

Environmental Monitoring Plan

Rum Jungle Stage 3 Rehabilitation Works

RJ3-4-P-018

Document title	Environmental Monitoring Plan
Contact details	Department of Industry Tourism and Trade
Approved by	NA - Draft Prepared for CEMP submission
Date approved	NA - Draft Prepared for CEMP submission
Document review	On environmental approval if granted
RJM Doc number	RJ3-4-P-018
TRM number	NA

Version	Date	Author	Reviewed By	Changes made
0.1	03 June 2020	Jackie Hartnett	Megan Bailey, Glen Ewers, Ross Smith, Andy Markham, Scott Downs.	Draft Framework
0.2	10 June 2020	Jackie Hartnett	Glen Ewers	Draft for Supplementary Submission
0.3	20 January 2022	Jackie Hartnett		Draft for CEMP Submission
0.4	17 June 2022	Anna Wilkins		SW sample sites and additional erosion monitoring added

Acronyms	Full form
DEPaWS	Department of Environment Parks and Water Security
DITT	Department of Industry Tourism and Trade (formerly Department of Primary Industry and Resources)
EBFR	East Branch Finniss River
EIS	Environmental Impact Statement (DPIR, 2020)
FR	Finniss River
LDWQOs	Locally Derived Water Quality Objectives (as established by Hydrobiology).
LFA	Landscape Functional Analysis
mS/yr	milli Sieverts per year
NT	Northern Territory.
TO	The Traditional Owners of the Rum Jungle site - the Warai and Kungarakan peoples.
WRD	Waste Rock Dump (existing)
WSF	Waste Storage Facility (proposed)
WTP	Water Treatment Plant

Contents

1. Project Overview	5
1.1. Introduction.....	5
1.1.1. Conditional Status	6
1.2. Purpose	6
2. Construction Monitoring Plan	7
2.1. Objectives.....	7
2.2. Construction Monitoring Locations and Trigger Action Response Plan.....	7
2.2.1. Bush Foods	15
2.2.2. Weeds	15
2.3. Adaptive Management Strategy	15
3. Stabilisation Monitoring Plan	16
3.1. Objectives	16
3.2. Monitoring Locations and Trigger Action Response Plan.....	16
3.2.1. Radiation.....	21
3.2.2. Weeds	21
3.2.3. Revegetation.....	21
3.2.4. Restoration of flow EBFR	21
3.2.5. Riparian and Aquatic Flora and Fauna Survey	22
3.2.6. Contaminated Sites Auditor	22
3.3. Adaptive Management Strategy	22
4. Rehabilitation Success Monitoring Plan	23
4.1. Objectives.....	23
4.2. Rehabilitation Success Monitoring Locations and Trigger Action Response Plan.....	23
4.2.1. Radiation.....	25
4.2.2. Landform Stability	25
4.2.3. Weeds	25
4.2.4. Riparian and Aquatic Flora and Fauna Survey	25
4.3. Adaptive Management Strategy	25
5. Reporting	26
6. Relationship to Management Plans	26
7. Role of the Contaminated Sites Auditor	26
8. Data Capture	27
9. Review	27

1. Project Overview

1.1. Introduction

Since 2009, the NTG and the Australian Government have been working under a National Partnership arrangement to complete investigative work to inform a rehabilitation plan, deliver site maintenance and continue environmental monitoring of the former Rum Jungle mine. The results of these programs have been used to develop an improved rehabilitation strategy that is consistent with the views and interests of traditional Aboriginal owners and that meets contemporary environmental and mined land rehabilitation standards. The Project's high-level objectives are two-fold and focus on environmental remediation and restoration of cultural values of the site as described below:

- Improve the environmental condition onsite and downstream of site within the East Branch Finniss River (EBFR). This includes the following key outcomes:
 - Improved surface water quality conditions within EBFR in accordance with locally derived water quality objectives (LDWQOs).
 - Achieve chemically and physically stable landforms.
 - Support self-sustaining vegetation systems within rehabilitated landforms.
 - Develop physical environmental conditions supportive of the proposed Land Use Plan.
- Improve site environmental conditions to support future land use, including cultural values. This includes the following key outcomes:
 - Restoration of the flow of the EBFR to original course as far as possible.
 - Remove culturally insensitive landforms from adjacent to sacred sites and relocate ensuring a culturally safe distance from the sacred sites.
 - Return living systems including endemic species to the remaining landforms.
 - Preserve Aboriginal cultural heritage artefacts and places.
 - Isolate sources of pollution including radiological hazards.
 - Maximise opportunities for Traditional Owners to work onsite to aid reconnection to country.

It is envisaged that the achievement of these objectives may support the potential future Land Management and Use Plan (detailed within the draft Environmental Impact Statement – DPIR 2020).

The high-level delivery schedule for the rehabilitation program is shown here in Figure 1-1:

SCOPE OF WORK	PRE-CONSTRUCTION STAGE 2B	ENVIRONMENTAL IMPACT STATEMENT SCOPE OF WORK - STAGE 3											MONITORING AND MANAGEMENT - STAGE 4	HAND TO FRALT
	Yr. 1-3	Site Establishment	Yr.1	Yr.2	Yr.3	Yr.4	Yr.5	Yr.6	Yr.7	Yr.8	Yr.9	Yr. 10	Yr. 1-20	Yr. 1
Pre-Construction - STAGE 2B														
Revegetation - Existing Landforms														
Land Management (fire and weeds)														
CONSTRUCTION														
Site Establishment														
Earthworks														
Water Treatment - Surface Waters														
Water Treatment - Groundwater														
Revegetation - New Landforms														
Monitoring - Construction														
Land Management (fire and weeds)														
STABILISATION AND MONITORING														
Revegetation - Infill														
Monitoring - Post Construction														
Landform Maintenance														
Land Management (fire and weeds)														
MONITOR AND PROVE CLOSURE CRITERIA														
HAND TO FINNISS RIVER ALT														

Figure 1-1 High Level Project Delivery Schedule (DPIR Draft EIS, 2020)

1.1.1. Conditional Status

It is important to note that Stage 3 environmental approval has not been secured therefore this Plan will remain as a draft until such time as the Stage 3 Rehabilitation works plan is approved and funded by both the NT and Australian Governments. Additionally, this plan is to be reviewed at such time that Stage 4 Monitoring and Management works are funded and approved should this eventuate.

1.2. Purpose

This Plan is a sub plan of the Construction Environmental Management Plan (RJ3-3-MP-003). The purpose of this document is to provide an overview of the Monitoring Plan for the future Rum Jungle Rehabilitation works should funding and project approval be achieved. The works package for the Rum Jungle Rehabilitation Plan has been divided into three phases for the purpose of monitoring plan development and these phases are directly related to the Figure 1 schedule:

- **Construction (Stage 3)** – this refers to the construction phase of the project whereby bulk earthworks and pit backfilling are taking place.
- **Stabilisation (Stage 3)** – this refers to the stabilisation and intensive monitoring phase of the project whereby the site’s engineering erosion controls are progressively taken over by vegetation development in landform stabilisation. This is also the phase where the groundwater abstraction and remediation continues until such time as the water treatment plant is decommissioned.
- **Rehabilitation Success (Stage 4)** – this refers to the final longer term phase whereby trends are established to determine project success. This phase of work consists of land management activities and repairs where needed and longer term monitoring plans.

Each phase has monitoring objectives that are matched to the purpose and potential impacts of that scope of work and this is described within each of the following sections.

2. Construction Monitoring Plan

2.1. Objectives

The purpose of the Construction Monitoring Plan is to maintain control of the environmental impacts resulting from the rehabilitation project. The project requires action to be taken on site that may cause short term detrimental impact in order to effect long term environmental and cultural improvement. An example of this includes the deconstruction of existing waste rock dumps (WRD) and construction of new waste storage facilities (WSFs) for the safe long term storage of mine waste rock. The waste rock materials are the current main sources of impact to the EBFR and as such, disturbing them may result in additional temporary impact. The baseline for this project is an already impacted legacy mine site and impacted receiving water course.

The objective of the Construction Monitoring Plan is to ensure that unacceptable additional adverse impacts do not occur during this phase of works where unacceptable additional adverse impacts are defined as:

1. Irreversible impact to sensitive environmental receptors such as the groundwater dependant ecosystem (monsoon vine thicket) to the north of the Intermediate Pit.
2. Irreversible impact to downstream freshwater aquatic ecosystems such as medium term (one month) water quality degradation beyond that which already exists within the EBFR.
3. Irreversible impact to groundwater surrounding the Main and Intermediate Pits such as medium term (6 months) water quality degradation beyond that which already exists.
4. Irreversible impact to the terrestrial ecosystem across the project by the exacerbation of existing weed and fire impacts.
5. Irreparable bank erosion within the EBFR due to the water discharge operations on site.

In addition to managing adverse impacts, monitoring of the groundwater remediation shall commence with ongoing water quality monitoring of the groundwater Seepage Interception System (SIS) over the course of the Operational phase. Qualitative monitoring of revegetation progress will also commence during this phase.

The construction Quality Assurance and Control monitoring is specified within the Technical Specifications for each work package however they are also highlighted here as they are critical to the long term success of the site rehabilitation project.

2.2. Construction Monitoring Locations and Trigger Action Response Plan

The Construction Monitoring Plan requires routine inspection, sampling and review of several elements of the operational work area in order to maintain operational control and prevent unacceptable additional adverse impacts as described above. These elements, links to objectives, parameter, trigger levels and an action response plan are documented in the following Table 2-1. Additional groundwater and surface water monitoring plan information is shown in Table 2-2. This section of the Plan is proposed for implementation during the Main Pit Backfilling and Bulk Earthworks operations.

It is acknowledged that a Waste Discharge Licence will be required for the operation of the Water Treatment Plant and discharge of treated waters to the EBFR. The requirements of the Licence may necessitate a review of this draft Monitoring Plan.

The water monitoring points noted in Table 2-1 and Table 2-2 are shown in the following series of maps.

Table 2-1 Construction Monitoring Plan and Trigger Action Response Plan

Element	Obj.'s	Parameter	Location	Frequency	Trigger Levels	Action Response Plan	Comment
Main Pit Operational Water Levels	2,3	Water Level	MPO	Automated, continuous	58-59mRL	If over 59mRL, cease pit backfilling until water level is recovered. If under 58mRL, cease pit backfill until water level is recovered. In a high rainfall event, stop groundwater recovery and focus all water treatment effort on surface waters.	
Intermediate Pit Operational Water Levels	1,2,3	Water Level	IPO	Automated, continuous	49-50mRL	If over 50mRL, cease pit backfilling until water level is recovered. If under 49mRL, cease drawing from Intermediate Pit until water level is recovered. In a high rainfall event, switch off groundwater recovery system and focus all water treatment effort on surface waters.	
Groundwater Bores adjacent to Main Pit	1,3	pH, EC and water levels	RN22107, RN22544	Weekly	To be established	Sample bores and analyse for sulphates to determine if surface water from main pit backfill is migrating into surrounding groundwater aquifer. Investigate conformance to operational water levels in the Main Pit. Escalate requirement for response plan to the Project Director.	
Groundwater Bores adjacent Main and Intermediate Pits	1,3	Water Level	RN22107, RN22544, RN37722, RN37719, RN37727, RN23516, RN23517, RN23518	Weekly	NA	NA	Purpose is to collect dataset to understand localised drawdown. Data to be used in relation to investigating impact to the nearby Vine Thicket. Also drawdown impact on EBFR groundwater (if any).
Groundwater SIS (abstract and treat)	NA	Water Level	All Groundwater SIS Bores	Weekly	NA	NA	Purpose is to collect data to understand the rates of Cu desorption and quality improvement within the existing impacted groundwater plumes and to monitor aquifer drawdown.
Groundwater SIS (abstract and treat)	NA	Quality see table below	All Groundwater SIS Bores	Monthly, shift to quarterly if stabilised values	NA	NA	Purpose is to collect data to understand the rates of Cu desorption and quality improvement within the existing impacted groundwater plumes.
Groundwater SIS (abstract and treat)	NA	Flow Rate	All Groundwater SIS Bores	Continuous	No flow	Investigate reason for no flow. Re-establish flow.	To ensure active groundwater decontamination.
Sediment Ponds - WSFs	2	Mud level	To be established during operations	Daily	TBA	Visual inspection of level. Clean out if upper levels triggered. Maintenance as per ESCP.	
Sediment Ponds - WSFs	2	pH, EC, Turbidity	To be established during operations	Weekly	TBA	Neutralise in situ or send to WTP for treatment prior to discharge.	
All other site bores	1	Water quality and level	All other site bores	Quarterly	NA	NA	Background data collection to establish any shifts in trends, support incident investigation, monitor improvements across site over time.
Vine Thicket Health	1	Vegetation water stress (Normalised Difference Water Index using Sentinel data)	Entire vine thicket patch	Monthly	Monthly	A significant deviation from baseline NDWI value (seasonally-adjusted) for three months in a row - see Comment	Seasonal fluctuations can be taken into account by analysing data for a few years prior to the commencement of dewatering. That analysis will also identify what constitutes a 'significant deviation' from baseline. If required, that data can be coupled with regular field monitoring, such as using photo-points.
Water Treatment Plant	2,5	Flow Rate to EBFR	WTP	Automated, continuous	NA	NA	Purpose is to collect dataset to understand local flow conditions throughout operations. Data to be used in relation to investigating impact to downstream environs and reporting where required.
	2,5	Volume (cumulative)	WTP	Automated, continuous	NA	NA	Purpose is to collect dataset to understand local flow conditions throughout operations. Data to be used in relation to investigating impact to downstream environs where required.
	2,5	WTP Discharge quality	WTP	Automated, continuous	pH, EC, Alkalinity, Turbidity	Cease discharge and investigate non-conformance.	
	2,5	Field pH, EC, Alkalinity Turbidity	WTP	Daily through commissioning then rely on in-line automated monitoring	LDWQOs 70% Species Protection Zone 2	Trigger sampling for external analysis of same parameters. Determine if additional testwork is required from external laboratory. Investigation into causes.	Cease discharge to EBFR until stabilised and within range.

Element	Obj.'s	Parameter	Location	Frequency	Trigger Levels	Action Response Plan	Comment
	2,5	See table below	WTP	Weekly on commissioning, shift to monthly when stabilised	LDWQOs 70% Species Protection Zone 2	Trigger sampling for external analysis of same parameters. Determine if additional testwork is required from external laboratory. Investigation into causes.	Purpose is to also collect dataset to understand local flow conditions throughout operations. Data to be used in relation to investigating impact to downstream environs where required.
Downstream EBFR Zone 2 and 3	2,5	Flow Rate, pH, EC, Turbidity	EB@GS200, EB@GS327, EB@GS097	Continuous at gauge	NA	NA	Purpose is to collect dataset to understand local flow conditions throughout operations. Data to be used in relation to investigating impact to downstream environs where required.
	2,5	Field pH, EC	WTPO	Weekly	LDWQOs - Zone 2	Investigation into cause of variation against trigger levels. Commence additional monitoring if required. Report variation internally to Project Director. If 3 sequential triggers, report variation to DENR case officer.	
	2,5	See table below	WTPO	Monthly	LDWQOs - Zone 2	NA	At site boundary within Zone 2. All weather access may not be possible in high rainfall events. Safety audit required to confirm safe access can be established (crops). Trigger investigation into WTP operations.
	2,5	See table below	EBdsRB	Monthly	LDWQOs - Zone 3	Proposed WDL compliance point. Report exceedance to DENR.	Downstream within mid-Zone 3. Access all year round. Trigger investigation into WTP operations or if legacy water quality impacts. Trigger investigation into downstream water quality post high-rainfall event that overtops the Pit control system and if deemed necessary by the project aquatic ecologists.
	2,5	Visual Inspection - Downstream Erosion (Qualitative)	EBdsRB	Quarterly	Significant Erosion	Trigger investigation into cause of bank erosion. Commence quantitative monitoring as directed by project geomorphologist.	
Downstream Zone 4 to 7	2,5	See table below	See table below	Quarterly	LDWQOs	Trigger investigation if adverse findings to determine if changes driven by mobilisation of legacy sediments or from the rehabilitation operations.	Purpose is to collect local dataset to understand longer term changes.
Weed and Fire Break Inspections	4	Weed Survey and Firebreak Inspections	All active areas	Monthly inspections & Annual surveys at end of wet	Presence of declared pests/ Fire Breaks poor condition.	Treatment implemented at critical points in plant life cycle. Map location of weeds spotted. Immediately inform HSE Manager. Maintain fire breaks/fuel loads in accordance with Fire Management Plan.	
Vegetation Clearing	1, 4	As per vegetation clearing procedure see EIS section 14.5.	Areas of remnant bushland subject to clearing.	As required	Non-conformance with clearance procedure.	Stop vegetation clearing until operational control is regained. Report non-conformance to HSE Manager.	Section 14.5 of Draft EIS
Vegetation Clearing	1,4	Success of translocated significant cycads	Revegetation areas	As required	<80% survivorship of translocated cycads	Seek advice from native plant expert regarding mortality of transplanted cycads	
Revegetation - Preliminary 1-3 yrs	NA	Plants/ha Survival rate - seasonal success Qualitative plant health	All revegetation areas	1 to 3 seasons old, end of wet	Notable poor performance	Investigate cause of poor performance and enact remedial works based on findings. Replant infill planting where required in following wet season.	Further information provided in the Revegetation Management Plan (RJ3-4-MP-009)
Revegetation	NA	Land Function Analysis	All reveg areas and analogues	Yr 1 then Yr 3 and Yr 8	NA	NA	Establish longer term performance trends and establish understanding of what final state vegetation type may exist on modified landforms. Further information provided in the Revegetation Management Plan (RJ3-4-MP-009)
Revegetation: Erosion	NA	Erosion visual inspection	All revegetation areas	Wet: weekly (until 90% plant cover) & after heavy events >50mm/24hr	Signs of erosion, slumping, pooling	Notify HSE manager, investigate cause and determine appropriate action as per ESCP and supporting Management Plans.	
Revegetation: Erosion	NA	Erosion Rapid Assessment	All revegetation areas	Annually at end of wet season			
Construction Quality Assurance and Control	NA	As per the QA/QC plan established by project engineers	WSF construction areas and pit backfill construction areas	Continuous	As described in Technical Specifications	Rework areas that do not conform to QA/QC requirements on WSFs. Halt operations on pit backfill until operational control is regained on QA/QC elements. Other remedial actions for non-conformance set out in the Technical Specifications	Contaminated Sites Auditor to overview these processes on behalf of the Governance Board.

Element	Obj.'s	Parameter	Location	Frequency	Trigger Levels	Action Response Plan	Comment
Dust during Construction	NA	Visual inspections and monitoring of construction activities	All active areas	Continuous	Excessive visible dust/complaints	Ensure dust suppression is managed under contractor's site environmental management plan/traffic management plan. Stop work during high dust generating weather conditions. Inform Superintendent of excessive dust.	
Dust during Construction	NA	Vegetation dust cover	Surrounding work areas	Monthly	Excessive dust layers on nearby vegetation	Review work practices to identify offending work area. Review controls to determine if sufficient or what additional controls are needed. Corrective Action Plan.	
Nuisance Dust	NA	Dust deposition gauge	R3 (Mt Burton), R8, R10.	Monthly	TBC	Report exceedance to HSE Manager.	Dust deposition gauges to monitor effect and compliance at nominated receptor sites. Preferred control measure at Mt Burton (R3) is to relocate residents during operations in which case dust monitoring will not be required at this location.
Erosion – culverts, roads and crossings	5	Erosion and sedimentation	All culverts, crossings and roadsides	Wet – weekly and after heavy events (>50mm/24hr)	Visible changes to erosion and sedimentation	Repair and maintenance of structures as per ESCP. Investigate root cause and determine if any remedial actions are appropriate to address root cause.	
Riparian Vegetation	2	Riparian vegetation condition – Tropical Rapid Appraisal of Riparian Condition	Minimum 21 sites See EIS 12.4.1 for details	2 seasons annually	Indices and trends TBE	Investigate trend deflections once enough data is collected to establish baseline and trending profiles.	Purpose is two-fold – baseline data for riparian revegetation works and also to monitor impacts of changing water quality and hydrology regime over the construction phase
Aquatic Macrophytes	2	Presence / absence Total area of macrophyte-bed withing 100m stretch of river at each monitoring site	Minimum 21 sites See EIS 12.4.1 for details	2 seasons annually	Indices and trends TBE	Investigate trend deflections once enough data is collected to establish baseline and trending profiles.	
Aquatic Fauna	2	As established	18 sites as established See Table 2-3 and Figure 2-4	4 years	NA		
Plant and equipment inspections	NA	Presence of weed seed and plant materials	Front gate	As required	Presence weed seed or materials	Wash down plant and equipment as per Weed MP	
Fire	NA	Areas burned unintentionally and uncontrolled	Revegetation areas	Annually	Fire in unplanned area of revegetation	Review impact to revegetation, replant and resow area. Review fire break and fire prevention controls are adequate.	
Terrestrial Fauna	NA	Fauna strike on operational roads	All operational roads	Daily	Any occurrence of fauna strike	Notify shift supervisor and then Superintendent, inspect area and determine control adjustments are required to reduce impact	

Table 2-2 Additional Groundwater and Surface Water Monitoring information

Program	Site List	Suite List
WTP Discharge Weekly Fields/Monthly Analysis	WTPO and EBdsLB	pH, EC, Turbidity, Major Ions (Alkalinity, SO ₄ , Ca, Mg, Na, K), Metals Total and Dissolved (Cu, Co, Mn, Ni, Pb, U, Zn)
EBFR (zones 2 and 3) Monthly	MP, IP, EB@GS200, EB@GS097, EBGs327, EBdsRB.	pH, EC, Turbidity, Major Ions (Alkalinity, SO ₄ , Cl, Ca, Mg, Na, K), Metals Total and Dissolved (Al, Fe, Cd, Cu, Co, Mn, Ni, Pb, U, Zn)
Upstream and Downstream (zones 4 to 6, and zone 1) Quarterly	EB@LB, FC@LB, TCus@LB, TC@LB, WCus, WCtrib@LB, WCusEB, EBusFR, FRusEB, FRdsFC.	pH, EC, Turbidity, Major Ions (Alkalinity, SO ₄ , Cl, Ca, Mg, Na, K), Metals Total and Dissolved (Al, Fe, Cd, Cu, Co, Mn, Ni, Pb, U, Zn)
Satellite sites (Mt Burton and Mt Fitch) Monthly during earthworks then quarterly.	FRusMB, FRdsMB, MBdsPit, FR@GS204.	pH, EC, Turbidity, Major Ions (Alkalinity, SO ₄ , Cl, Ca, Mg, Na, K), Metals Total and Dissolved (Al, Fe, Cd, Cu, Co, Mn, Ni, Pb, U, Zn)
Groundwater SIS	To be developed once SIS is installed	pH, EC, Turbidity, Major Ions (Alkalinity, SO ₄ , Cl, Ca, Mg, Na, K), Metals Total and Dissolved (Al, Fe, Cd, Cu, Co, Mn, Ni, Pb, U, Zn)





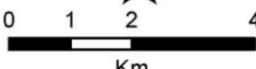
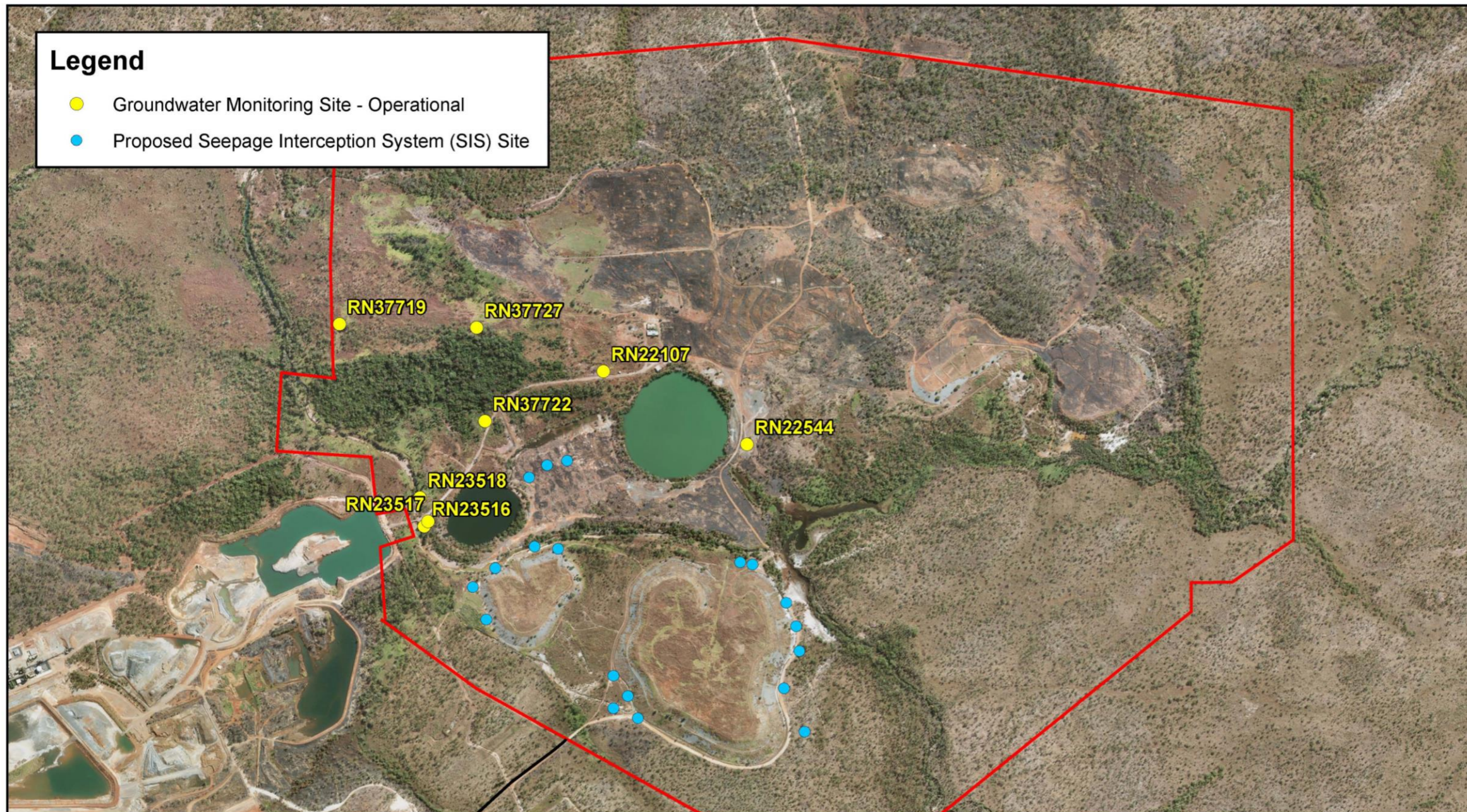
 Northern Territory Government	<h2 style="margin: 0;">Former Rum Jungle Mine Surface Water Monitoring Points Operational Phase</h2>	<p>Details Mapping by NT Department of Primary Industry and Resources Legacy Mines Unit (LMU). Data sources: Aerial photography from NT DLPE, vector data from Northern Territory Government. Map is not to be used for navigation purposes. Contact (08) 8999 6528 for further information.</p>	<table border="1" style="margin: 0 auto; border-collapse: collapse; font-size: x-small;"> <tr> <td style="padding: 2px;">Version</td> <td style="padding: 2px;">01</td> <td style="padding: 2px;">Date</td> <td style="padding: 2px;">11/06/2020</td> </tr> </table> <div style="text-align: center;"> <p>N</p>   <p>Km</p> </div>	Version	01	Date	11/06/2020
Version	01	Date	11/06/2020				
<p>Disclaimer The Northern Territory Government bears no responsibility for the accuracy and completeness of this information and any decisions or actions taken on the basis of this map. While information appears accurate at publication, conditions and circumstances depicted in this map are constantly changing.</p>							

Figure 2-1 Surface Water Monitoring Points through Operations





 <p>Northern Territory Government</p>	<p>Former Rum Jungle Mine Groundwater Monitoring Points Operational Phase</p>	<p>Details Mapping by NT Department of Primary Industry and Resources Legacy Mines Unit (LMU). Data sources: Aerial photography from NT DLPE, vector data from Northern Territory Government. Map is not to be used for navigation purposes. Contact (08) 8999 6528 for further information.</p>	<table border="1"> <tr> <td>Version</td> <td>01</td> <td>Date</td> <td>11/06/2020</td> </tr> </table> <p style="text-align: center;">N</p>  <p style="text-align: center;">0 0.125 0.25 0.5 Km</p>	Version	01	Date	11/06/2020
Version	01	Date	11/06/2020				
<p><small>Disclaimer The Northern Territory Government bears no responsibility for the accuracy and completeness of this information and any decisions or actions taken on the basis of this map. While information appears accurate at publication, conditions and circumstances depicted in this map are constantly changing.</small></p>							

Figure 2-2 Groundwater Monitoring Locations through Operations

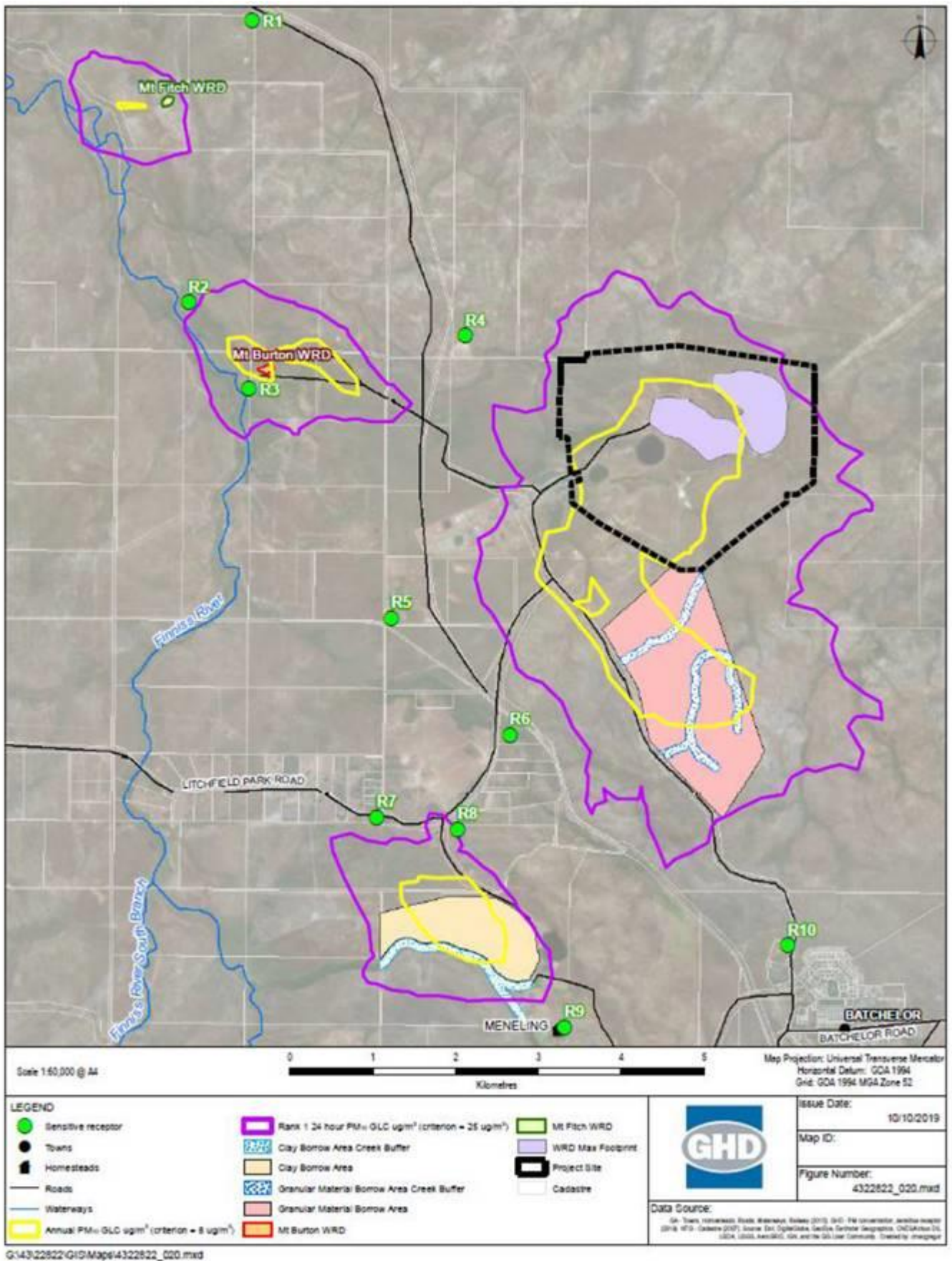


Figure 2-3 Sensitive Receptors - Dust

Table 2-3 Hydrobiology Established Aquatic Fauna Sampling Points

Site Code	Historic Code	Site Name	Easting	Northing	Zone
EB@LB		East Branch at Lease Boundary	131.02700	-12.98820	1
FC@LB		Fitch Creek at Lease Boundary	131.01600	-12.99887	1
EB@G_Dys		East Branch at Dyson's gauging station	131.01700	-12.98780	2
EB@GS200		East Branch at gauging station GS8150200	131.00059	-12.98996	2
TC@LB		Tailings Creek at Lease Boundary	131.99840	-12.98010	2
EB@GS327		East Branch at gauging station GS8150327	130.99100	-12.97660	3
EBdsRB	EB5	East Branch downstream of Railway Bridge	130.98417	-12.98019	3
EB@GS097		East Branch at gauging station GS8150097	130.96800	-12.96410	3
EBusHS	EB3	East Branch upstream of Hannah's Spring	130.96402	-12.96414	3
EBdsHS	EB2	East Branch downstream of Hannah's Spring	130.96090	-12.96346	4
EBusFR	EB1	East Branch upstream of the Finniss River Confluence	130.95100	-12.95950	4
FRUSMB	~ FR6	Finniss River Upstream Mount Burton mine	130.96300	-12.98240	5
FRDSMB	FR5	Finniss River Downstream Mount Burton mine	130.96039	-12.97912	5
FR@GS204	FR4	Finniss River at gauging station GS8150204	130.94200	-12.94780	6
FR3	FR3	Finniss River 1.1km downstream of GS8150204	130.93085	-12.94718	6
FRusFC	FR2	Finniss River upstream of Florence Creek	130.78637	-12.97783	6
FRdsFC	FR1	Finniss River downstream Florence Creek	130.76000	-12.96740	7
FR0	FR0	Finniss River at Walker's Ford	130.71533	-12.91317	7

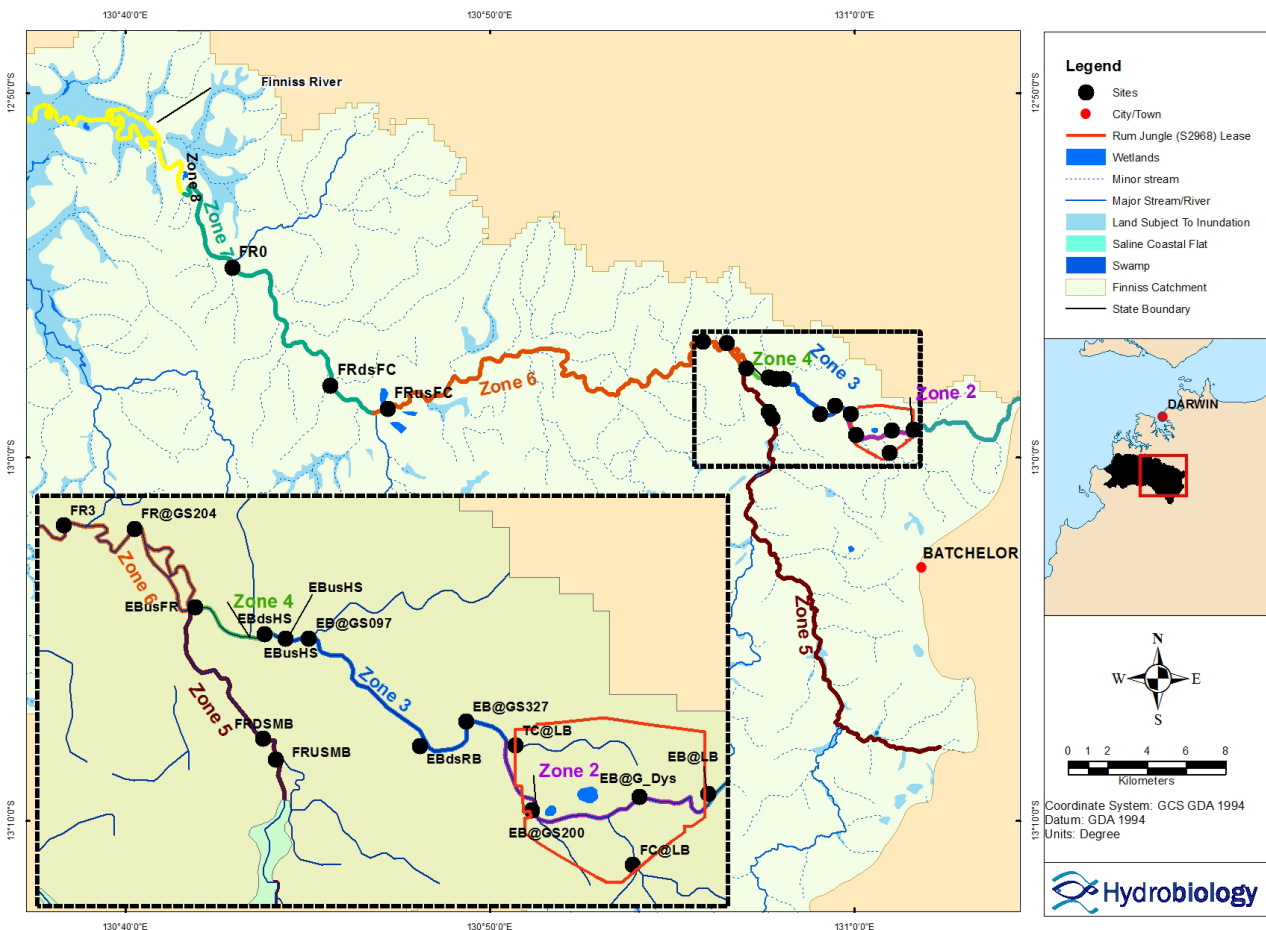


Figure 2-4 Hydrobiology Established Aquatic Fauna Sampling Points

2.2.1. Bush Foods

In addition to the above mentioned Operational Monitoring Plan, it is proposed that during this phase the investigation into the safety of bush foods from the Zone 8 and 9 Finnis River is carried out. This will inform the public health query around the safety of eating fish, mud crab and other commonly harvested bush tuckers from the riparian and aquatic systems of the Finnis. This investigation will not be for the purposes of operational control, rather the purpose of this would be to address ongoing public health queries resulting from the impacts of historic mining activities.

Riparian bush foods including fruit, yams/tubers and vegetative material will need to be collected when in season to ensure sufficient material for metal and radionuclide assay. For some species the window of availability is narrow however immediate post-wet season sampling will give the greatest margin for success on most species. Vertebrate bush foods from the riparian zone include feral pigs, monitors and turtles that are more accessible during the late dry season. Sampling at that time would coincide with cultural utilization practices and simplify sourcing sufficient material for assay.

This investigation program will be designed by the project aquatic ecology and toxicology specialists and information gathered in this study will be prepared for issue to DENR.

2.2.2. Weeds

Baseline weed survey is required prior to works commencing and routinely during construction to ensure good hygiene practices and impact to revegetation areas is controlled.

2.3. Adaptive Management Strategy

The Construction Monitoring Plan has been developed to target early identification of detrimental impacts and early management decision making to mitigate these impacts. Impacts identified and actions taken within the Trigger Action Response Plan will form the foundation for the operational adaptive management strategy whereby the data collection → information forming → management action process is an element of normal operational business.

3. Stabilisation Monitoring Plan

3.1. Objectives

The objectives of the stabilisation scope of the monitoring plan are to:

1. Identify early signs of landform instability and causes and rapidly address those causes (erosion, fire, weeds and feral animals).
2. Measure progress towards achieving overall objective of meeting EBFR LDWQOs and aquatic health improvement resulting from this.
3. Measure revegetation progression across the various landforms to establish revegetation trends and realistic climax vegetation community characteristics for each landform. These characteristics can then inform site-specific success criteria.
4. Understanding of new impacts to groundwater quality from the newly constructed WSFs and backfilled Main Pit.
5. Understanding of improving groundwater conditions across legacy Acid Mine Drainage impacted groundwater due to the groundwater abstraction and treatment system. From this, an acceptable point at which the groundwater abstraction and treatment system can be decommissioned.
6. Measure progress towards improved site radiological conditions post-construction works in order to inform the Land Management and Use Plan.
7. Avoidance of irreversible impact from water treatment plant (WTP) operations to downstream environments such as medium term (one month) water quality degradation beyond that which already exists within the EBFR and bank erosion within the EBFR due to the water discharge operations on site.

3.2. Monitoring Locations and Trigger Action Response Plan

The Stabilisation monitoring plan requires routine inspection, sampling and review of several elements of the post-construction work area and downstream environs in order to rapidly respond to forces detrimental to landform stability and revegetation progression. Additionally, during this phase, key decisions are to be made regarding the timing for decommissioning of the groundwater abstraction and treatment system and the establishment of key revegetation success criteria. These elements, links to objectives, parameter, trigger levels and an action response plan are documented in the following Table 3-1. This section of the Plan is proposed for implementation during post-construction phase nominally for a period of 5-years. The duration may be extended or reduced in future depending on the performance of the revegetation works and the groundwater remediation works.

The surface water and groundwater monitoring points noted in Table 3-1 and Table 3-2 are mapped in Figure 3-1 and Figure 3-2

Table 3-1 Stabilisation Monitoring Plan and Trigger Action Response Plan

Element	Obj.'s	Parameter	Location	Frequency	Trigger Levels	Action Response Plan	Comment
Fire Prevention	1	Fire Break Condition and load	All revegetation areas	Quarterly	Breaks in poor condition or load risk unacceptable	Repair immediately. Particular attention needed at end of wet season. Informs annual burn plan.	
Fire Impact	1	Fire impact	All revegetation areas	Event based	Fire passes through revegetation areas – controlled or uncontrolled	Fire exclusion first 5 years. Fire within this time triggers assessment and re-planting or re-sowing as needed. Further information in Fire Management Plan.	
Weed Impact	1	Weed presence	All revegetation areas and adjacent land parcels	Monthly	Presence of high risk weeds	Notify Land Management Supervisor for immediate attention. Further information in Weed Management Plan.	
Ferals Impact	1	Impact to revegetation by feral animals	All revegetation areas	Monthly	Impact causing detriment	Identify species and plan for targeted response.	Feral Animal Management Plan to be developed.
Erosion and Stability	1	Terrestrial, aquatic and riparian landforms	Waste Storage Facilities, EBFR channel and banks	Monthly during wet season	Serious erosion causing detriment to control structures or vegetation.	Immediately investigate erosion triggers and impact. Work with technical experts to develop remedial works plans.	
Main Pit capping: Erosion	1	Erosion visual inspection	Main Pit capping	Annually at end of wet season & after heavy events >50mm/24hr	Signs of erosion, gouging of capping layer, and exposure of settlement rods.	Notify HSE manager, investigate cause and determine appropriate action as per ESCP and supporting Management Plans and if necessary Work with technical experts to develop remedial works plans.	
Surface Water	2	See Table Below	Sites within EBFR and FR. See Table below	Start of Wet and End of Wet	LDWQOs	Variation against LDWQOs triggers investigation.	Purpose of this data collection at this point is to track progress of improvement post-construction. Further data collection will assist in updating the groundwater/surface water fate transport modelling.
Water Treatment Plant	7	Flow Rate and cumulative volume to EBFR	WTPO	Automated, continuous	NA	NA	Purpose is to collect dataset to understand local flow conditions throughout operations. Data to be used in relation to investigating impact to downstream environs where required.
	7	WTP Discharge quality	WTPO	Automated, continuous	pH, EC, NTU	Cease discharge and investigate non-conformance.	
	7	Field pH, EC	WTPO	Daily	Zone 2 LDWQO	Trigger sampling for external analysis of same parameters. Determine if additional testwork is required from external laboratory. Investigation into causes.	Cease discharge to EBFR until stabilised and within range.
	7	WTP Discharge quality monthly	WTPO	Monthly	Zone 2 LDWQO	NA	Purpose is to collect dataset to understand local flow conditions throughout operations. Data to be used in relation to investigating impact to downstream environs where required.
Downstream EBFR Zone 2 and 3	2,5	Flow Rate, pH, EC, Turbidity	EB@GS200, EB@GS327, EB@GS97	Continuous at Gauge	NA	NA	Purpose is to collect dataset to understand local flow conditions throughout operations. Data to be used in relation to investigating impact to downstream environs where required.
	2,5	Field pH, EC, Turbidity and Alkalinity	EBdsLB	Weekly	LDWQOs - Zone 2	Investigation into cause of variation against trigger levels. Commence additional monitoring if required. Report variation internally to Project Director. If 3 sequential triggers, report variation to DENR case officer.	
	2,5	See table below	EBdsLB	Monthly	LDWQOs - Zone 2		At site boundary within Zone 2. All weather access may not be possible in high rainfall events. Safety audit required to confirm safe access can be established (crops). Trigger investigation into WTP operations.
	2,5	See table below	EBdsRB	Monthly	LDWQOs - Zone 3	Proposed compliance point. Report exceedance to DENR.	Downstream within mid-Zone 3. Access all year round. Trigger investigation into WTP operations or if legacy water quality impacts. Trigger investigation into downstream water quality post high-rainfall event that overtops the Pit control system and if deemed necessary by the project aquatic ecologists.
	2,5	Visual Inspection - Downstream Erosion (Qualitative)	EBdsRB	Quarterly	Significant Erosion	Trigger investigation into cause of bank erosion. Commence quantitative monitoring as directed by project geomorphologist.	
Riparian Vegetation	2,7	Riparian vegetation condition – Tropical Rapid Appraisal of Riparian Condition	Minimum 21 sites See EIS 12.4.1 for details	2 seasons annually	Indices and trends TBE	Investigate trend deflections once enough data is collected to establish baseline and trending profiles.	Purpose is two-fold – baseline data for riparian revegetation works and also to monitor impacts of changing water quality and hydrology regime over the construction phase

Element	Obj.'s	Parameter	Location	Frequency	Trigger Levels	Action Response Plan	Comment
Aquatic Macrophytes	2,7	Presence / absence Total area of macrophyte-bed withing 100m stretch of river at each monitoring site	Minimum 21 sites See EIS 12.4.1 for details	2 seasons annually	Indices and trends TBE	Investigate trend deflections once enough data is collected to establish baseline and trending profiles.	
Aquatic Fauna	2,7	As established	18 sites as established See Table 2-3 and Figure 2-4	4 years	NA		
Groundwater	2, 4	See Table Below	Main Pit, Int Pit, WRDs, WSFs (new). See Table Below.	6 monthly	NA	NA	Purpose is to collect data to establish trends across site as groundwater stabilises. Data utilised in investigation where needed.
Groundwater	5	See Table Below	Former WRDs and Cu extraction pad	Monthly	TBA	Once pattern of desorption rates is understood and ongoing load to EBFR is reduced to a stable position, SIS and WTP to be decommissioned.	
Revegetation	3	Land Function Analysis	All reveg areas and analogues	Yr 1, Yr 3, Yr 8, Yr 12.	Notable poor performance	Investigation into cause of performance deficiencies.	Establish longer term performance trends and establish understanding of what final state vegetation type may exist on modified landforms. Further information provided in the Revegetation Management Plan (RJ3-4-MP-009).
Revegetation	3	Seasonal success	All revegetation areas	End of wet season	Notable poor performance	Investigate cause of poor performance and replant infill planting where required in following wet season.	
Revegetation: Erosion	NA	Erosion visual inspection	All revegetation areas	Wet: monthly & after heavy events >50mm/24hr	Signs of erosion, slumping, pooling	Notify HSE manager, investigate cause and determine appropriate action as per ESCP and supporting Management Plans.	
Revegetation: Erosion	NA	Erosion Rapid Assessment	All revegetation areas	Annually at end of wet season			
Radiation Dose	6	Radiation Dose Assessment	Rum Jungle Site	One Program	NA	NA	Purpose of this program is to assess the dose received from site access across the non-ingestion radiation pathways. This will be assessed against the dose reference level of 10mS/yr and can inform future works on bushfood consumption in a total dose calculation for the final Land Management and Use Plan.

Table 3-2 Surface Water and Groundwater Monitoring Program

Program	Locations List	Suite List
Surface Water Start of Wet and End of Wet	EBdsLB, WCus, WCusEB, FC@LB, EB@LB, TCus@LB, MP, IP, EBusWTP, EB@GS200, EB@GS097, EB@GS327, TC@LB, EBdsLB, EBdsRB, EBusFR, FRusEB, FRusFC, FRdsFC.	pH, EC, Turbidity, Major Ions (Alkalinity, SO ₄ , Cl, Ca, Mg, Na, K), Metals Total and Dissolved (Al, Fe, Cd, Cu, Co, Mn, Ni, Pb, U, Zn)
Water Treatment Plant Discharge Monthly	WTPO	pH, EC, Turbidity, Major Ions (Alkalinity, SO ₄ , Cl, Ca, Mg, Na, K), Metals Total and Dissolved (Al, Fe, Cd, Cu, Co, Mn, Ni, Pb, U, Zn)
EBFR Zone 2 and 3 Monthly	MP, IP, EBusWTP, EB@GS200, EB@GS097, EB@GS327, EBdsLB, EBdsRB	pH, EC, Turbidity, Major Ions (Alkalinity, SO ₄ , Cl, Ca, Mg, Na, K), Metals Total and Dissolved (Al, Fe, Cd, Cu, Co, Mn, Ni, Pb, U, Zn)
Groundwater 6 monthly	MB17-24D/S, RN23304, MB14-06D/S, RN22544, RN23419, RN37711, RN23791, RN23792, MB14-20D/S, RN37725, RN22107, RN22107.	pH, EC, Turbidity, Major Ions (Alkalinity, SO ₄ , Cl, Ca, Mg, Na, K), Metals Total and Dissolved (Al, Fe, Cd, Cu, Co, Mn, Ni, Pb, U, Zn)
Groundwater monthly	To be developed once SIS installed.	pH, EC, Turbidity, Major Ions (Alkalinity, SO ₄ , Cl, Ca, Mg, Na, K), Metals Total and Dissolved (Al, Fe, Cd, Cu, Co, Mn, Ni, Pb, U, Zn)





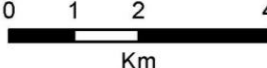
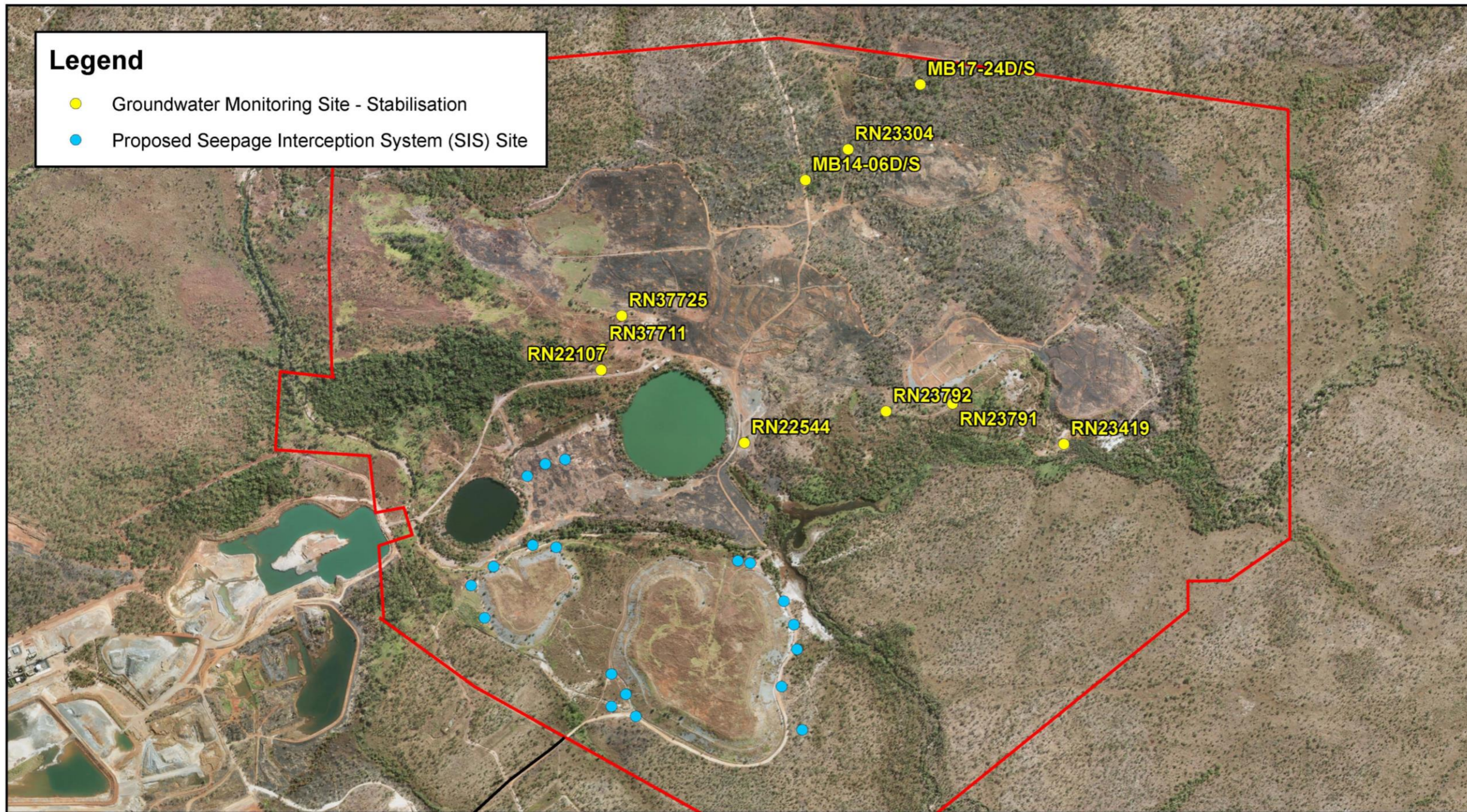
 Northern Territory Government	<h3>Former Rum Jungle Mine Surface Water Monitoring Points Stabilisation Phase</h3>	<p>Details Mapping by NT Department of Primary Industry and Resources Legacy Mines Unit (LMU). Data sources: Aerial photography from NT DLPE, vector data from Northern Territory Government. Map is not to be used for navigation purposes. Contact (08) 8999 6528 for further information.</p>	<table border="1" style="width: 100%; border-collapse: collapse; font-size: x-small;"> <tr> <td style="width: 25%;">Version</td> <td style="width: 25%;">01</td> <td style="width: 25%;">Date</td> <td style="width: 25%;">11/06/2020</td> </tr> </table> <div style="text-align: center;"> <p>N</p>   <p>Km</p> </div>	Version	01	Date	11/06/2020
Version	01	Date	11/06/2020				
<p>Disclaimer The Northern Territory Government bears no responsibility for the accuracy and completeness of this information and any decisions or actions taken on the basis of this map. While information appears accurate at publication, conditions and circumstances depicted in this map are constantly changing.</p>							

Figure 3-1 Surface Water Monitoring Locations After Operational Works





 <p>Northern Territory Government</p> <p><small>Disclaimer The Northern Territory Government bears no responsibility for the accuracy and completeness of this information and any decisions or actions taken on the basis of this map. While information appears accurate at publication, conditions and circumstances depicted in this map are constantly changing.</small></p>	<h3>Former Rum Jungle Mine Groundwater Monitoring Points Stabilisation Phase</h3>	<p>Details Mapping by NT Department of Primary Industry and Resources Legacy Mines Unit (LMU). Data sources: Aerial photography from NT DLPE, vector data from Northern Territory Government. Map is not to be used for navigation purposes. Contact (08) 8999 6528 for further information.</p>	<table border="1"> <tr> <td>Version</td> <td>01</td> <td>Date</td> <td>11/06/2020</td> </tr> </table> <p style="text-align: center;">N</p>  <p style="text-align: center;">0 0.125 0.25 0.5 Km</p>	Version	01	Date	11/06/2020
Version	01	Date	11/06/2020				

Figure 3-2 Groundwater Monitoring Locations After Operational Works

3.2.1. Radiation

During the Stabilisation phase, knowledge gaps on radiation pathways onsite can be investigated. After completion of Stage 3 earthworks a final radiological assessment of the major dose pathways can be complete. The total dose in context of the site dose reference level (10mS/yr) can then be utilised to give guidance on the safe use of the land and water and safe consumption of bush foods. It is expected that additional bushfoods ingestion pathway investigations will be required during the final Rehabilitation Success monitoring plan to inform the Land Management and Use Plan for site. The timing of this will be dependent on the availability of bushfoods within the revegetated areas and will align with the refined Land Management and Use Plan for the site at this time.

3.2.2. Weeds

Weed monitoring over all revegetation work areas will be required to establish early control over weed risks.

3.2.3. Revegetation

A more detailed Revegetation Monitoring Plan is to be established during the construction works program that is aligned with the principles of Landscape Function Analysis as described in the Revegetation Strategy Framework. Top End Seeds propose a modified LFA program utilised across several regional mine revegetation work areas (Bootu Creek and Cosmo). The revegetation program monitoring is strongly linked to the effectiveness of the fire and weed management and monitoring plans for the site as the revegetation areas mature. The introduction of controlled fire into the revegetation area requires careful consideration and planning and as such, will be guided by revegetation and fire management advice sought locally.

Importantly through this Stabilisation phase, as site specific knowledge is developed, key revegetation success criteria can be established. This will require a pragmatic approach that melds the assessment of site revegetation progression and performance with the aspirations of the Traditional Owners for the final vegetation state. Particularly, the ends state of the constructed landforms will be a modified vegetation state that is similar to though not identical to surrounding bushland qualities.

3.2.4. Restoration of flow EBFR

It is estimated that the riparian vegetation system that is established within the original EBFR watercourse will require a period of time 5-8 years to establish before full flow of the EBFR can be restored through this original course. This will require specialist advice in developing a series of indicators as to when the system will be ready for this change. This is likely to occur within the Stabilisation phase of the project. If feasible, low flow 'wetting flows' will be allowed through the reinstated channel prior to full flow reinstatement, or will be allowed to hold water prior to full opening to assist vegetation establishment.

Sediment transport processes are likely to be temporarily disrupted during reinstatement of the original flow path therefore the project geomorphologist will assist in development of an appropriate monitoring plan for this at a later stage. Elements of the monitoring plan are likely to include:

- Regular and flow event-based visual inspections and drone-base imagery of the physical integrity of the channel and transition zones, based on established protocol for diversion and channel maintenance monitoring;
- Review of the success and resilience of revegetation both prior to and subsequent to flow reinstatement; and

- Sediment deposition levels in the Main Pit as a guide to the likely duration of sediment deficit conditions in the reinstated channel.

3.2.5. Riparian and Aquatic Flora and Fauna Survey

The expected improvement in water quality within the EBFR as a result of the site rehabilitation works is likely to see recovery of flora and fauna values within the EBFR. Over the five year stabilisation period, two sampling rounds are proposed to monitor recovery including the round undertaken at the end of Operational phase/Start of stabilisation phase. The details of the works program are to be established by the project aquatic ecology specialists. It is anticipated that this work would complement the existing studies that describe the impacted values within the EBFR and FR. Therefore, it is anticipated to include:

- Aquatic fauna sampling (zones 1 to 7) of
 - Fishes and decapod crustaceans
 - Macroinvertebrates
 - Diatoms
 - Aquatic tetrapods
 - Tissue sampling of fishes and mussels for metal(oid) concentration and radionuclide activity concentrations
- Riparian and aquatic flora (zones 1 to 7);
- Riparian fauna, particularly water monitors (zones 1 to 6); and
- Bush Tucker including sampling for metal(oid) concentration and radionuclide activity concentrations (zones 1 to 7).

3.2.6. Contaminated Sites Auditor

During this period, the Auditor will overview progress towards the rehabilitation objectives and conformance to the monitoring plan and report findings to the Governance Board for information and actioning if required. This independent third party overview provides a recognised level of independent quality assurance and control over the project.

3.3. Adaptive Management Strategy

At this time, the timing for decommissioning of the groundwater abstraction and treatment system can only be estimated. The actual delivery schedule of the WRD deconstruction, the actual copper desorption rates from the WRD saturated/unsaturated zones, the actual performance of the pump and treat system will determine the decommissioning point. Monitoring of the ground and surface water quality response to the rehabilitation program of works will inform future decision making on the timing of decommissioning.

The management of the revegetation system will also require an adaptive management approach. As knowledge from both qualitative and quantitative monitoring matures across the site, so too will the management approach to revegetation and land systems. Examples of this include remedial and maintenance works on erosion and sediment control structures, introduction of fire, weeding practices and the management of surrounding lands to improve successful outcomes within the developing final landforms.

4. Rehabilitation Success Monitoring Plan

4.1. Objectives

The purpose of the rehabilitation success monitoring program is to establish a sufficient data set to confirm that the project's whole of site rehabilitation objectives have been met. It is expected that the rehabilitation success metrics are refined over time however the following rehabilitation success metrics are established within the draft Environmental Impact Statement (DPIR, 2020). Multiple metrics established in Chapter 7 of the draft EIS relate directly to actions achieved during the Stage 3 construction works program. These include excavation depths, removal of contaminants and waste, physical realignment of the EBFR to satisfy cultural needs and heritage places and artefacts are protected. The longer term quality parameters established as indicators of success within the draft EIS are:

1. Meeting the LDWQOs within the EBFR.
2. Dose assessment for the site is reduced to below 10 mS/yr.

It is anticipated that revegetation success metrics will be established as the project's revegetation works are developed over the Operational and Stabilisation monitoring phases and in conjunction with Traditional Owners and revegetation practitioners. Ecosystem recovery monitoring is also likely to provide valuable information to inform the final Land Management and Use Plan. Therefore additional objectives are:

3. Evaluate revegetation success.
4. Monitor and evaluate aquatic ecosystem health recovery.

4.2. Rehabilitation Success Monitoring Locations and Trigger Action Response Plan

The Rehabilitation Success monitoring plan requires routine inspection, sampling and review of several elements of the site and downstream environs in order to respond to forces detrimental to landform stability and revegetation progression. Additionally, during this phase, trends towards meeting the LDWQOs and revegetation success criteria are established. These elements, links to objectives, parameter, trigger levels and an action response plan are documented in the following Table 3-1. This section of the Plan is proposed for implementation during post-construction phase nominally for a period of 1 to 20 years. The duration may be extended or reduced in future depending on the performance of the site and potential future land claim resolution (see draft EIS for further information). Once terms are understood from the Contaminated Sites Auditor's Land Use Management Plan, this Monitoring Plan will need to be reviewed.

The surface water and groundwater monitoring points noted in the Table 4-1 are listed in Table 4-2 and mapped above in Figure 3-1 and Figure 3-2.

Table 4-1 Rehabilitation Success Monitoring Plan and Trigger Action Response Plan

Element	Objectives	Parameter	Location	Frequency of Monitoring	Trigger Levels	Action Response Plan	Comment
Surface Water	1	See table below	Sites within EBFR and FR	Start of Wet and end of Wet	LDWQOs	Variation against LDWQOs triggers investigation. LDWQOs may require amendment during this phase.	Purpose of this data collection at this point is to track progress of improvement post-construction.
Groundwater	1	See table below	Main Pit, Int Pit, WRDs, WSFs (new).	6 monthly	NA	NA	Data utilised in investigation where needed.
Radiation Dose	2	Radiation Dose Assessment	Rum Jungle Site	One Program	NA	NA	Purpose of this program is to complete site dose assessment with the ingestion pathway assessment. This will be assessed against the dose reference level of 10mS/yr and inform the final Land Management and Use Plan.
Fire Prevention	3	Fire Break Condition	All revegetation areas	End of Wet Season	Breaks in poor condition	Repair at end of wet season.	Contributes to annual burn plan
Fire Impact	3	Fire impact and fuel load	All revegetation areas	Event based	Fire passes through revegetation areas - controlled or uncontrolled	Monitor revegetation response to fire.	Contributes to annual burn plan
Weed Impact	3	Weed presence	All revegetation areas and adjacent land parcels	Seasonal	Presence of high risk weeds	Notify Land Management Supervisor for immediate attention. Further information in Weed Management Plan.	
Ferals Impact	3	Impact to revegetation by feral animals	All revegetation areas	Six monthly	Impact causing detriment	Identify species and plan for targeted response.	Feral Animal Management Plan to be developed.
Erosion	3	Terrestrial, aquatic and riparian landforms	Waste Storage Facilities, EBFR channel and banks	Monthly during wet season	Serious erosion causing detriment to control structures or vegetation.	Immediately investigate erosion triggers and impact. Work with technical experts to develop remedial works plans.	
Revegetation	3	Land Function Analysis	All reveg areas	Yr 15 or 16	NA		Purpose is to collect data to contribute to understanding of terrestrial ecosystem recovery.
Aquatic Fauna and Flora	4	Survey to be defined by project aquatic ecologists	Downstream Zone 2 to 6	5 yearly intervals	NA	NA	Purpose is to collect data to contribute to understanding of aquatic ecosystem recovery.

Table 4-2 Summary of Water Monitoring Program

Program	Locations List	Suite List
Surface Water 6 monthly	WCus, WCusEB, FC@LB, EB@LB, TCus@LB, MP, IP, EBusWTP, EB@GS200, EB@GS097, EB@GS327, TC@LB, EBdsLB, EBdsRB, EBusFR, FRusEB, FRusFC, FRdsFC.	To be modified and rationalised based on previous stage data but based on parameters listed in Table 4.
Ground water 6 monthly	SIS bores - reduce to 4 for monitoring purposes based on previously collected data, MB17-24D/S, RN23304, MB14-06D/S, RN22544, RN23419, RN37711, RN23791, RN23792, MB14-20D/S, RN37725, RN22107, RN22107.	To be modified and rationalised based on previous stage data but based on parameters listed in Table 4.

4.2.1. Radiation

It is expected that additional bushfoods ingestion pathway investigations will be required during the final Rehabilitation Success monitoring plan to inform the Land Management and Use Plan for site. The timing of this will be dependent on the availability of bushfoods within the revegetated areas and will align with the refined Land Management and Use Plan for the site at this time.

4.2.2. Landform Stability

Terrestrial, riparian and aquatic zones may require additional long term monitoring depending on the progress made during earlier stages. Visual inspections for erosion, fire and feral impact may be required but the program for this will be developed in future if required.

4.2.3. Weeds

Weed management is likely to be required over the long term as the site is surrounded by heavily impacted land parcels. The weed monitoring and management plan for Stage 4 works will be developed at a later stage and informed by the progress made during Stage 3 works.

4.2.4. Riparian and Aquatic Flora and Fauna Survey

- The expected improvement in water quality within the EBFR as a result of the site rehabilitation works is likely to see recovery of flora and fauna values within the EBFR. Over the rehabilitation success period, aquatic flora and fauna survey is proposed for a 5 yearly basis. The details of the works program are to be established by the project aquatic ecology specialists. It is anticipated that this work would complement the existing studies that describe the impacted values within the EBFR and FR. Aquatic fauna sampling (zones 1 to 7) of
 - Fishes and decapod crustaceans
 - Macroinvertebrates
 - Diatoms
 - Aquatic tetrapods
 - Tissue sampling of fishes and mussels for metal(oid) concentration and radionuclide activity concentrations
- Riparian and aquatic flora (zones 1 to 7);
- Riparian fauna, particularly water monitors (zones 1 to 6); and
- Bush Tucker including sampling for metal(oid) concentration and radionuclide activity concentrations (zones 1 to 7).

4.3. Adaptive Management Strategy

The details of the Stage 4 Land Management and Use Plan will be derived and driven by the needs of Traditional Owners with the Project Owners providing the foundation information around radiological assessment and engineering requirements for the site. The final Land Management and Use Plan will need to adapt to the findings of the radiological assessment and incorporate the management and maintenance needs of the site to support stabilisation and revegetation processes. The timing of future access may be staged whereby, for example, Traditional Owners can walk on country sooner than bushfoods can be sourced from country. Results from weed, revegetation and landform stability monitoring will inform the adaptive management strategy for the site as the land management practices mature for the post-construction condition.

5. Reporting

Reporting of exceptions during the Construction and Stabilisation phases will be carried out through the Project's reporting structure including the project Governance Board. This will include reporting of progress internally via the Governance Board reporting cycle.

Reporting of progress and data to DENR and the public is expected to be carried out annually during the Construction phase then two yearly post-operations. Reporting of operational compliance matters are to be established during the Waste Discharge Licence process.

6. Relationship to Management Plans

It is important to note that elements of this draft Plan are related to content of planned future Management Plans. These are mapped at a high level for the purpose of demonstration of the conceptual Management, Monitoring and Reporting framework for Stage 3 and Stage 4, should approval and funding for both Stages be achieved:

Table 6-1 Links to planned future Management Plans

Management Plan	Monitoring Requirements	Link to draft EIS
Cultural Heritage	Contained within future CHMP and relate to Construction Phase only as post-construction works there are no planned activities impacting on Cultural Heritage elements.	8.4
Radiation	Construction phase objectives relate to worker and public safety. Post-construction objectives relate to guidance of the Land Management and Use Plan and site user safety during late Stage 3 and Stage 4.	7.12.1, 16.3, 16.4
Revegetation	Ranges from establishment of baseline and analogue conditions, tracking of development progress, establishment of completion criteria and tracking against those criteria during Stage 3 and 4.	7.11.3, 7.12.1, 12.4.1
Weeds	Requirements based on risk mitigation during Stage 3 and Stage 4.	14.5.2
Fire	Requirements based on risk mitigation during Stage 3 and Stage 4.	8.3.6, 15.4.3,
Feral Animal	Requirements based on risk mitigation during Stage 3 and Stage 4.	7.11.4, 7.12.1, 17.4.1
Water	As documented within this plan. Ranges from Construction phase operational control through to long term monitoring of rehabilitation completion criteria during late Stage 3 and Stage 4.	7.12.1, 10.7.1, 10.7.2, 11.4,

In addition to the above listed plans, various site operational procedures may require monitoring elements such as the Vegetation Clearance and Cycad Salvaging. These will be determined in future should Stage 3 works achieve approval and funding.

7. Role of the Contaminated Sites Auditor

Throughout the Stage 3 and potential Stage 4 works program the Contaminated Sites Auditor will perform a key quality assurance role and report directly to the Project Board. This overarching role will include routine review of conformance with construction quality assurance/quality control parameters as

established within the construction technical specifications. Additionally, the Auditor will review progress towards achieving the overall project objective of improving the water quality within the EBFR. Progress on impacted elements that may constrain future land use (radiological material clean up, groundwater clean-up, revegetation and aesthetics) will also be reviewed routinely by the Auditor. The purpose of this is to ensure that the Auditor can advise on and issue a Land Management and Use plan for the site after the Stage 3 works are complete.

It is envisaged that although Stage 4 long term monitoring may not be complete, safe restricted access may return for the Traditional Owners of the site. This would foster continuation of reconnection to country and progressive steps towards resolving the outstanding land claim. The role of the Auditor will therefore be to advise the Project Board on conformance to the site's quality processes, progress towards objectives and certifying progressive steps towards a positive future land use.

8. Data Capture

All monitoring data captured for the project will continue to be stored within the Department's current database and system – ESDAT. Hard copy records, photographic records, calibration records and other pertinent supporting data will be kept within the Monitoring team's record keeping system. This data will be required to support external reporting and the role of the Contaminated Sites Auditor. NATA accredited environmental water laboratories will be utilised for environmental sample analysis and calibrated equipment will be used for field data collection.

9. Review

This draft Monitoring Plan is to be finalised during the Preliminary phases of project establishment should the funding approval be granted for this project. After this time, the plan is to be reviewed annually during the Stage 3 works. At the commencement of Stage 4 works, the plan should be refocussed on rehabilitation progression and success and as such, reviewed on a two-yearly basis.