Principle of sustainable use Natural resources should be used in a manner that is sustainable, prudent, rational, wise and appropriate.	The NT EPA acknowledges the importance of sustainable use of resources and has considered this principle during the environmental impact assessment process. It considers that this principle is closely linked in this proposal to the principles of intergenerational and intragenerational equity, and conservation of biological diversity and ecological integrity.
Principle of conservation of biological diversity and ecological integrity Biological diversity and ecological integrity should be conserved and maintained.	This principle was considered by the NT EPA when assessing the impacts of the proposal on the receiving environments. In considering this principle, the NT EPA notes that terrestrial and aquatic ecosystems, would potentially be significantly impacted by the proposal if appropriate measures were not implemented to avoid and mitigate impacts. Biological diversity and ecological integrity would likely be improved through remediation of contamination and radiation due to the proposed rehabilitation approach and long-term management. The NT EPA has recommended conditions to manage potential significant impacts on biological diversity and ecosystems, to ensure that environment protection outcomes are achieved.
	The NT EPA's assessment of the proposal concluded that the proposal is unlikely to cause further significant impacts on biological diversity or ecological integrity of the proposal area and downstream receiving environment, if carried out in accordance with the NT EPA's recommended conditions and the proposed management commitments. The proposal would likely improve biological diversity and ecological integrity compared to the current condition.
Principle of improved valuation, pricing and incentive mechanisms (1) Environmental factors should be included in the valuation of assets and services.	In considering this principle, the NT EPA notes that the proponent will bear the costs relating to implementing the proposal to achieve environmental outcomes, and management and monitoring of environmental impacts during proposal implementation. The NT EPA notes that the proponent would undertake remediation of legacy mine waste in line with the NRF and the ASC NEPM, which assesses and remediates contamination.

Matters taken into account	NT EPA's consideration
 (2) Persons who generate pollution and waste should bear the cost of containment, avoidance and abatement. (3) Users of goods and services should pay prices based on the full life cycle costs of providing the goods and services, including costs relating to the use of natural resources and the ultimate disposal of wastes. (4) Established environmental goals should be pursued in the most cost-effective way by establishing incentive structures, including market mechanisms, which enable persons best placed to maximise benefits or minimise costs to develop solutions and responses to environmental problems. 	The proponent has noted that it has and would continue to evaluate opportunities to reduce impacts to land, reduce waste and improve efficiencies in water and energy. The proponent would be responsible for bearing the costs of implementing measures to minimise emissions and discharges, remediate contamination and monitor the integrity of the waste storage facilities in the long-term.
Environmental decision-making hierarchy	
 (1) In making decisions in relation to actions that affect the environment, decision-makers, proponents and approval holders must apply the following hierarchy of approaches in order of priority: (a) ensure that actions are designed to avoid adverse impacts on the environment; (b) identify management options to mitigate adverse impacts on the environment to the greatest extent practicable; (c) if appropriate, provide for environmental offsets in accordance with this Act for residual adverse impacts on the environment to adverse impacts on the environment that cannot be avoided or mitigated. 	In its assessment of the proposal, the NT EPA considered the extent to which the proponent has applied the environmental decision-making hierarchy in its design of the proposal and the proposed measures to avoid and then mitigate potential significant impacts. The NT EPA is satisfied that this hierarchy has been applied appropriately to avoid and/or mitigate impacts and has recommended conditions to support the proponent's commitments. The NT EPA did not identify any residual impacts that would require offsetting.
(2) In making decisions in relation to actions that affect the environment, decision-makers, proponents and	The proposal is located in an area where ecosystem values have sustained serious environmental damage arising from contamination from historic mining activities. The

Matters taken into account	NT EPA's consideration
approval holders must ensure that the potential for actions to enhance or restore environmental quality is identified and provided for to the extent practicable.	proposed action is a rehabilitation project, which aims to restore environmental quality of the site and downstream receiving environment as practicable. However, the NT EPA acknowledges that any improvement in receiving environment quality may not be evident for a number of years following remediation and rehabilitation works. The NT EPA has recommended conditions requiring remediation of the site in line with the ASC NEPM and NRF to ensure that environmental quality is restored or enhanced to meet the NT EPA's objectives.
Waste management hierarchy	
 (1) In designing, implementing and managing an action, all reasonable and practicable measures should be taken to minimise the generation of waste and its discharge into the environment. (2) For subsection (1), waste should be managed in accordance with the following hierarchy of approaches in order of priority: (a) avoidance of the production of waste; (b) minimisation of the production of waste; (c) re-use of waste; (d) recycling of waste; (e) recovery of energy and other resources from waste; (f) treatment of waste to reduce potentially adverse impacts; (g) disposal of waste in an environmentally sound manner. 	The NT EPA has considered the waste management hierarchy in its assessment and has had particular regard to this principle in its assessment of terrestrial environmental quality and inland water environmental quality. The NT EPA is satisfied that the benefits of the proposal outweigh the potential impacts and considered that implementation of the proponent's commitments would ensure that the waste management hierarchy is adhered to. Treatment of AMD- affected water and encapsulation of potentially acid forming waste rock to reduce potentially adverse environmental impacts is a key objective of the proposal. The NT EPA recommends conditions for the disposal of potential wastes from the water treatment plant to ensure their environmentally sound disposal.
Ecosystem-based management	

Matters taken into account	NT EPA's consideration		
Management that recognises all interactions in an ecosystem, including ecological and human interactions.	The NT EPA acknowledges the importance of ecosystem-based management for achieving both sustainable development and biodiversity protection goals. With consideration of the links between inland waters (surface water and groundwater inputs), aquatic ecosystems, terrestrial ecosystems, communities and economy, the NT EPA also considered the connections and interactions between parts of the environment to inform a holistic view of impacts to the whole environment. The NT EPA formed the view that the impacts from this proposal can be managed to be consistent with the NT EPA's environmental factors and objectives.		
The impacts of a changing climate			
The effects of a changing climate on the proposal and resilience of the proposal to a changing climate	The NT EPA considered the life of the proposal in the context of resilience to climate change, and how climate change may impact the proposal.		
	The NT EPA had regard to measures and controls relating to extreme weather events such as flooding and high intensity rain events. A Climate Change Assessment provided by the proponent included long-term modelling of the site components and hydrology and identified some minor design changes to be implemented to accommodate higher flow rates, including enhanced erosion protection and channel widening. The NT EPA considered that specific conditions did not need to be recommended to address this requirement. The NT EPA considered that conditions set for erosion and sediment control addressed the effects of a changing climate. The NT EPA made conditions for climate change to be considered in the revegetation, i.e. in the selection of plant species and seed sourcing, to ensure revegetation would be able to adapt to the greatest extent possible to a changing climate. Conditions for long-term management and adaptive management would further mitigate potential impacts of a changing climate. The NT EPA had regard to this matter during its accommended to the proposal		

Appendix 3 – Environmental impact assessment timeline

Date	Chronology	
30-06-2016	Notice of intent information accepted	
01-07-2016 to 25-07-2016	NT Government authority submission period	
04-08-2016	Australian Government decision -Controlled Action under the Environment Protection and Biodiversity Conservation Act 1999	
30-08-2016	Decision on accepted notice of intent and statement of reasons published	
15-02-2017	Draft terms of reference released for public consultation (16 days)	
03-03-2017	Draft terms of reference submission period closed	
17-03-2017	Approved terms of reference issued to proponent	
23-09-2019	Notification of variation received	
16-01-2020	Draft EIS received	
17-01-2020	Draft EIS accepted	
25-01-2020	Draft EIS released for public comment (6 weeks)	
06-03-2020	Draft EIS public comment period closed	
13-05-2020	NT EPA direction to prepare supplement to the draft EIS issued	
18-06-2020	Supplement to the draft EIS received	
09-07-2020	Additional information requested	
24-08-2021	Response to additional information request received	
22-09-2021	Additional information requested	
18-07-2022	Response to additional information request received	
13-02-2023	NT EPA's assessment report and draft environmental approval provided to Minister	
30 business days after receiving the NT EPA's advice	Minister's decision on environmental approval due (if Minister does not make a decision within 30 business days after receiving the NT EPA's advice the Minister is taken to have accepted the NT EPA's recommendation for approval).	

Appendix 4 – Rehabilitation stages

This proposal is the third stage of the five stage Rum Jungle Rehabilitation Project (Table 16).

Stage	Timing	Description
1	2009-2013	Consultation with traditional owners Kungarakan and Warai and other stakeholders; development of knowledge base, preliminary investigations and conceptual rehabilitation plan; endorsement of plan by Australian Government Minister for Resources, Energy and Tourism in June 2013
2	2013-2016	Traditional Owner consultation, detailed engineering designs and associated cost frameworks
2A	2017-2020	Supplementary stage to improve Traditional Owner consultation, further investigations to refine the methods and fill knowledge gaps, optimise engineering designs and associated cost frameworks, and undertake Environmental Impact Statement
2B	2022	Supplementary stage to continue Traditional Owner traineeships, undertake site safety works, engage with traditional owners to identify future business and employment opportunities and to build the project management framework for delivery of stage 3.
3 (this proposal)	10 years	 Implementation of rehabilitation design and plan in two phases: a five year construction phase a five year post-construction stabilisation phase, including intensive monitoring and maintenance
4	20 years	Short-term post-rehabilitation monitoring and maintenance work
5	>20 years	Long-term post-rehabilitation monitoring and maintenance work

Table 16 Stages of the proposal

Appendix 5 – Investigations and surveys

Investigation and surveys undertaken for each component of the Environmental Impact Statement are available on the NT EPA website at the links below:

- Additional Information (2) 18 July 2022: <u>https://ntepa.nt.gov.au/your-business/public-registers/environmental-impact-assessments-register/assessments-in-progress-register/rum-jungle-former-mine-site/additional-information-2-18-july-2022</u>
- Additional Information (1) 9 August 2021: <u>https://ntepa.nt.gov.au/your-business/public-registers/environmental-impact-assessments-register/assessments-in-progress-register/rum-jungle-former-mine-site/additional-information-1-9-august-2021</u>
- Supplement to Environmental Impact Statement: <u>https://ntepa.nt.gov.au/your-business/public-registers/environmental-impact-assessments-register/assessments-in-progress-register/rum-jungle-former-mine-site/supplement-to-environmental-impact-statement</u>
- Draft Environmental Impact Statement: <u>https://ntepa.nt.gov.au/your-business/public-registers/environmental-impact-assessments-register/assessments-in-progress-register/rum-jungle-former-mine-site/draft-environmental-impact-statement.</u>