Second Request for Information Report

Rum Jungle Rehabilitation Project Stage 3 – Environmental Impact Statement

NORTHERN TERRITORY GOVERNMENT

Document title	Second Request for Information Report
Contact details	Department of Industry, Tourism and Trade
Approved by	J. Hartnett
Date approved	01/07/2022

Version	Date	Author	Changes made
0.1	31/01/2022	Anna Wilkins Ross Smith	Draft
0.2	31/01/2022	Jackie Hartnett	Review and editing
0.3	30/06/2022	Anna Wilkins	Review and editing
1.0	01/07/2022	Jackie Hartnett	Review and approval

Acronyms	Full form
AHD	Australian Height Datum
AMD	Acid and metalliferous drainage
ANSTO	Australian Nuclear Science and Technology Organisation
ARR	Australian Rainfall and Runoff
CEMP	Construction Environment Management Plan
CMP	Construction Management Plan
DAWE	Cth Department of Agriculture, Water and the Environment
DCMC	NT Department of the Chief Minister and Cabinet
DENR	NT Department of Environment and Natural Resources *Now Department of Environment Parks and Water Services (DEPaWS)
DISER	Cth Department of Industry, Science, Energy and Resources
DIPL	NT Department of Infrastructure, Planning and Logistics *Now Department of Industry, Tourism and Trade (DITT)
DITT	NT Department of Industry Tourism and Trade* formerly the Department of Primary Industry and Resources.
DPIR	NT Department of Primary Industry and Resources
DoF	Cth Department of Finance
EBFR	East Branch Finniss River
EIS	Draft Environmental Impact Statement (DPIR, 2020)
EPBC	Environment Protection and Biodiversity Conservation Act 1999
ESCP	Erosion and Sediment Control Plan
HDS	High Density Sludge
IAP2	International Association for Public Participation

IPCC	Intergovernmental Panel on Climate Change
LDWQO	Locally Derived Water Quality Objectives
LLDPE	Linear low-density polyethylene
MCA	Minerals Council of Australia
NGO	Non-Government Organisation
NIAA	National Indigenous Australians Agency
NLC	Northern Land Council
NT	Northern Territory
NT EPA	Northern Territory Environment Protection Agency
NTG	Northern Territory Government
PAF	Potentially Acid Forming
PM_{10}	Particulate matter with aerodynamic diameter of less than 10 microns
$PM_{2.5}$	Particulate matter with aerodynamic diameter of less than 2.5 microns
QA/QC	Quality Assurance/ Quality Control
RFI	Request for Information
RGC	Robertson GeoConsultants
RMP	Radiation Management Plan
SIS	Seepage Interception System – installed around Intermediate and Main WRDs
SLR	SLR Consulting – Environmental Consultancy
SMDD	Maximum Dry Density (Standard Compaction)
SRB	Sulphate Reducing Bacteria
TARP	Trigger Action Response Plan
TCSD	Transport Civil Services Division
TMP	Traffic Management Plan
ToR	Terms of Reference
WDL	Waste Discharge Licence
WRD	Waste Rock Dump (existing)
WSF	Waste Storage Facility (proposed)
WTP	Water Treatment Plant

Contents

Figures

1. Purpose

Following the submission of the Environmental Impact Statement (EIS) (DPIR, 2019) and the subsequent Supplementary Report (DPIR, 2020), the Northern Territory Environment Protection Authority (NT EPA), have requested further information on key points of the submission to aid the bilateral environmental assessment of the Project. This report aims to provide clarification on the identified issues outlined below and aid the NT EPA and the Australian Department of Agriculture, Water and the Environment (DAWE) in the bilateral assessment to form a view and make recommendations to the Minister as to the acceptability of the proposal under the *Environmental Protection and Biodiversity Conservation Act 1999*.

The Department of Industry Tourism and Trade (DITT) have prepared this report in line with recommendations and additional assessments undertaken by technical experts to better inform the environmental assessment process.

2. Project Update

As at January 31, 2022 the Project continues to work under the Stage 2B Federation Funding Agreement to deliver key preliminary outcomes:

1. Direct employment and training of 10 Kungarakan and Warai Conservation and Land Management Trainees who are now almost complete their yearlong traineeship. The Trainees have been working as part of the Project team to deliver on ground works such as weed control, feral animal monitoring, commencement of seed harvesting and planting for revegetation, water monitoring and aquatic ecology monitoring.
2. Site safety works including asbestos removal, improved access signage, scrap metal removal and, once the dry season starts, upgrade to fencing and firebreaks.
3. Engagement with Kungarakan and Warai to start the conversation about future economic opportunities should the Project be approved. Considerable job and business opportunities will arise from this Project.
4. Building the project management framework for delivery of Stage 3. This includes management plans, procedures, systems and preparations for major procurement and recruitment activities. A review of engineering works will take place to incorporate any environmental conditions into the engineering framework, procurement plans and related processes to support efficient delivery of Stage 3.

The Stage 3 Federation Funding Agreement was finalised on 31 January 2022 and secures the funding pipeline for delivery of the rehabilitation program.

3. Request for Information

3.1. Water Treatment Plant

Ref. 3.2	
Comment	Part 1) Appendix 19 of the Supplement (SLR 2020j) outlined the likely water treatment method used in the water treatment plant (WTP), including details of all chemicals used. However, the potential risks and impacts of these chemicals (e.g. flocculant Praestol 2540) and their breakdown products (e.g. environmental contamination from seepage if buried on site) were not addressed. (Part 2) Appendix 19 of the Supplement (SLR 2020j) introduces a recent water treatment technology, the Electrocoagulation MTECH Water, which produces 95% less sludge, requires no chemicals and would be powered by solar. This seems to have environmental benefits compared to the proposed WTP method. It is not clear why this alternative treatment method is not proposed and therefore what the considerations were, particularly in consideration of the waste management hierarchy.
Further Information Requested	• Provide further information about the potential environmental risks and impacts of chemicals and their breakdown products used in the WTP. (NOT ADEQUATE) • Provide clarification and an outline of the considerations / analysis of the alternative water treatment options such as the Electrocoagulation MTECH Water WTP outlined in Appendix 19 to the Supplement, and justification for the proposed method. (NOT ADEQUATE)
Adequacy of Response	The Department notes that, while the design of the WTP has not been finalised and hence further information regarding environmental risks and impacts of the WTP have not been provided and the proponent has committed to finalising the design within the coming 18 to 24 months. However, further information on the proposed method or alternative methods [such as the Electrocoagulation MTECH Water method] has not been provided. The Department recommends the proponent provide an assessment of the environmental risks and impacts of a 'shortlist' of WTP methods currently considered viable, including the following for each method: - Chemicals used; - Estimated quantity and quality of discharge water; - Proposed risk mitigation and management measures; and - The quantity, composition, and intended management and disposal method of sludge by-products. The Department will ideally require this information to form a view and make recommendations to the Minister as to the acceptability of the proposal under the EPBC Act. An alternative approach may be for the requested information to be included in a 'WTP Construction Plan' required to be considered and endorsed by a committee of suitably qualified experts (to be approved by the Minister) as part of the conditions. This endorsement by committee would be required prior to the commencement of

	construction of the WTP, potentially be at proponent's expense and potentially resulting in administrative (and subsequent construction) delays. A second alternative approach may be for the Department to condition prescriptive requirements of how the WTP operates [waste levels, baselines for outflow quality, restrictions on what remediated water can be used for] and otherwise leave design finalisation and approval to the post-approval phase. Again, this approach may result in administrative and subsequent construction delays.

Response

On request of the NT EPA, the Department has now completed a short-list assessment of WTP options with consideration for the operational requirements of the Project and potential impacts to human health and the environment, the full report is available at Appendix 1. Please note that supply chain service providers may have methodologies and technologies available that have not been included within this consultant's report.

The WTP will have two main functions over the 10 year operational period. Firstly to treat captured groundwater, that is already impacted from historic mining activities, extracted at low flow rates. Secondly to treat the less impacted water from the Main and Intermediate Pits during the estimated 3 year backfilling period, at a rate matched to displacement to maintain the Operating Water Levels within both Pits. At the conclusion of the backfilling operation, the WTP would then be scaled back to maintain the groundwater treatment program, the full period of the program would be subject to groundwater monitoring results however groundwater treatment has been modelled for the full 10 year operational phase.

Throughout the entire 10 year period it will be necessary for the Project to discharge to the EBFR year round, although rates would be significantly reduced during the dry season. The potential impacts of this treated water discharge regime have been discussed in previous reports, however the risk to downstream environmental quality in this already highly disturbed environment, is low. Any limitation placed on treated water discharge flow rate, seasonality or quality is a limitation on the rate of site clean-up and East Branch improvement. In the Project's view, a WTP discharge quality of 70% LDWQO is a significant improvement the balances both long-term and short-term outcomes, this is discussed further in section 3.1.1. It is the Project's view that the previously presented discharge flow rates within both wet and dry season will improve East Branch aquatic health and not cause detriment to the main Finniss. Further discussion on the water balance and the LDWQOs is presented in sections 3.5 and 3.7.

As the final design of the WTP requires industry collaboration through formal procurement processes, the type and volume of reagents that will be used will only be known on completion of the procurement process. It is impracticable to develop and provide a chemical and spill management plan at this stage without a final WTP design. It will however be a requirement for the WTP contractor to develop and provide an acceptable management plan as part of the contractual requirements.

The management of waste from the final selected WTP design has already been considered and accounted for within the rehabilitation plan. During the Main Pit backfilling operations, sludge will be deposited in the pit alongside waste rock recovered from the WRDs. Sludge and waste material from the WTP has been assumed to contain Uranium and will therefore be stored with the same level of control as that of waste rock – within the Main Pit co-disposed with backfill and when the Main pit backfill operations are complete, sludge/filtercake will then be disposed of within a dedicated facility/segment of the new WSFs. The design for this in-WSF facility is not complete and will form part of the operational engineering requirements once more is known about the final WTP design.

For the development of the WTP options assessment, the worst case scenario for water quality was assumed to comparatively test proposed methods and the likelihood of LDWQOs being achieved. A high level summary table (Table 21) is available on page 30 of the report and has been included below at Table 1. The assessment included the referenced High density Sludge (HDS) design (Appendix 8) which was provided during the submission of the Supplementary report and three alternative options. Shortlist options assessed by this report include:

- 'Geco' High density Sludge (HDS) with polishing (this is the reference design presented in the Supplementary report)
- Electrocoagulation
- Membrane Technology
- Anaerobic Sulphate reducing Bacteria (SRB) Wetlands

Each option was assessed for its ability to meet discharge criteria equivalent to the LDWQOs for Zone 2, input reagents, sludge volumes, plant mobilisation, the required operator skill set, proven past performance, and the potential impacts to human health and the environment. Of the 4 possible design options assessed, only the referenced HDS design meets all requirements with further exploration necessary to test new and emerging technologies.

Table 1. Option Comparison Summary - extracted from the SLR (2022) Water Treatment Plant Options Assessment.

Description	Ability to meet Zone 2 LDWQOs	Input Reagents	Power Input	Sludge Volume	Plant Mobilisation	Skill Set	Precedence	Human health/ Environmental Risks
HDS 'Geco' with Ion exchange resins and Greensands/DMI65 catalytic filtration media	Yes.	Lime. Flocculant. Carbon dioxide. Hydrochloric acid. Chlorine. Sodium bisulphate. Ion exchange resin. Greensands/DMI65 media.	Diesel = 2,764kL. Supplemented by solar / batteries.	107,700 m^3 wet OR 54,400 m^3 if dry pressed. No further treatment required to stabilise sludge.	Complex pipe and control network, significant earthworks.	1 skilled operator (remote). 2 support staff (site based), plus redundancy.	Proven technology and practiced worldwide.	Low to high risks associated with reagents and diesel.
Electrocoagulation	Possibly, pilot testing necessary for design.	None required.	Diesel = 227kL. Supplemented by solar / batteries.	141 m^3. Dry powder that can be stored in the WSFs with no further treatment. Sludge could be on sold.	Self-contained units mobilised to site.	Low skilled staff for plate replacement during operation. Local industry could cut plates.	Proven in other settings and applications, however not yet proven in treating high density AMD. Would require Pilot testing.	Moderate risks associated with diesel. Low voltage power.
Reverse osmosis	Yes, pilot testing necessary for design.	Sulphuric acid. Caustic soda.	Diesel = 227kL. Significant mains power required. Supplemented by solar / batteries.	3,799 ML. An evaporation pond with a surface area of 70Ha is required.	Compact plant but requires a 70 Ha evaporation pond.	1 highly skilled operator. 2 moderately skilled operators.	Proven technology in this application but requires pilot testing to verify if secondary RO will achieve the LDWQO otherwise it needs to be coupled with another process.	High risk with sulphuric acid.
SRB wetland	Unlikely.	Organics (no limestone). Organics (with crushed limestone and seeded bacteria). Limestone cobble.	Diesel = 227kL. Supplemented by solar / batteries.	325 m^3. Can be on sold, stored in the WSFs or encapsulated locally with no further treatment.	Significant earthworks, requires 90 Ha footprint for treatment cells and settlement ponds which may not be available.	1 moderately skilled operator permanent. 1 highly skilled operator occasional.	Is often used as a cost effective means to mining metals, however at Rum Jungle it may not provide the required performance. Required footprint may also not be available.	Moderate risks associated with diesel. Low voltage power.

3.1.1. WTP Design, Discharge and Best Outcomes

The Project's approach to water treatment and the WTP, at first, appears to go somewhat 'against the grain' of what traditional project proposals would present. However, the Project believes that the proposed rehabilitation plan will deliver the best outcome for both community and environment in a balanced approach. During the development of the Project's Rehabilitation Plan, the principles of environment protection and ecologically sustainable development, as outlined in the *Environmental Protection Act 2019* (*EP Act*), have guided key decisions and played a central role shaping the way in which rehabilitation will be undertaken. The Project design and execution strategy, particularly in relation to water treatment, has aimed to apply these principals summarised in Table 2 below.

There are undeniable limitations as to what can be reasonably achieved with the resources available to the Project, and as such, the Project must balance best practice through the lens of short-term and long-term environmental and social equity considerations and outcomes. Further discussion on what this balance looks like, the outcomes for community and environment, and the alternative options to the actions proposed are discussed in further detail below.

Table 2. Project Approach to the Principals of Ecologically Sustainable Development.

Principals of Ecologically Sustainable Development	Project Application of ESD Principals
Decision-making principal (1) Decision-making processes should effectively integrate both long-term and shot-term environmental and equitable considerations (2) Decision-making processes should provide for community involvement in relation to decisions and actions that affect the community	(1) The Project, in its decision-making process, has applied the principal of environmental and equitable considerations to ensure short-term and long-term goals for the environment are achieved to the greatest extent practicable. This has lead the Project to put forward a Rehabilitation Plan that it believes represents a balanced approach to a complex environmental issue. In this context, short term environmental improvement is expected by the installation of the Seepage Interception System to immediately capture impacted waters and greatly reduce flow of impacted waters to the EBFR. Comparatively, benefits delivered to the environment by treating water to 95% species protection rather than the proposed LDWQO benchmark do not represent a significant improvement on environmental outcomes in the short-term. While increasing the WTP quality discharge does not represent a significant improvement in ecological outcomes (discussed on page 17) it does represent a significant reduction in the overall Project outcomes as discussed under *Project Alternatives* on page 20. For these reasons the Project considerers the proposed Plan the best outcome when considering short-term and long-term ecological consequences equitably. Although delivering a maximum environmental enhancement in the short-term would be ideal, the Project, for reasons of equity and in good conscience, cannot prioritise short-term WTP output quality when it does not represent best investment of public funds or even a significant positive impact to the short-term environmental outcomes. The application of this guiding principal has steered the Project towards making short-term concessions for the long-term, sustained, ecological benefit of the EBFR. (2) The Project, from its early stages, has openly engaged with community through various channels of communication to facilitate informed decision making. The Project has documented around 100 formal engagement events (not inclusive of informal engagement opportunities) with stakeholders in development of the Rehabilitation Plan. Feedback from engagement opportunities have been taken on-board and addressed at the appropriate level in design and assessment which has ultimately altered the Project direction.

	Key themes that emerged during consultation include improved quality in the EBFR, land rehabilitation, cultural connectivity to site, long-term environmental beneficial use, regional economic opportunities and benefits, and employment opportunities. The Project has taken great care to ensure that these key themes raised have influenced the Project direction. This is demonstrated in the application of the Project LDWQOs which were informed and driven by community aspirations for the EBFR and the potential beneficial uses highlighted by stakeholders. More in-depth information on the community and stakeholder consultation activities and outcomes can be found at section 4 of the Draft EIS, information on the development of the LDWQOs can be found within the Hydrobiology report series (2016 to 2022) submitted with the Draft EIS and Supplementary report.
Precautionary principal (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: (a) A careful evaluation to avoid serious or irreversible damage to the environment wherever practicable; and (b) An assessment of the risk-weighted consequences of various options.	(1) The Project, over the years, has developed a comprehensive knowledge of the site and the complex environmental challenge it presents. The Project has undertaken significant scientific studies to improve the understanding of key risks, and additional work has been carried out to improve certainty to the greatest extent practicable. Where assumptions have been made the Project has taken a conservative approach to facilitate a level of pragmatism in the design. It has been demonstrated that, at present, uncontrolled movement of AMD-impacted waters from the Former Rum Jungle Mine site is causing environmental degradation, namely to the EBFR, the 8km stretch that reports to the Finniss River, that receives approximately 2.5 tonnes of copper and 2,000 tonnes of sulphate load annually. This can be substantially reduced through the installation of the Seepage Interception System (and treatment of captured waters) in the short-term and then through sound AMD-generating rock storage in the long-term. The WTP, while unmistakably important to the treatment of contaminated waters, is only one component in the Rehabilitation Plan and it alone will not deliver the ecological recovery the Project is aiming for. While the Project recognizes that there are 'gaps' in knowledge, these gaps can be informed by on-the-ground learning, and an adaptive management approach during the Construction phase. Project knowledge at this point would only benefit from commencing remediation activities. The Project it is of the opinion that, at this stage, additional time and work to further predict how the remediation works will perform in the real world does not justify postponing remediation action and that the further expenditure of public funds in the pursuit of satisfying scientific interest is not equitable. It is already modelled and

	estimated that the rehabilitation effort will substantially improve the environmental health of the EBFR and any knowledge gaps such as copper desorption rates from impacted ground cannot be known through theoretical modelling – only through practical remediation works. It is hard to justify further postponing remediation works at this point when it is the environment at the receiving end of a legacy of contamination. (2) The Project's decision-making process has been guided by the underlying principle of risk-weighted consequences of various options. The Project is of the opinion that the 'do nothing' approach undoubtedly represents the worst outcome for the environment. The risk of Project actions, during the construction phase, causing serious or irreversible damage to the environment have been designed out or mitigated to the greatest extent practicable (GHD 2019f, Rum Jungle Stage 3 Risk Register). Risks have been assessed through a qualitative process to consider the likelihood and consequence of individual risks, and where possible significant risks were then quantified to further evaluate their specific impacts. Control measures for identified risks have been designed into the Rehabilitation Plan and planned system of work. Much of the risk relating to the operation of the WTP stems from by products, such as sludge waste produced, rather than the action itself (operating the WTP and discharging improved water to the EBFR). The operation of the WTP and the discharge of water based on the LDWQOs will improve the quality of water reporting to the EBFR rather than further impact it. The Project believes that the proposed Rehabilitation Plan adequately balances the risk of actions causing harm and the net benefit proposed actions will deliver. The core purpose of the Project is environmental rehabilitation and the enhancement of biological diversity and ecological integrity. Therefore, Project actions have been designed, to the greatest extent practicable, to provide a net benefit to the environment avoiding any adverse outcomes during the pursuit of rehabilitation.
Principle of evidence-based decision-making Decisions should be based on the best available evidence in the circumstances that is relevant and reliable.	As discussed above, the Project has undertaken significant scientific studies and extensive modelling to improve its understanding of the site specific environmental conditions and challenges rehabilitation poses. This information, along with best practice guidelines, represents the most relevant and reliable foundation for decision-making and has informed the Project approach to rehabilitation, particularly in relation to the WTP. Decisions regarding the WTP, the discharge quality and flow regime have been based on years of site-specific studies and informed by tailored models that have enabled the Project present what it believes to be the best

	approach to this particular environmental problem. Modelling has enabled the Project to look at what the implications are of adjusting certain components, such as the SIS program and the discharge regime, and make adjustments to enable the best outcomes to the environment be delivered. It is the Project's view that the Proposed Plan is based on the best available and relevant information and represents a balanced, evidence-based approach.
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.	A fundamental value of the Project is that any activity undertaken today should not compromise the standard of life or environment available to present and/or future generations. The principle objectives of the Project to restore onsite and downstream environmental values as far as practicable can be expected to deliver a multi-generational impact. These short and long-term impacts and the mechanisms for delivery include: • The delivery approach to the WTP design process to engage industry early and facilitate solution driven designs and secure outcomes the represent the best value for public funds and enhanced ecological integrity, • The WTP water quality output based on LDWQOs to deliver short-term ecological improvement rather than impact on current water quality, • Year-round discharge to facilitate the expedited Main Pit back fill and reduce risks to environment during construction (will also not impact the EBFR or main Finniss river in the short-term), • Seepage Interceptive System (SIS) to capture uncontrolled movement of AMD-impacted waters (short-term), • Industry leading design of WSF to store and immobilise contaminants from AMD-generating waste rock (long-term). If priorities are placed on short-term outcomes, such as limiting discharge quality and regime in a heavily impacted system, over long-term outcomes that inevitably jeopardises the quality of outcomes and therefore the health of the environment for future generations. The decisions around the best WTP options and approach to water treatment (both design and output) have been carefully weighed to ensure that the environment is enhanced for the benefit of both present and future generations equally.
Principle of sustainable use Natural resources should be used in a manner that is sustainable, prudent, rational, wise and appropriate	The Project has aimed to minimise its environmental impact, following the Environmental Decision-making Hierarchy, and be mindful in its use of resources. This has led to the development of a preferred approach to Project delivery, the preferred approach in regards to the WTP includes: • Capturing impacted groundwater and treating it to an achievable quality rather increasing output quality to an unnecessary level that would also require significant additional funds and an increase chemicals

	used for treatment and waste produced. Realistically (as demonstrated on page 16, the impact improvement achieved from improved WTP output quality is not material but costs significantly more). • Early industry engagement to develop WTP design options that provide innovative solutions that could potentially reduce the resources required by the Project for example reduced fuel consumption or solar alternatives. • Investigation into the opportunity to lease the existing site facilities at the adjacent Browns Oxide Mine to reduce the cost, materials and other resources needed to develop, decontaminate and decommission these facilities should they be built on the Rum Jungle site.
Principle of conservation of biological diversity and ecological integrity Biological diversity and ecological integrity should be conserved and maintained.	The purpose of the proposed action is to improve ecological integrity and biological diversity rather than conserve what remains, which in this instance is a highly impacted and degraded system. One of the primary objectives of restoration being to restore EBFR water quality and therefore the ecological integrity of the system. The WTP and the SIS are essential components towards delivering this goal as improved water quality in the EBFR is expected to result in improved ecological integrity. The approach to improving the water quality, the value in targeting the predominant contamination pathways, and the impact on the environment is discussed in more detail below under the *WTP Discharge, Impact Reduction and Dilution Capacity* on page 16.
Principle of improved valuation, pricing and incentive mechanisms (1) 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.	It is important to note that this Project falls outside of the traditional sense of 'development' as there is no net economic gain to the Proponent. As this Proposal is a publicly funded project it is critical that sound cost-benefit analysis is carried out over all project elements. One of the key outcomes from the cost-benefit analysis this is the value of incentivising industry engagement around design solutions for the WTP. The goal of this is to enable the Project to select a solution or innovative design that can potentially deliver outcomes beyond the proposed WTP 70% discharge criteria while balancing the available Project resources and the desired ecological outcomes. The implications of the Project being overly prescriptive WTP design would mean that innovative solution driven designs would potentially be overlooked and opportunities missed. The Project presents a unique opportunity to advance legacy mine rehabilitation in Australia and opportunities to invite industry to participate should not be discounted. More discussion on the implications of industry lead design solutions for the WTP can be found under the *Minimum Standard and Continuous Improvement* discussion on page 19.

WTP Discharge, Impact Reduction and Dilution Capacity

Through the perspective of delivering ecological improvements to the EBFR, the ecosystem will receive the most benefit in short-term from the capture and treatment of AMD-impacted groundwater up gradient (around the existing waste rock dumps). This benefit can begin as soon as the Seepage Interception System (SIS) and WTP are operational and will continue to provide an overall reduction in impacted waters reporting to the EBFR throughout the construction phase. Long-term ecological recovery and improvement will come from the mitigation of contaminants reporting from old landforms and stored in groundwater onsite.

Compared to the impacted groundwater reporting to the EBFR in its current uncontrolled state, treated water from the proposed WTP represents a significantly smaller overall contaminant load to the ecosystem, regardless of the WTP discharge criteria. Figure 1 illustrates the simulated and estimated loads to the EBFR for Copper and Sulphate under current conditions (less than 1% species protection), and with both 70% and 95% species protection as WTP discharge criteria. It is important to note that estimated loads include both treated water from the WTP and residual uncaptured waters reporting to the EBFR. The most significant reduction of impact to the environment can be seen in the capture of groundwater reporting to the system under current conditions (red columns) and the residual groundwater that would report to the system once the SIS program is operational (blue columns). Comparatively, there is significantly less improvement seen by increasing the discharge quality from 70% (yellow columns) to 95% (green columns).

Table 3 presents figures of the modelled contaminants loads under current conditions, at 70% and 95% species protection. While the jump from 70% to 95% WTP discharge only represents, overall, a small reduction in contaminant load reporting to the EBFR, it requires a substantial increase to operational costs, the implications of which are explored further below under Project Resources and Alternative Options.

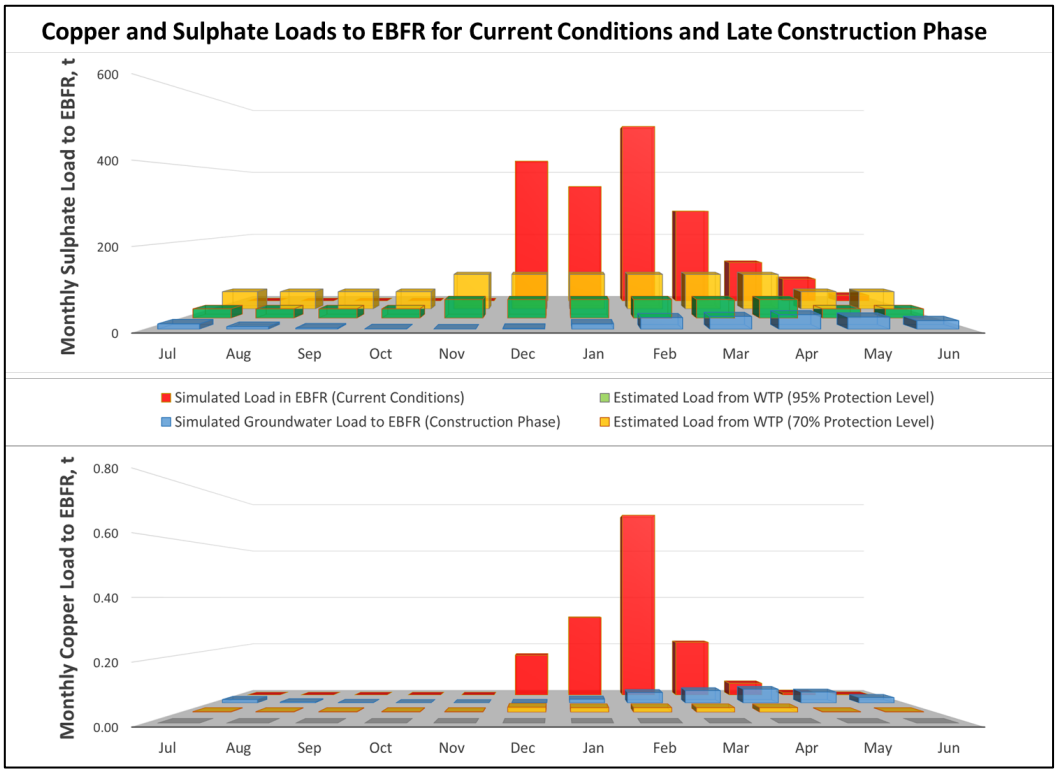


Figure 1. Simulated and Estimated contaminate loads to the EBFR
Note: Calculations informed by the RGC Goldsim Models.

Table 3. Total Contaminants Loads to the EBFR under Modelled Scenarios

Condition	Cu Load (t/year)	SO4 Load (t/year)	Load Reduction to the EBFR during construction
Current condition (all sources)	2.5	2,000	N/A
LDWQOs (70%) as WTP discharge criteria (all sources)	0.24 (this includes 0.2 load from uncaptured groundwater at Dysons backfill pit)	1,062 (this includes 180 load from uncaptured groundwater at Dysons backfill pit)	2.26t less of Cu 938t less of SO4 Compared to the current condition
95% species protection level as WTP discharge criteria (all sources)	0.2 (this includes 0.2 load from uncaptured groundwater at Dysons backfill pit)	620 (this includes 180 load from uncaptured groundwater at Dysons backfill pit)	2.3t less of Cu 1,380t less of SO4 Compared to the current condition (0.04t and 442t less than under the LDWQOs)

Note: Calculations informed by the RGC Goldsim Models.

Uncaptured groundwater at Dysons backfilled pit represents a higher portion of copper reporting to the EBFR than that achieved by increasing WTP discharge quality from 70% to 95%, 200kg vs less than 40kg per year.

As the Project has proposed year round discharge, it is important to discuss the impacts of discharging from the WTP at a quality of 70% LDWQO to both the EBFR and the main Finniss River in terms of dilution capacity. Gauge stations 097 and 204 provide data on flow rates and volumes both within the EBFR and the main Finniss downstream of the confluence (Figure 2). Gauge station 097, within the EBFR, fluctuates between 10 to 65 GL annually, depending on rainfall, and flows from December to June with stagnant pools forming during the drier months. Gauge station 204 sees between 90 to 310 GL annually, dependent on rainfall, and flows year round. A breakdown of the discharge volume by domain is available at Table 10 and indicates that the annual discharge from the WTP would be approximately 1.7GL, calculated from the Project's water balance. This represents only a minor increase to flow volume and rate within the Finniss River, the peak of which will be seen during the Main Pit backfill process and then further decrease.

The final impact of the proposed discharge from the WTP to the EBFR is a change in the period for which there is flow in the 8km stretch upstream of the confluence (Zones 2, 3 and 4). This section of the EBFR is expected to see year round flow rather than stagnant pools forming during the cessation of flows in the dry season. Currently during the dry season, evapoconcentration forms concentrated pools which then flush downstream during the rewetting of the EBFR in the early wet season. These concentrated pulses of water can be observed in the tabulated data from Hydrobiology and do have an impact of aquatic ecology. The Proposed change in flow regime in this section of the EBFR due to the Project would reduce or eliminate dry season evapoconcentration and impacted water pulses during the start of wet seasons. The proposed discharge is not anticipated to substantially alter the flow regime of the permanent main Finniss River.

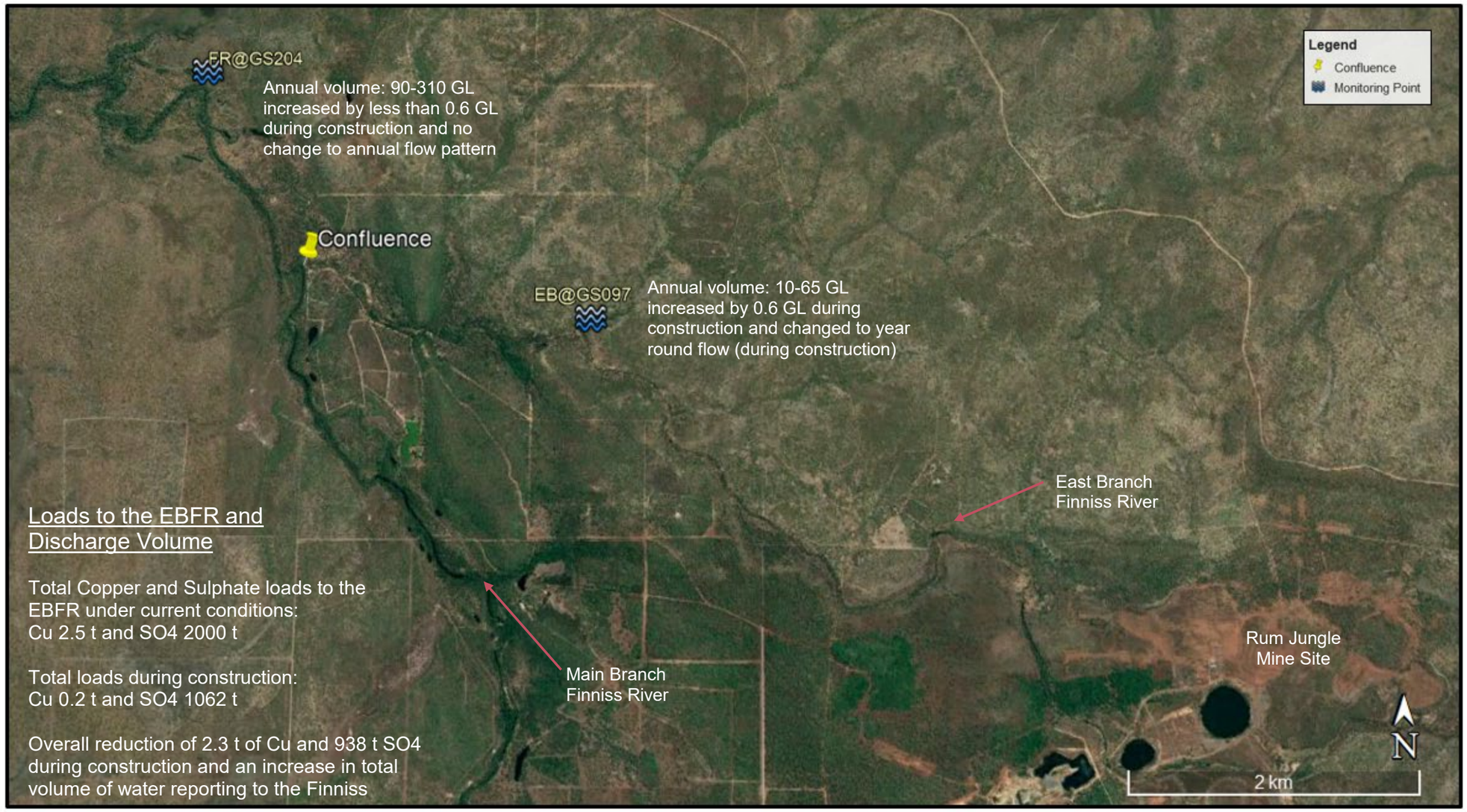


Figure 2 Flow and Contaminant in the EBFR and Finniss River – Current Conditions and During Construction

Note figures presented in this map were calculated from the RGC Goldsim model and the SLR Water Balance model.

In short while the overall volumes of water will increase due to water treatment and construction activities, the actual total contaminant load reporting to the EBFR and the Finniss river will be reduced significantly even at WTP discharge quality of 70% LDWQO.

Minimum Standard and Continuous Improvement

The proposed WTP discharge of 70% species protection is the minimum at which the Project will consider design solutions for the WTP, with an emphasis being placed on achieving the best solution possible within available budget. This means that the Project will discharge at 70% at all times as a minimum standard, however, will aim to improve on this whenever possible through innovative design and operational solutions. Continuous improvement of the WTP discharge water quality over the span of the WTP operation will also be explored during final design development with contractors.

The selection of the final WTP design has not yet been made. This decision to postpone the finalisation of the WTP design has been deliberate on the Project's behalf, as it is the goal of the Project to pursue a solution that's not only cost effective but delivers maximum benefits to the environment. To do this, the Project must seek engagement from industry specialist suppliers, who are best positioned to develop solutions and innovative designs that can potentially deliver outcomes beyond the proposed WTP 70% discharge criteria. This is in line with the *EP Act* principal of improved valuation, pricing and incentive mechanisms which aims to maximise benefits or minimise costs when developing solutions and responses to environmental problems.

It's also important to consider the varying degrees of operational demand on the WTP over Stage 3 of the project. During backfill operations the WTP will be required to capture and treat the highest volumes of water expected over the duration of the Project, however this will be significantly reduced following the completion of this work component. This means that while the Project may discharge at a minimum of 70% during the initial 3 to 4 year wet season period, the Project will be more likely to discharge at higher quality than this after the completion of Pit backfilling.

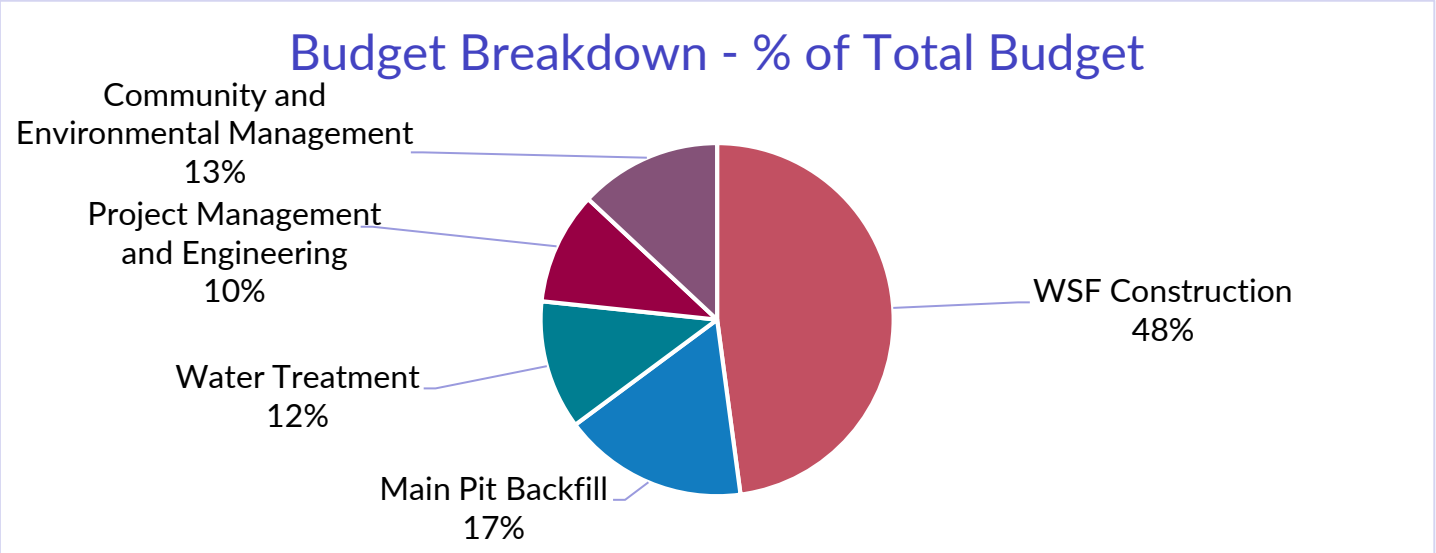
The proposal of 70% species protection as discharge criteria aims to balance what funding resources are available to the Project, the short-term ecological benefits the WTP will deliver to the EBFR and the overall long-term ecological outcomes for the site and the river. The Project has not only been designed to avoid adverse environmental impacts during remediation activities but will actively reduce contaminant loads to the EBFR during the construction phase of the project.

Due to the highly impacted nature of the EBFR it is also reasonable to assume that, in the short-term, it is unlikely, even at a WTP discharge quality of 95% LDWQOs, the system would be returned to that of even moderately disturbed. Significant ecosystem and biological recovery in the East Branch is likely to take time. Therefore rehabilitation efforts may not be validated within the EBFR in the short-term but more likely in the mid to long-term. This can be seen in the rate of recovery of the EBFR from the initial rehabilitation efforts in the 80s, with some components of the ecosystem quite slow to respond to improvement. Therefore it is important that short-term improvements are not prioritised to the detriment of long-term sustained enhancement and that continuous improvement should be the goal.

Project Resources

It is impossible to consider what a balanced approach would be without discussing the available resources and the limitations the Project has had to overcome. Of the resources available to the Project, the most constraining are time and budget, with the Project's Federation Funding Agreement executed as of January 2022 these two resources are now fixed with no options to return to the Commonwealth Government for additional concessions. In addition to this, the Project is facing increased price pressures since the original cost estimate in 2019 due to unforeseen global events that have inflated the cost of resources such as labour, equipment, fuel and reagents. The Project is currently capable of meeting the costs associated with running the WTP at 70% discharge quality in the current economic climate, however, any increase in the Project scope, such as increased water treatment requirements, means that funding shortfalls would have to be supplemented from other key areas of the Project. A high level budget breakdown of the funding assigned to each key Project component can be found below at Figure 3.

Figure 3. Project Budget by Domain



Alternative Options

If the Project were to increase the capacity of the WTP to facilitate discharge at 95% species protection rather than the proposed 70% this would unavoidably increase the WTP operational costs. The estimated cost of such an increase in scope would be in exceedance of $20 million. As the Project has no option to request further funding, this shortfall would need to be supplemented by decreasing the amount of funding assigned to other key areas of the project. This amounts to $20 million less towards the delivery of community benefits, environmental management, project engineering or landform construction.

The construction activities and engineering design of the WSFs and the Main Pit backfill consumes a significant portion of the Project budget, this however is not an area in which the Project is willing to compromise on quality of outcome. A reduced construction quality in these areas directly correlates to a reduction in the long-term environmental outcomes for the EBFR and would negate any minor short-term benefit delivered by more stringent WTP discharge quality. It would be unreasonable for the Project to prioritise minor short-term outcomes over the long-term stability of the rehabilitation effort and would be in contradiction with the objects of the *Environmental Protection Act* to protect the environment and promote ecologically sustainable development.

An alternative to the above is to reduce the allocation of funds towards environmental management and community benefits. The Project has designed its delivery model so that local economic benefits to the Batchelor community are maximised through multiple approaches, local employment opportunities being significant to this. Employment opportunities is an area in which during consultation with stakeholders has been repeatedly highlighted as of importance to community. As a result the Project has adopted a local workforce policy and day-shift only operation to increase the potential for workforce requirements to be met within the Batchelor region. This, in conjunction with employment pathway programs, aims to deliver short and long-term economic benefits to the region. A reduction in the budget allocation is likely to reduce regional economic outcomes.

It is the Project's view that the reallocation of funds in the pursuit of increasing the WTP discharge quality skews the balance of long-term and short-term environmental and equitable considerations towards immediate outcomes over sustained ecological restoration. The increase in expenditure required to facilitate the escalation in water treatment also represents diminished returns on the investment of public funds as the overall benefit to both environment and community is reduced in the long-term. Overall, it is the Project's view that the proposed rehabilitation plan represents the best outcome for environmental and intergenerational equity to the greatest's extent practicable.

3.2. Waste Rock Segregation

Ref. 3.7	
Comment	The Supplement indicated that materials would no longer be segregated at the deconstruction loading face.
Further Information Requested	Clarify if PAF-I material would still be deposited in the Main Pit. (ADEQUATE) • If yes, provide information about a field validated segregation method, and associated quality assurance/quality control program for waste rock identification, segregation and management. (NOT ADEQUATE) • If no, would less waste rock be deposited in the Main Pit? (N/A)
Adequacy of Response	While the response clarifies the intent to store PAF-I in the main pit, it does not precisely conform to either option outlined in the request for further information. The response indicates that a no segregation will occur and that an adaptive approach will be taken by testing and applying lime to the pit. This leaves uncertainty as to the results that will be achieved. The response refers to section 3.3 of this report which does not appear to adequately describe how this approach will be successful. Section 7 of the draft EIS is also referenced however the details that adequately address the concerns of the request for further information are not specified. Given the importance of managing PAF-I material in the main pit, a more direct and thorough response is necessary. To properly understand the proponents plans to address relevant concerns and provide reassurance to the delegate, the relevant details should be extracted to explicitly address concerns.

Response

Targeted Landforms

At no time has the proponent committed to segregating materials at the loading face within the EIS submission. Segregation at the loading face was investigated as part of the project development work prior to EIS submission and deemed unworkable. Instead, material has been classified at the landform scale based on the extensive test work performed on each landform. As such, Section 2.4.3 of the Draft EIS clearly states:

The materials nominated for permanent storage within the Main Pit backfill are those with the highest acid forming potential:

- *Intermediate WRD*
- *Dyson's (backfilled) Pit – materials formerly from the Copper Extraction Pad*
- *Main WRD – the remaining volume that can be stored within Main Pit.*

To reframe this Draft EIS statement, materials nominated for the backfill zone are segregated on a landform-scale basis. The following discussion describes the basis for this Project decision.

Core to the Project's remediation action plan is the prioritisation of material by landform to be relocated to the Main Pit backfill based on risk of AMD production posed by PAF material. Previous work done by RGC and summarised in the 2019 *Rum Jungle Physical and Geochemical Characteristics of Waste Rock and Contaminated Materials* report has enabled the Department to make the informed decision to segregate waste rock by facility and **place all waste rock material** from the Intermediate WRD and Dysons Backfilled Pit into the Main Pit. Figure 1 shows that the vast majority of these two facilities are PAF-I and PAF-II.

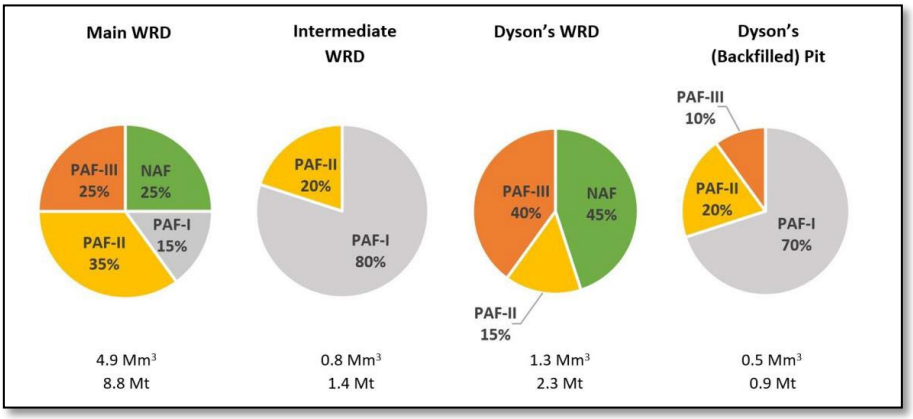


Figure 4 RGC Waste Rock Dump PAF Characterisation Summary

It is measured that the Main Pit can accommodate approximately 2.2 Mm^3 of material. Planned backfill volumes are 0.1 Mm^3 of bedding material, 1.6 Mm^3 of material from Intermediate WRD and Dysons Backfill (including corresponding volume required for lime, swelling and settling factors). Opportunistically, the remaining pit void volume will be made up of Main WRD materials (0.4 Mm^3 waste rock and corresponding lime, swell and settling factors). The Main WRD is the third highest AMD generation risk landform on site and less than 8% of its total volume would actually fit within the remaining available pit backfill void. Finally, some 0.18Mm^3 of clean capping material is required to complete the pit backfill landform.

While segregation of the PAF-I material from the Main WRD to send to the pit backfill would be ideal, it is not possible to segregate at an operational level. Due to the highly mixed nature of historically placed waste rock, it is not feasible to segregate waste rock by PAF type at the WRD on a load-by-load or block basis. For example, a single load of waste originally mined from the Pit would likely have been end-dumped

resulting in material spread from the top of the WRD down the rill slope to the bottom whilst others paddock dumped without consistency. Even an extensive drilling program is unlikely to effectively deliver a three-dimensional physical model of PAF types throughout the WRD at a scale suitable for an excavation plan. The effort required to identify and segregate less than 8% of the Main WRD volume destined for pit backfill is not balanced by the benefit of managing to segregate it nor is it realistically achievable at a constructible scale.

Taking the ideal (though unachievable) scenario of being able to segregate the 8% of the Main WRD PAF-I material for pit backfilling, the remaining **7% of Main WRD that is still PAF-I** would still end up at the WSF. A process would still be required to adequately manage this PAF-I material going to the WSF.

To moderate the risk of PAF-I and PAF-II ending up at the WSF in a mixed state with other PAF category materials (which will happen 100% of the time), a testing program will be implemented on the tipping work area. As the mixed nature of all waste rock PAF categories cannot be avoided, it was necessary to accept whatever is placed at the WSF and carry out the designed test program to correctly dose lime to the placed waste rock. This method was developed to mitigate risk of under/over dose of lime and in consideration what is actually constructible.

Aside from consideration to practically achieving segregation at a waste dump source, realistically the Project must avoid a scenario where the Main Pit Backfill operations are put on hold 'waiting' for the right PAF-I material to be exposed and available from the Main WRD in the excavation plan.

The proposed work plan balances and trades ideal scenarios with what can practically, effectively be achieved and identifies points of risk while offering adequate risk management strategies. Key risk management strategies are outlined here and in Appendix 2. Please note that all of the engineering design packages will require refreshing prior to going to market for procurement.

QC – Neutralisation

Waste rock nominated for placement within the Main Pit will be routinely tested following a QC program to ensure the correct amount of lime is added to neutralise existing acidity prior to sub-aqueous placement.

The attached SLR (2020) *Main Pit Backfill Construction Methodology* report (Appendix 2) outlines the Projects quality requirements for chemical stabilisation of waste rock for long-term storage and includes geochemical conformance testing. In summary the Main Pit will operate at pH ≥7 during backfilling operations with the lime-dosing of waste rock to occur before sub-aqueous placement. Liming rates are available at section 2.1 of Appendix 2, volumetric (m^3) and weight (tonnes) of lime dosed will be measured and recorded against waste rock source with complied data provided to the Superintendent on a weekly basis. Minimum data to be recorded, ideally by an automated bathymetry and production system, will include:

- Time and date of backfill
- Main Pit floor reduced level (m AHD) at time of backfill
- Lime volume and weight that has been applied to backfill material
- Type of lime applies and lime efficiency rate (as provided by the supplier and/or tested by the Contractor)
- Waste Rock source, volume and weight that has been dosed and backfilled
- Applied dose rate (kg of lime/per tonne backfill material)

- Applicable calibration certificates of mass/weight/volume measuring equipment

Records will be auditable and the measurement and recording methodology demonstrable. Note however that this is a reference placement methodology (overwater barging) and the procurement process may identify more efficient, lower risk methods for the material placement within the pit. Withstanding this, the construction quality requirements are set.

QC - Water

Water from the Main Pit impacted during backfilling operations must not be allowed to enter the EBFR during normal operations, only water meeting the LDWQOs will be actively discharged from site and only under conditions established by the NT EPA. There may be occasion under extreme rainfall conditions (as previously described in preceding EIS documentation) where flooding may result in uncontrolled pit overtopping, with any impact moderated by dilution.

The rate of placement of backfill material will be controlled to manage the potential disturbance of the in situ tailings materials and chemocline and subsequent water quality of the Main Pit. The Main and Intermediate Pit Operating Water Levels will be maintained to ensure flood surge storage capacity throughout the backfilling process and water level monitoring will be continuous with operation to stop if limits are breached, operations will not re-commence until water levels conform. Section 2.6 of Appendix 2 outlines the TARP for water levels during the backfill process.

Backfill operators are expected to assist the Water Management operators with access to continual monitoring of the Main Pit water quality. Continuous water monitoring will occur at multiple depths to understand vertical and horizontal changes to the water quality from waste rock placement. A summary of the in-situ monitoring is included at Table 4. Data gathered will inform both the backfilling operation and the feed water for the WTP. A Trigger Action Response Plan (TARP) for the backfill operations has been included in section 2.2.5 of Appendix 2.

Table 4. Main Pit water quality testing – extracted from SLR (2020) *Main Pit Backfill Construction Methodology*

Backfilling Stage	Locations	Depth (m below pit lake surface)	Probe Parameter Requirements	Frequency
Sand Bedding Layer	Off Backfill Material Delivery System.	10, 20, 30 & within 3.0m of Main Pit floor.	pH, Electrical Conductivity, Depth of Probe, Oxidation Reduction Potential, Time & Date of test	Continuous
Waste Rock < 27m AHD	Off Backfill Material Delivery System.	10, 20 & within 3.0m of Main Pit Floor	pH, Electrical Conductivity, Depth of Probe, Oxidation Reduction Potential, Time & Date of test	Continuous
Waste Rock < 35m AHD	Off Backfill Material Delivery System.	5, 10 & within 2.0m of Main Pit Floor	pH, Electrical Conductivity, Depth of Probe, Oxidation Reduction Potential, Time & Date of test	Continuous
Waste Rock < 56m AHD	Off Backfill Material Delivery System.	Within 2.0m of Main Pit Floor	pH, Electrical Conductivity, Depth of Probe, Oxidation Reduction Potential, Time & Date of test	Continuous
Inert Capping Layer < 58m AHD	Off Backfill Material Delivery System.	Within 2.0m of Main Pit Floor	pH, Electrical Conductivity, Depth of Probe, Oxidation Reduction Potential, Time & Date of test	Continuous

3.3. Post Rehabilitation Flow Regime – Climate Change

Ref. 3.8	
Comment	The River Reinstatement and Flooding Report (Appendix 17 of Supplement), and design drawings for the Main Pit and Reinstatement of the EBFR (Appendix 24) indicate that the dry season Top Water Level of the Main Pit post-rehabilitation will be 1m over the capping layer. This is contrary to statements in the supplement that the minimum depth would be 2 m above the capping layer. The Draft EIS and Supplement state that this water level was estimated based on current groundwater levels. The depth of water over the backfilled waste rock in the Main Pit is essential information for the NT EPA to consider since the water cover is a critical element of the rehabilitation to prevent oxidisation of stored waste rock. For the Supplement, the NT EPA requested that worst case scenarios of climate change impacts be taken into account. This should include not only extremes of high rainfall, but also extremes of low rainfall, falling groundwater levels and increased evaporation. The Proponent needs to consider the potential effects of these extremes on water levels in the Main Pit. The Proponent states that there will be settlement within the Main Pit once it has been capped (Appendix 17 of Supplement). If settlement is uneven, this could result in riffles or dips, leading to altered rates of erosion to the surface.
Further Information Requested	• Provide modelling on the worst case scenarios for the potential impacts from the modification of the hydrological processes through the reinstatement of the EBFR flow path, in particular the potential pathways for contaminants to be transported during extreme weather events. (PARTIAL) • Provide an assessment of the potential for erosion of the capping surface over time due to settlement of waste rock. (NOT ADEQUATE) • Provide an assessment of the potential effects of climate change on Main Pit water level, including consideration of increased evaporation and potential decreases in groundwater levels. (NOT ADEQUATE)
Adequacy of Response	• Please provide an initial Climate Change Assessment that provides high level information including estimates of increased evaporation, potential decreases in groundwater levels, and the impacts of future extreme events on the water level of the Main Pit, including the frequency and magnitude of those events. The Department requires this information in order to form a view, and make recommendations to the delegate, on the acceptability of the proposal under the EPBC Act. • Within the Climate Change Assessment, please provide modelling on the worst case scenarios for modification of hydrological processes through the proposed realignment strategies of the EBFR flow path, including potential pathways for contaminant transport during extreme weather events. The Department requires

	this information (which has previously been requested) in order to form a view, and make recommendations to the delegate, on the acceptability of the proposal under the EPBC Act. • The response to the request for further information describes an assessment of the stability of Main Pit walls and slopes. Please provide, as previously requested, an assessment of the potential for erosion of the capping surface within the Main Pit, particularly in light of the realignment of the EBFR, extreme weather events, and settlement of the waste rock layer over time. The Department requires this information (which has previously been requested) in order to form a view, and make recommendations to the delegate, on the acceptability of the proposal under the EPBC Act. • Finally, the Department notes the proponent commits to undertaking a comprehensive Climate Change Assessment during Stage 3 of rehabilitation works. The Department recommends this assessment include consideration of : o - a range of probable seasonal rainfall scenarios (including a 'worst case' scenario); o - the impact of changing rainfall patterns (including rainfall event intensity, frequency and duration); and o - the impact of increased evaporation. The Department considers that the more comprehensive Climate Change Assessment is likely to be able to be conditioned and provided during the post-approvals phase of the proposal under the EPBC Act. • The Department recommends this assessment include but may not be limited to: o - Groundwater levels and subsequent impact on groundwater quality and pit lake depth; o - Erosion of WSF capping layers; o - Erosion of the capping layer of waste rock in the Main Pit, especially in the context of rock settlement producing a non-level surface; and o - Flow rates, volume and velocity in the proposed diversion/realignment of the EBFR pathway. • The Department recommends any conditions regulating the more comprehensive Climate Change Assessment (as above) include these requirements.

Response

The Department has now completed a climate change assessment (Appendix 4) considering the worst case scenarios and the design components that would likely be impacted. Table 2 of SLR (2022) *Potential Impact of Climate Change on Rehabilitation Design* report outlines climate change influences and the rehabilitation design elements that have been highlighted as topics of interest.

The assessment identified three components that could be impacted by climate change:

- Backfilling and capping on the Main Pit
- Realignment of the EBFR through the Main Pit
- Capping and landform of the WSF's

Climate Variability and Model Design, Scope, and Limitations

Currently there are few tools to model erosion, however SIBERIA has been used for more than 25 years and has become an industry standard for long-term erosion modelling. There are no methods to introduce specific climate events into the different input parameters of SIBERIA. However, the SIBERIA model outputs when compared to previous Landform Erosion Studies (using SIBERIA and other methods) at sites comparable to Rum Jungle, returned similar material loss (m^3/ha/yr.) outcomes. In assessing the suitability of SIBERIA model, there needs to be an appreciation that rainfall is one input into model, SIBERIA also considers a landforms resistance to erosion which can be reliant on ground cover, vegetation cover and influences that may impact these (e.g. bushfires). Pedological and biological processes are outside the scope of the SIBERIA model, however it does consider multiple independent variables in relation to the transport of sediment and therefore erosion and deposition as a result.

The model submitted in the Draft EIS has a deteriorating resistance to erosion for time periods >50 years. Comparatively, in a second model run following the climate change assessment, a more aggressive deterioration in the erosion resistance was applied (both in terms of erosion resistance and applied earlier time intervals to mimic more frequent and severe bushfires). Outcomes indicate at the worst erosion location, the cover system was found to be adequate with the model showing an increased loss of material in the order of 100mm over 500yrs. In summary, it is the Project's view that the model presented is sufficient in representing future climate variability.

Key Outcomes

Climate change influences were developed based on the recommendations outlined in the Australian Rainfall and Runoff (ARR) 2019 guidelines and the Intergovernmental Panel on Climate Change (IPCC) report 2021. Climate change influences such as changed rainfall patterns, catastrophic fire, and temperature increases resulting in hydrophobic soil conditions have now been modelled against the key rehabilitation components above. Modelling indicates that:

- Catastrophic fire which diminishes the catchment vegetation will have the greatest impact on increased of runoff at the site.
- Rainfall increases will have a slightly greater impact than hydrophobic soil conditions.

Two key findings of the assessment have highlighted recommended design changes for the Main Pit and the EBFR realignment. To maintain the realignment of the EBFR and reduce erosion it will be necessary to enhance the erosion protection immediately upstream and downstream of the Main Pit. Widening of the Main Pit inlet design will be necessary to allow flows to move in an anti-clockwise direction around the pit rim to increase the flow path and reduce flow velocity. No other modification were found to be necessary to mitigate the effects of climate change.

Main Pit Water Cover

The level of the water cover will be dictated by the permanent groundwater table however if evaporation exceeds groundwater inflow and the capping layer be exposed there will be no ongoing environmental impact due to the use of inert material in the 2m thick layer. Geomorphic processes will result in the deposition of sediments from upstream, however, given the estimated long-term settlement of up to 6m it is still unlikely that the capping layer will be exposed. It is certain that there will be differential settlement across the pit capping layer which will result in an undulating surface and a natural process that cannot be designed out, nor is it a detrimental outcome. The natural process of deposition of upstream sediments will, with time, even out the surface of the capping layer as the Main Pit acts as a "sink" rather than erosive source.

Erosion Monitoring of the Main Pit Capping

The instillation of anchored rods into the waste rock, analogous to a settlement plate, will enable the Project to monitor high risk zones of the Main Pit capping as identified by the Climate Change Assessment (appendix 4). The installed settlement bars will move with the waste rock and depth markings will enable the relative thickness of the capping layer to be monitored throughout the wet season and following high flow or flood events. Evidence of erosion would then trigger corrective actions to repair and reinforce areas that have been susceptible to erosion. Corrective actions would be in the form of capping "top ups" and rock armouring to minimise ongoing erosion. Geophysical surveys such as ground penetrating radar would be triggered if multiple points of erosion activity is identified and used to inform corrective actions. An example of an in-situ settlement plate/rod can be found below at Figure 5, please note that although the below example includes casing around the rod the Project would not include this element to reduce the risk of contaminant movement pathways and oxidisation occurring within the waste rock.

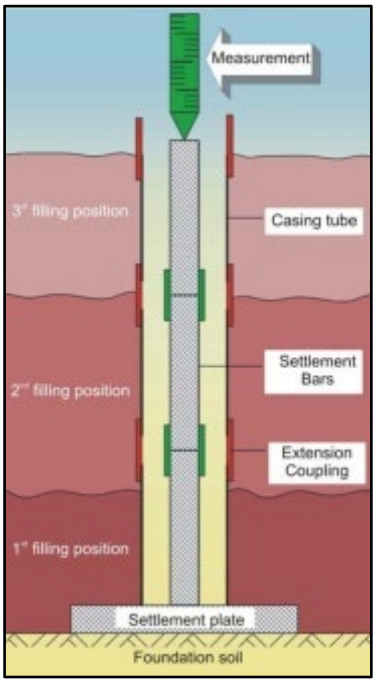


Figure 5. Settlement Plate/Rod for Monitoring (Geometrik 2022).

The Project has included these measures in the EMP Stabilisation Monitoring Plan and Trigger Action Response Plan and supporting management plans as appropriate.

WSF Capping

The results of modelling for 500 year period with no vegetation cover indicate that gully depth is not likely to exceed 1m over 99% of the WSFs with a maximum expected depth of 1.45m, and erosion rates are significantly below industry standards at 1.75t/ha/yr. Regardless of the modelling results the Department is committed to an adaptive management approach and erosion monitoring has been included in the Monitoring Plan. Key management actions include:

- Rock armouring areas of high susceptibility to erosion, which are to be identified once construction is complete and real world performance can be assessed.
- Progressive revegetation and replanting of vegetation in areas that have not preformed to the desired standard.
- Reviewing soil and cover specifications prior to Stage 3 procurement to reconsider opening the suitability parameters towards increasing the rock, gravel, cobble fractions for upper layers of the WSF cover.

The model for the WSF capping was not updated from the original submitted in the Draft EIS as it was found to be adequate as indicated by the climate change assessment.

Browns Oxide

As part of the flood modelling and climate change assessment, and in light of the Projects proposed actions to realign the EBFR, impacts on the neighbouring Browns Oxide mine were considered. With flows redirected through both pits and the flow path between the pits widened and roughened, the peak flow adjacent to Browns will actually be attenuated. Browns Oxide will see an overall lower flood level but this level will persist for a longer period. This impact represents a lower level of risk to the neighbouring pits rather than an increased risk of overtopping during peak flood events.

For more detail on the climate assessment see Appendix 4 of this report.

3.4. Post Rehabilitation Flow Regime

Ref. 3.9	
Comment	The delay in wet season flows reaching the EBFR downstream of the Proposal area was quantified in the Supplement as 24-81 days, depending on wet season rainfall. This is a significant delay, especially in the drier years, which could impact aquatic ecosystems downstream.
Further Information Requested	• Provide an assessment of the potential impact of flow delays on downstream aquatic ecosystems, including consideration of alternatives, such as the retention of the EBFR's current flow path. (NOT ADEQUATE)
Adequacy of Response	• As previously requested, please provide an ecohydrological assessment of impacts on downstream aquatic ecosystems resulting from flow delays. This assessment should include consideration of alternatives, such as retention of the EBFR's current flow path, and of indicator species as a frame of reference for impacts. • Please provide further details, in terms of graphs and/or calculations, to support the conclusions of flow delay calculations presented in the request for further information response, including quantitative assessments of flow delays in the current 0% and the hypothetical 100% flow realignment pathways. The Department recommends these assessments be compared to the proposed 75% flow realignment scenario. • Additionally, please provide an assessment of potential impacts on water quality, erosion, and downstream aquatic ecosystems for each of the 0%, 75%, and 100% flow realignment scenarios. • While the request for further information response presents a number of calculations for the proposed 75% flow realignment scenario, it is unclear if these calculations are based on the initial estimated height of the proposed pit lake, or the height once waste rock settlement occurs. Please provide further information on how the flow delay may change over time, under the above scenarios, and any proposed strategies for management of flow delays. • The Department will ideally require this information to form a view and make recommendations to the Minister as to the acceptability of the proposal under the EPBC Act. An alternative approach may be for the requested information to be considered and endorsed by a committee of suitably qualified experts (to be endorsed by the Minister) as part of the conditions. This endorsement by committee would be required prior to the commencement of the action, potentially be at proponent's expense and may potentially result in administrative (and subsequent construction) delays.

Response

Current conditions onsite, specifically; the pit voids, the dry season drawdown and net groundwater out-flows, alters the hydrology of the EBFR downstream of the site by sequestering a portion of the flow at the beginning of the wet season that would otherwise pass through the site. Once the two pits are filled to their respective levels the influence on the downstream hydrology is virtually imperceptible. The implementation of the rehabilitation plan will reduce the net impact of the pits on the EBFR as the storage

deficit at the end of each wet season is reduced, calculated storage deficits before and after rehabilitation are available below at Table 5 and Table 7, calculated annual runoff volume and percentages required to fill pit deficit are below in Table 6 and Table 8.

Two analyses were carried out to estimate the impact of the open pits on the EBFR hydrology, the impact was quantified by estimating the amount of the streams annual runoff volume that is required to fill storage deficit at the beginning of the wet season. For the assessment the lowest observed historical lake level was used and the storage deficit was calculated as a horizontal slice between the water level at the end of the dry season and the crest of the spill way. Table 8 highlights that post rehabilitation the Main Pit will have a reduced impact on the EBFR through the reduced storage deficit.

Table 5. Estimated Volume between Minimum Water Level and Spillway Crest Elevation – Current conditions

Reservoir	Historically Lowest Lake Level (m AHD)	Spillway Crest Elevation (m AHD)	Empty Storage Available at end of Dry Season (m^3)
Main Pit	57.4	59.95	211,600
Intermediate Pit	56.4	57.82	43,100
TOTAL			254,700

Table 6. Estimated Proportion of Annual Yield Required to Fill Pit Deficit

Condition	Annual Runoff Volume (million m^3)	Proportion of Annual Runoff Required to Fill Two Pits (%)
Average year	23.6	1.1
Dry year with 50-year return period	3.7	6.9

Table 7. Estimated Volume between Minimum Water Level and Spillway Crest Elevation – Post Rehabilitation

Reservoir	Historically Lowest Lake Level (m AHD)	Spillway Crest Elevation (m AHD)	Empty Storage Available at end of Dry Season (m^3)
Main Pit	57.4	59	115,000
Intermediate Pit	56.4	57.82	43,100
TOTAL			158,100

Table 8. Estimated Proportion of Annual Yield Required to Fill Pit Deficit – Post Rehabilitation

Condition	Annual Runoff Volume (million m^3)	Proportion of Annual Runoff Required to Fill Two Pits (%)
Average year	23.6	0.7
Dry year with 50-year return period	3.7	4.3

The rehabilitation plan, including the realignment of the EBFR, is expected to result in a positive impact on the aquatic ecosystem both downstream, within, and upstream of the site. Current conditions on site impact the seasonal flow regime and water quality in the EBFR, the proposed rehabilitation plan aims to address these issues. Importantly restoring the flow of the EBFR through the Main Pit is likely to have a positive impact on the aquatic ecosystem via improved aquatic fauna passage to upstream sites in the wet season. Under current condition fauna passage is heavily impacted, both by physical and chemical barriers, and as a result there has been an observed reduction in recorded species that would otherwise be expected at sites upstream of the mine (Hydrobiology 2016a). The remediation of the EBFR flow path will allow for colonisation of upstream sites after the dry season resulting in a positive impact on fauna habitat.

Downstream fauna species are unlikely to be impacted by the realignment or change in flow regime for a number of reasons. The EBFR immediately downstream of the site, zones 3 and 4, is a highly disturbed system and is currently impacted by the quality of water reporting from the site. Any potential change in flow regime due to realignment is unlikely to cause any further impact to the ecology, the system typically varies by several orders-of-magnitude of the course of a single year as a response to intra-annual variability of the region. The calculated proportion of annual yield from the upstream runoff required to fill pit deficits is overall reduced from the current conditions onsite and therefor delays in flow are not estimated to natively impact the immediate downstream zones.

Further downstream, zones 6 and 7, any impacts from an altered EBFR flow regime will be imperceptible as at this point in the system flows from the main portion of the Finniss, upstream of zone 5, far outweigh the volume reporting from the East Branch of the catchment.

An assessment of erosion in the Main Pit and the impacts of climate change can be found at Appendix 4, however, in summary the Main Pit was found to behave as a sink rather than a source for sediments and impacts from the realignment to the downstream water quality will not negatively impact the system.

3.5. Water Balance

Ref. 3.11	
Comment	A Goldsim Water Balance for the site has been completed, however the proponent only provided a table of the cumulative flows across site and for the water treatment plant (WTP) discharge predicted for 2023 (DPIR 2020c). It is also unclear if the Goldsim Water Balance presented in DPIR (2020b) and the high level water balance provided in SLR Consulting Australia (2020j) are the same. The proponent provided a remediation high level water balance in Appendix 19 of the Supplement. It is not clear if this Water Balance was prepared in accordance with the MCA 2014 Water Accounting Framework. If not, this framework should be used.
Further Information Requested	• Clarify whether the water balances are the same or are independent. If they are independent of each other, provide justification for the separate water balance models presented. (ADEQUATE) • Clarify whether the MCA 2014 Water Accounting Framework was used. If not, provide further information on model construction and estimates and assumptions used in the water balance provided in Appendix 19. (PARTIAL)

	• Provide further information on the estimated discharges to the EBFR over all stages of rehabilitation. (NOT ADEQUATE)
Adequacy of Response	• The Department notes the Goldsim model was confirmed to be "developed in consideration" of the MCA 2014 Water Accounting Framework, but "not 100% consistent" with that Framework. As previously requested, please provide further information on model construction, estimates, and assumptions used to develop both the Goldsim and the SLR water balance models. • Please update the SLR model to incorporate the estimate discharge volume of the different WTP scenarios requested in 3.2 above. Further information on estimated discharges to the EBFR across all rehabilitation stages, as previously requested, should be provided for all scenarios. • The Department will require this information to form a view, and make recommendations to a delegate of the Minister, as to the acceptability of the proposal under the EPBC Act.

Response

Goldsim Model Construction

The objectives of the RGC groundwater flow model were to simulate transient groundwater conditions at the site to allow for a quantitative analysis of groundwater flow and seepage from the landforms on the site. Key assumptions of the model extracted from the 2016 RGC report are listed in the table below, further detail on the assumptions and other aspects of the numerical representation of the model are discussed in section 5 of the RGC report.

Table 9. Key Assumptions of the RGC Conceptual Model – extracted from RGC 2016.

Key Assumptions of the RGC Conceptual Model
The aquifer system at the Rum Jungle Mine Site can be subdivided into hydrostratigraphic units that represent either mine waste (i.e. waste rock and/or tailings) or the naturally occurring bedrock aquifer and overburden units.
Each hydrostratigraphic unit can be represented as a single model layer with representative hydraulic properties (i.e. permeability, anisotropy, storage) and recharge can be estimated as a proportion of incident rainfall.
Water movement in the hydrostratigraphic units follows Darcy's law and hence can be modelled using the 'equivalent porous medium' approach, i.e. the use of effective (or 'bulk') hydraulic properties to approximate conditions in the aquifer.
The flooded Main, Intermediate and Brown's Oxide Pits can be represented by 'specified head boundaries' that are equivalent to observed water levels in the pit lakes during the simulation period.
Shallow creeks and seepage areas within the model domain can be adequately represented by drain nodes that have been set below the ground surface and receive flows from the surrounding aquifer.
Sections of the East Branch of the Finniss River downstream of Old Tailings Creek can be represented by 'specified head boundaries' that are nearly equivalent to observed groundwater levels in monitoring bores near the river.

SLR Water Balance

The WTP output water flow rates remain unchanged regardless of the technology options presented in 3.2. The output flow rates are driven by the input flow rates demanded by both the groundwater treatment system and the main pit backfill surface water system. Insufficient treatment capacity would restrain bit backfilling rates and not be acceptable. Over-designed treatment capacity would not result in an increase in WTP outflows as it is limited by the inflow demands. As such, as WTP outflow rate does not change with treatment technology, there are no changes to what has already been proposed.

The SLR water balance was developed to inform the operational requirements and the design specifications of the WTP (Appendix 17). The design of the WTP and its associated treatment is on the basis of the Project's required inputs matched to pit backfilling and groundwater treatment and the WDL constraints, if any. The overall design of the WTP will be required to have the capacity to process variable low flowrates of highly concentrated aqueous metals from groundwater sources with a pH in the rage of 3.5 at a flowrate of 17L/s in the dry season and 34L/s in the wet season. The Design will also be required to have the capacity to process variable high flowrates from surface water storages onsite in the range of 100L/s in the dry season and 180L/s in the wet season.

Discharge from the WTP is expected to occur over the 10 year construction period with the highest volume of discharge occurring during the Main Pit backfill process where water levels and quality within both the Main and Intermediate Pits will be tightly controlled. Overall volumes of discharge are expected to decrease once the backfill process is complete, however discharge from treated SIS recovered water will still occur. A high level summary of predicted water outflow volumes is presented below at Table 10.

Table 10 Water Management Domains by Operational Year

Year/Season	Estimated volumes by domain (ML/month)	Associated activities
Year 1 Wet Season	Discharge to the EBFR 435 ML	Dewater Main and Intermediate pits to achieve OWL, install and begin SIS program.
Year 1 Dry Season	OWL maintenance 23ML/m SIS recovery program 41ML/m Construction Water 31ML/m Estimated actual discharge to the EBFR 33ML/m	Maintain OWL in both pits treatment via WTP, some water used in construction activities onsite such as dust suppression, SIS program begins GW recovery, all discharges water treated through the WTP.
Years 2 to 4 Wet Season	OWL maintenance 176ML/m SIS recovery program 82ML/m WSF sediment basins via WTP 36ML/m Construction Water 29ML/m Estimated actual discharge to the EBFR 265ML/m	In addition to year 1 dry season activities surface water captured in the WSF sediment basins will be treated via the WTP.
Years 2 to 4 Dry Season	OWL maintenance 23ML/m SIS recovery program 41ML/m Construction Water 31ML/m Estimated actual discharge to the EBFR 33ML/m	Overall reduction in water treatment demands due to reduced surface water.

Year/Season	Estimated volumes by domain (ML/month)	Associated activities
Years 5 to 6 Wet Season	SIS recovery program 82ML/m WSF sediment basins via WTP 36ML/m Construction Water 29ML/m Estimated actual discharge to the EBFR 89ML/m	Main Pit backfill operations complete, WSF still under construction. Overall reduction in water treatment demands due to reduced level of works.
Years 5 to 6 Dry Season	SIS recovery program 41ML/m Construction Water 31ML/m Estimated actual discharge to the EBFR 10ML/m	Main Pit backfill operations complete, WSF still under construction. Further reduction in water treatment demands due to reduced surface water.
Years 6+ Wet Season	SIS recovery program 82ML/m Estimated actual discharge to the EBFR 82ML/m	SIS recovery program to continue treating impacted groundwater
Years 6+ Dry Season	SIS recovery program 41ML/m Estimated actual discharge to the EBFR 41ML/m	SIS recovery program to continue treating impacted groundwater

Red indicates water used onsite for construction activities which will decrease the total estimated volume of water discharged to the EBFR.

Overall discharge volume to the EBFR will be diminished by the use of treated water onsite during construction activities. The development of the SLR water balance model was based on the calculated Project requirements for production rates and the projected demand for water treatment and use onsite. Further discussion of the WTP design and treatment options is available at Appendix 1.

3.6. Flooding

Ref. 3.12	
Comment	The flood assessment (Appendix 17 of the Supplement) does not include a sensitivity analysis that assesses likely impacts of more severe rainfall events on the risk of pit dams overtopping. The Proponent has not examined the erosive potential of stream flows during extreme events, or runoff from earthworks with leachable solutes (preferential transportation of sediments and contaminants downstream)
Further Information Requested	• Provide a sensitivity analysis for the flood assessment that addresses likely impacts of more severe rainfall events on the risk of pit dams overtopping. (NOT ADEQUATE) • Examine the erosive potential of stream flows during extreme events, or runoff from earthworks with leachable solutes (preferential transportation of sediments and contaminants downstream). (NOT ADEQUATE)
Adequacy of Response	• Please provide, as previously requested, a sensitivity analysis for flood assessment that addresses likely on-site and downstream impacts of severe and extreme event rainfall and the risk of overtopping from the pit dams.

	• Additionally, please provide further information regarding the erosive potential of streamflows during extreme events, including risk of run-off from earthworks containing leachable solutes. • The Department notes that the proponent has outlined management strategies to reduce the risk of overtopping in the Main Pit, and has concluded flood risk on the site is medium-low. Please provide a quantitative assessment of flood risk and proposed management strategies to justify this conclusion. • Additionally, the Department notes post-rehabilitation flood risk modelling was undertaken using a 1% AEP event as the most extreme event. The Department recommends the impact of more extreme events be investigated and incorporated into the detailed Climate Change Assessment requested above. • The Department will require this information to form a view, and make recommendations to a delegate of the Minister, as to the acceptability of the proposal under the EPBC Act.

Response

Additional flood assessments have now been undertaken (Appendix 4) with consideration of the influence of climate change on flood levels across the site. The assessment found that, with the impact of climate change, flood levels would increase by approximately 50mm to 600mm however flooding would not exceed the defined channel or inundate WSFs, operational areas, or the WTP during the construction phase (Figure 22 of Appendix 4). The implementation of the ESCP and inclement weather procedures will ensure that sedimentation and runoff from non-flooded areas of the site, including stockpiles, minimise transportation of contaminants downstream. The greatest risk of downstream contamination during the construction phase therefore lies in a flooding event resulting in an un-controlled release of water from the Main and Intermediate Pits. Control of the Main and Intermediate Pits water quality and water levels is covered in the TARP presented in Appendix 2 section 2.2.5 and 2.6.

The assessment did highlight modest changes in the hydraulic behaviour that could impact the long-term erosion potential of the remediation design, specifically around the Main Pit. Recommendations made by the assessment and adopted by the Proponent include:

- Enhanced erosion protection immediately upstream and downstream of the Main Pit.
- Engineering of the Main Pit inlet to facilitate an anti-clockwise flow around the pit rim to reduce flow velocity.

Further detail on the flood assessment can be found at section 8.1.3 of the attached climate change assessment (Appendix 4).

3.7. Current Water Quality/LDWQO's

Ref. 3.13	
Comment	At this stage, the NT EPA does not have adequate information to assess if the proposed LDWQOs are appropriate to achieve the overall project outcomes and whether they are acceptable to provide adequate protection for the aquatic ecosystems of the Finniss River. The Draft EIS and Supplement have provided a large amount of information on water quality and the development and application of LDWQOs. The information is spread over a total of at least 8 documents, including several sections of the Draft EIS, a series of reports by Hydrobiology, groundwater and surface water modelling reports, and Appendix 2 of the Supplement. As previously requested, a concise summary table of proposed protection levels by zone, and proposed guideline values for all contaminants of concern, including a comparison of ANZG default guideline values to the proposed LDWQOs has not been provided by the Proponent, nor has the Proponent provided a suitable data summary that allows a comparison of current water quality to the proposed guideline values.
Further Information Requested	Provide: • a summary of current water quality data, specifying LDWOQs and trigger values in the format provided in Table 2 (of the RFI request). In providing the data, the proponent should include data collected between 2010-2020, or specify the data collection period. (PARTIAL) • Provide a one summary table for each Finniss River zone (1-9). (PARTIAL) • Provide equivalent summaries for groundwater data, grouped by aquifer type and impact/non impact locations depending on data availability (please specify). The groundwater monitoring data to include the full suite of analytes, including metals and the metalloids arsenic and selenium. (NOT ADEQUATE) • Provide a summary of trends in water quality over time as graphs. This should include the monitoring of first flush events. (PARTIAL) • Provide any raw data in Excel format. (NOT ADEQUATE) • Consult with the Environment Division of Department of Environment and Natural Resources to clarify and ensure that the proposed LDWQOs meet the requirements for environmental approvals and waste discharge licencing. [N/A]
Adequacy of Response	The Department notes that the requested information was either not provided or only partially provided. To fill this gap, please provide: - Summary tables for zones 8 and 9 of the Finniss River, in addition to the previously supplied information. - summaries of groundwater data, grouped by aquifer and impact/non impact locations, depending on data availability, as previously requested. Groundwater monitoring data should include the full suite of analytes, including but not limited to metals and the metalloids arsenic and selenium.

	- Any raw data in an Excel format, as previously requested. - A map clearly identifying water data monitoring locations in relation to the Rum Jungle mine site and the Main and Intermediate Pits. Sampling locations should be clearly shown so that spatial trends in contaminant distribution can be clearly delineated • The Department has previously requested summary tables for water quality data in zones 8 and 9 of the Finniss River from 2010-2020, however understands this data may not have been collected. If this data has not been collected, please confirm that this is the case. • The Department notes that, while provided as requested, the surface water summaries show no clear temporal trend for the majority of analytes, with many showing high levels of variance. Please provide summary graphs revised to include rainfall data to enable assessment of potential association between variance and first flush events. The Department notes that, as these summaries were used to develop the existing LDWQOs, inclusion of first flush events in trend analysis could develop systemic biases in the development of LDWQOs. • The Department notes that peer review through a number of conference presentations does not constitute a true peer review process. Please provide written evidence that the proposed revised LDWQOs have been subjected to a rigorous peer review process that assesses and incorporates feedback from experts in ecotoxicology, riparian ecology, and hydrology. • The Department will ideally require this information to form a view and make recommendations to the Minister as to the acceptability of the proposal under the EPBC Act. An alternative approach may be for the requested information, including the revised LDWQOs, to be considered and endorsed by a committee of suitably qualified experts (to be approved by the Minister) as part of the conditions. This endorsement by committee would be required prior to the commencement of the action, potentially be at proponent's expense and may potentially result in administrative (and subsequent construction) delays for the proponent.

Response

Please see Appendix 6 for the raw data in excel format for zones 1 to 7, summary data for zones 8 and 9 is not available as water quality in the estuary zones is not monitored. Surface and Groundwater monitoring points, mine features, and EBFR monitoring zones have also been provided in .kmz format (Appendix 21). Groundwater data is only available for the Rum Jungle lease area (Appendix 21), the Project does not have groundwater bore locations outside of crown land. As there have several iterations of the LDWQOs and updates have been dispersed across multiple reports, for conciseness the must up to date values have been tabulated below (Table 11 and Table 12).

Table 11. LDWQOs - Metals

%PC	Zone/Site		Cu (µg/L)	Zn (µg/L)	Ni (µg/L)	Co (µg/L)	Al (µg/L)	Fe (µg/L)	Mn (µg/L)	U (µg/L)	Se (µg/L)	Mg (mg/L)
70	2	EB@G_Dys	60.2	210.5	130.4	89	142	300	503	31	2	86.6
70	2	EB@GS200	60.2	210.5	130.4	89	142	300	503	31	2	86.6
80	3	EB@GS327	27.5	71.6	43.1	25.9	142	300	225	22.5	2	86.6
80	3	EBdsRB	27.5	71.6	43.1	25.9	142	300	225	22.5	2	86.6
80	3	EB@GS097	27.5	71.6	43.1	25.9	142	300	225	22.5	2	86.6
80	3	EBusHS	27.5	71.6	43.1	25.9	142	300	225	22.5	2	86.6
90	4	EBdsHS	7.86	26.1	20	3.6	117	300	62.2	13.2	2	44.3
90	4	EBusFR	7.86	26.1	20	3.6	117	300	62.2	13.2	2	44.3
95	6	FR@GS204	3.4	26.1	20	2.8	117	300	140	2.9	2	41.1/39.9
95	6	FR3	3.4	26.1	20	2.8	117	300	140	2.9	2	41.1/39.9
95	6	FRusFC	3.4	26.1	20	2.8	117	300	140	2.9	2	41.1/39.9
95	7	FRdsFC	3.4	26.1	20	2.8	117	300	140	2.7	2	41.1/39.9
95	7	FR0	3.4	26.1	20	2.8	117	300	140	2.7	2	41.1/39.9

Red indicates that values have been lowered on advice from Hydrobiology, where two values have been given the first indicated wet season levels and the second dry season levels.

Table 12. LDWQOs – EC and SO_4

%PC	Zone/Site		EC (µS/L)	SO_4 (mg/L)
70	2	EB@G_Dys	687	230
70	2	EB@GS200	687	230
80	3	EB@GS327	464	98.4
80	3	EBdsRB	464	98.4
80	3	EB@GS097	464	98.4
80	3	EBusHS	464	98.4
90	4	EBdsHS	345	25.3
90	4	EBusFR	345	25.3
95	6	FR@GS204	345/438	594
95	6	FR3	345/438	594
95	6	FRusFC	345/438	594
95	7	FRdsFC	345/438	594
95	7	FR0	345/438	594

Red indicates that values have been lowered on advice from Hydrobiology, where two values have been given the first indicated wet season levels and the second dry season levels.

LDWQO Development

The development of the Projects LDWQOs has been entirely in line with the Australian and New Zealand Guidelines for Fresh and Marine Water Quality. As established within the Guidelines, *'For the protection of aquatic ecosystems, locally derived guideline values are the most appropriate'*. While the guidelines present default values, it is noted that there are distinct advantages for tailoring the guideline values to reflect local conditions and values should represent the best available science.

It is also important to consider the level of protection afforded to a water body based on its ecosystem condition, both the current and desired health status, relative to the degree of human disturbance. The current ecosystem condition onsite and downstream of Rum Jungle is highly disturbed, with the present aquatic species protection at less than 1% in Zones 2 and 3. Water quality management in the case of remediation of highly disturbed ecosystems should be more flexible with the aim of achieving improvement from the highly modified state towards ecosystem function that is reflected in the Project's rehabilitation goals. The Project's proposed water quality objectives reflect the level of water quality necessary to meet the agreed rehabilitation goals in line with community values.

A true peer review process is not outlined as a requirement within the *Water Quality Management Framework* the Projects LDWQOs have been available online and open for public comment since the publication of the Draft EIS in 2019 and have been thoroughly reviewed across several areas of expertise relevant to the project due to the considerable public interest. The Project, however, has not formally procured a third party independent review of the work as the quality of this work has not found to be lacking by any internal or external high level review.

Prior to the final submission of the Draft EIS, in late 2019 a meeting of officers from the Project, Hydrobiology, the former DENR, former DIIS, Supervising Scientist Branch and Office of Water Science was held for the Project to present the Downstream Ecosystem Impact Assessment and Locally Derived Water Quality Objectives. The purpose of the meeting was to sound out the approach and findings with key stakeholders and to seek feedback on acceptability of approach for development and acceptance of LDWQOs. Hydrobiology presented the methodology including consultation with Traditional Owners for site and downstream and establishment of values with this important community sector. It was noted at the meeting that Hydrobiology had recently presented this work to the NTEPA for feedback and SSB noted that ERISS was supportive of the approach taken to develop LDWQOs and given the highly disturbed nature of the system, achieving improvement to the system would be a constructive outcome. Project has also presented the approach to the NT EPA on several occasions seeking feedback and guidance on appropriateness. Although, not formal peer reviews of work, it was encouraging to the Project that such experts were satisfied with the LDWQO approach.

The Project, as always, aims to assess and incorporate any feedback from experts in ecotoxicology, riparian ecology, and hydrology should valuable feedback be provided. While the Project has received some feedback on the development of the LDWQOs, which was addressed in the Supplementary report (2020), to date the Project is yet to receive any additional constructive criticism from the scientific community regarding the process for which the LDWQOs have been developed.

Systemic Biases

Firstly, it is reasonable to conclude, as DAWE has, that for many parameters there have not been strong temporal trends but there has been high variability. For example, the Figure 6 and Figure 7 plots for copper are from (Hydrobiology, 2020). While there are some trends within a season and a zone, there is little consistency in the trends between zones, even within the East Branch, and the trends appear to be strongly influenced by variability. Note that as these are left-censored data, increasing variability will tend to result in positive trends, even if the true mean does not change, but also that statistical analysis of the influence of low-frequency high concentrations has not been undertaken. For example, the apparent trends for Zones 2 and 7 in the dry season and zones 2 and 5 in the wet season were due to higher variability in the 2017 and 2018 datasets.

However, it is not reasonable to assume any particular association of the derived LDWQOs with first flush event for two main reasons:

- The highest parameter concentrations in a 12 month period are often recorded in the late dry season, not associated with a first flush event. Evapoconcentration during the dry season also can result in very high concentrations.
- The actual first flush is difficult to capture. Although (Hydrobiology, 2016) discusses the influence of early wet season flows on parameter concentrations in the main Finniss River (zones 6 and 7), this is specifically noted for the sites further from the East Branch, in part because at this distance from the source the first flush is a longer pulse of water, which is easier to capture in a round of sampling. Even so, it was not consistently captured across years.

Also, the timing and nature of the first flush events are also highly variable of themselves. Figure 8 shows daily rainfall at Batchelor airport. Initial wet season rainfall that might trigger a first flush can be a single substantial rainfall event, such as the 18.4 mm event at the start of the 2018/2019 wet season or a sequence of much smaller rainfall events 3 to 7 mm) over a month or so, as for the start of the 2020/2021 wet season.

Increased variability will result in a higher 95%ile value for any parameter because of the left censorship of the dataset and the monthly sampling regime implemented at Rum Jungle. Note that the concentrations used for the calculation of the LDWQOs will have been the highest concentration measured of the maximum of 12 samples collected at any one site. However, that highest concentration may or may not have had any particular association with a first flush event, a late dry season evapoconcentration maximum or any other particular climatic event at any single site. The combination of a highly variable climate, including rainfall patterns, and schedule regular sampling means that there is no particular bias inherent in the annual maximums of any parameter at any site or for any zone.

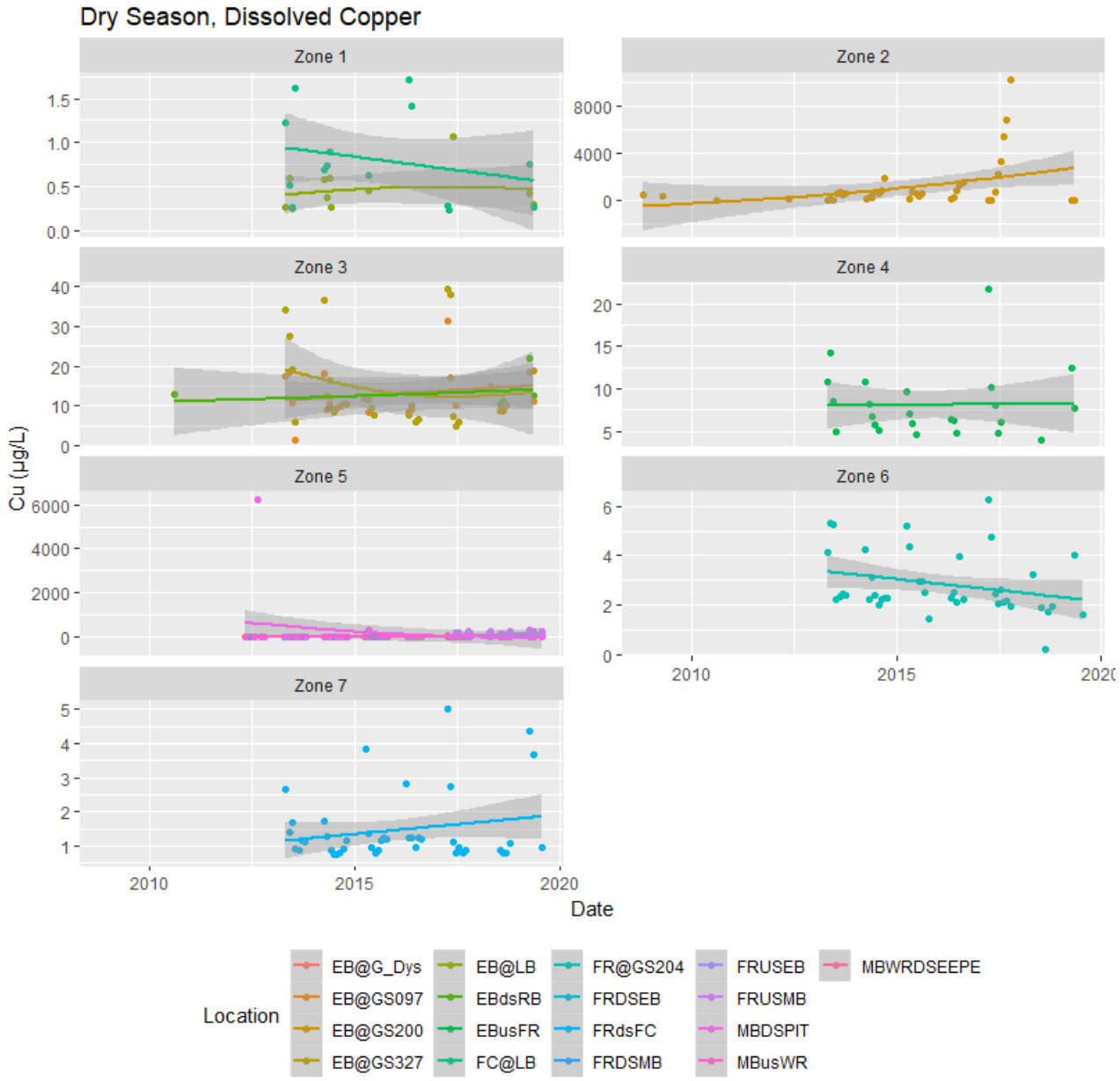


Figure 6. Dry season dissolved copper concentration trends and variability by Finniss River Zone.

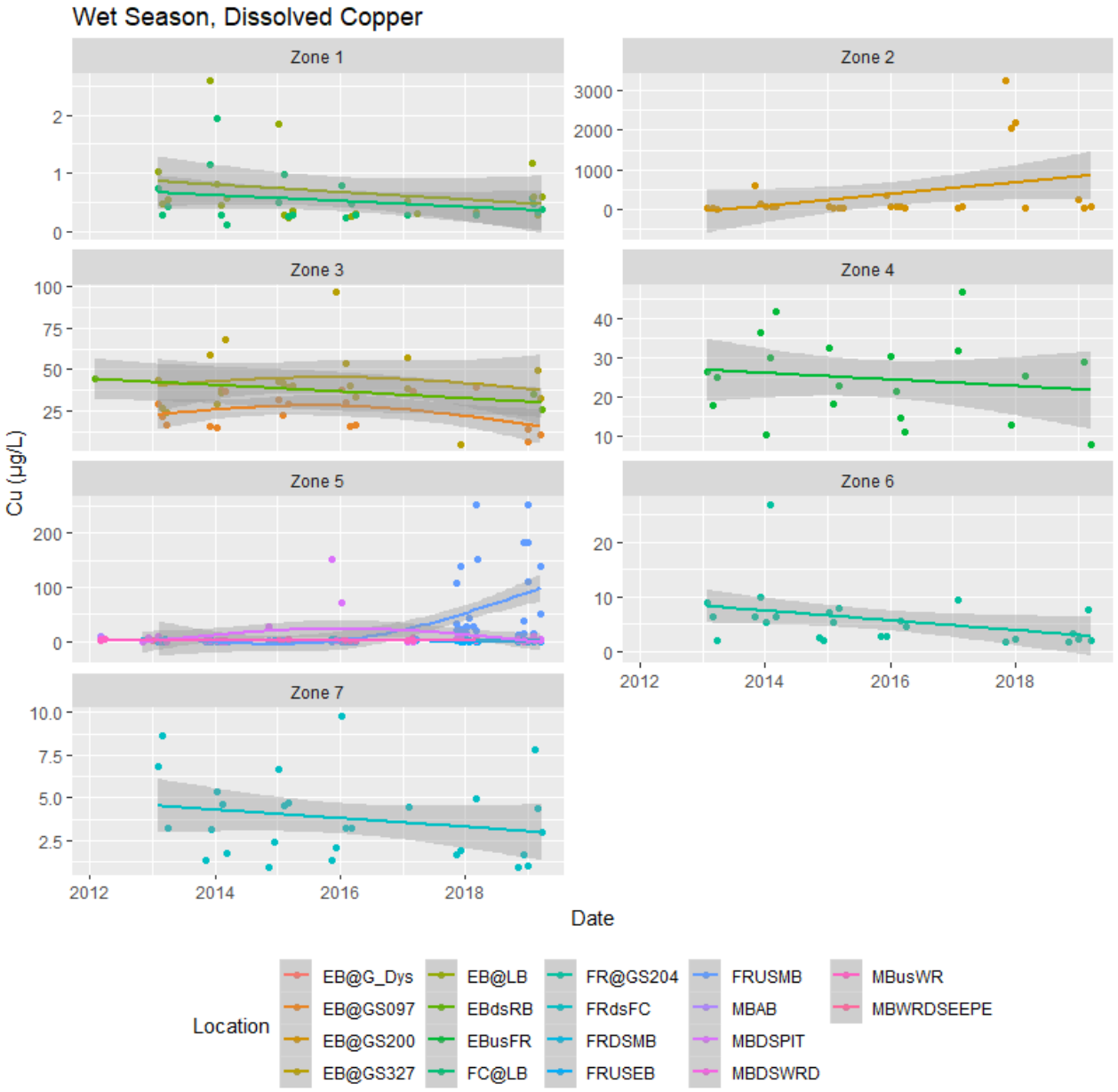


Figure 7. Wet season dissolved copper concentration trends and variability by Finniss River Zone.

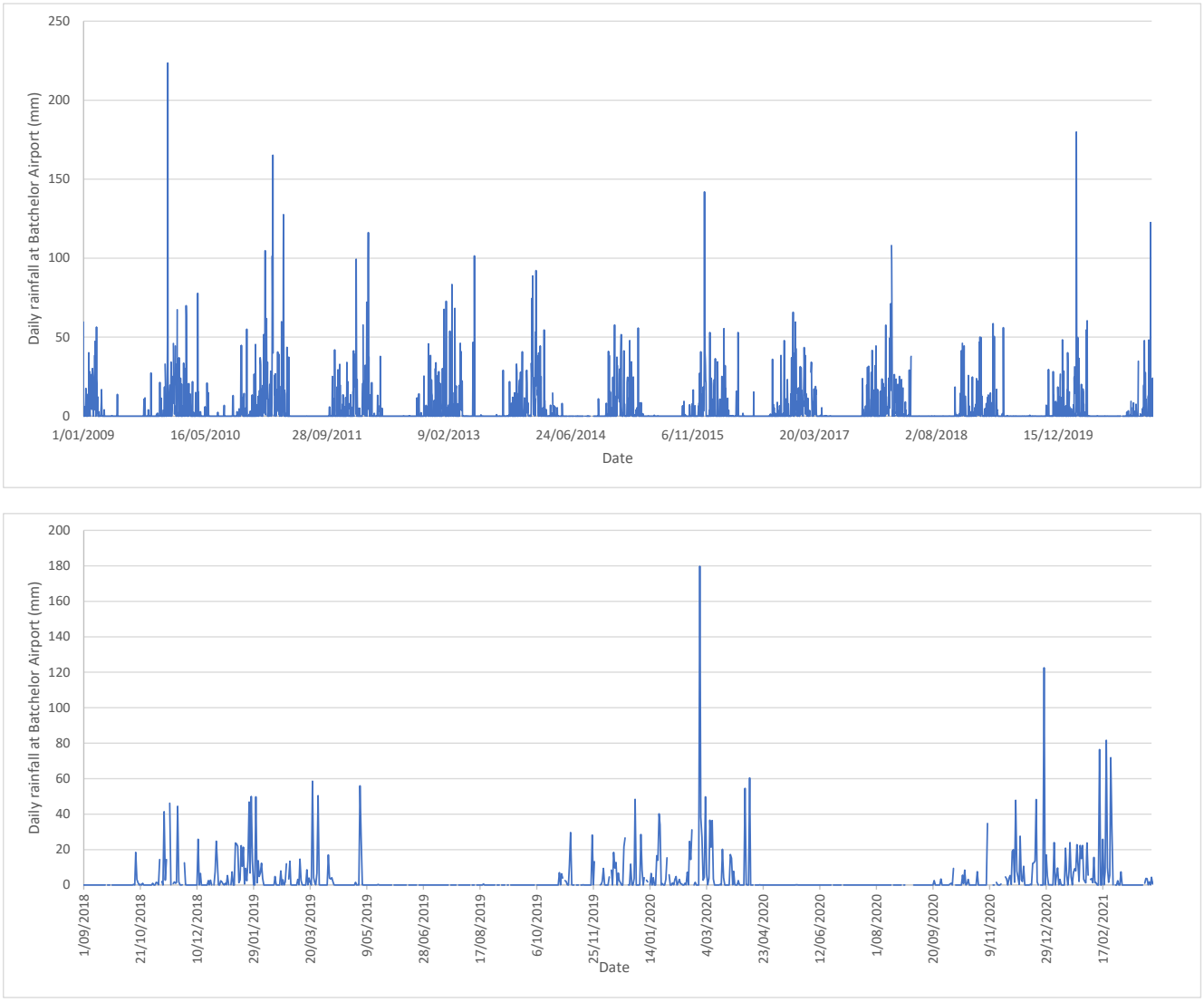


Figure 8. A) Daily rainfall at Batchelor airport 2009 to present and B) September 2018 to present.

Although the first flush has been a concept within the thinking by Hydrobiology for setting water quality objectives for the rehabilitation of the Rum Jungle mine site since at least 2013 (Hydrobiology, 2013), when the concept of applying acute ecosystems response thresholds to those events was put forward, it has been important at that conceptual level, not at the specific level because of the difficulty of reliably sampling the actual first flush.

The approach that has been adopted to use the 95%ile of parameter measurements over the 12 month period prior to collection of biodiversity data (in the early dry season) is consistent with the recommendations of (ANZG, 2018), except that the inter-annual variability of the rainfalls and flows of the Finniss River system has required the use of the 95%ile of a 12 month period rather than a 24 month period. It also provided the best goodness of fit of a range of summary statistics examined as part of development of the LDWQOs (Hydrobiology, 2016).

For these reasons, we regard the approach used as being a) consistent with the national guidelines; b) conservative, but based on actual site-specific biodiversity evidence; c) supported by key stakeholders, including the traditional owners of the lands the rehabilitation will take place upon; and d) able to be achieved, with difficulty and over an extensive period of time post rehabilitation, with the technology available to the rehabilitation project.

3.8. Contaminate Transport

Ref. 3.14	
Comment	The contaminant transport modelling (Appendix 28 of Supplement) includes only Cu and SO4. Metals transport can be affected by a wide range of environmental conditions, including pH, redox, the presence of organic matter, colloids and other metal ions. These matters have not been considered. The proponent has not provided an updated conceptual groundwater model. Therefore the comments made regarding the lack of a detailed (and properly presented) sensitivity and uncertainty analysis means that any discussion on the impact on inland water environmental issues can only be considered partially addressed. For example the sensitivity analysis should include all plausible ranges of parameters. Given the heterogeneity of the bedrock aquifer, the proponent should consider the potential pathways of faults for contaminant transport pathways
Further Information Requested	Provide an uncertainty analysis that considers: • all plausible ranges of parameters (NOT ADEQUATE) • How metal transport can be affected by a wide range of environmental conditions, including pH, redox, and the presence of organic matter, colloids and other metal ions. (NOT ADEQUATE) • potential pathways of faults for contaminant transport pathways (NOT ADEQUATE) • Modelling of the potential risks associated with aquifer contamination due to the groundwater extraction near the main pit should be also considered and provided. This should include the potential risk of contaminant transport pathways from the Main Pit leachate, including radionuclides, during groundwater extraction and backfilling of the Main Pit. (NOT ADEQUATE) Provide an outline of how the identified risks will be addressed and managed following the mitigation hierarchy. (NOT ADEQUATE)
Adequacy of Response	• The Department reiterates concerns regarding limiting contaminant transport modelling to only copper and sulphate. Please provide a revised uncertainty analysis that includes: ○ All plausible transmissivity ranges of all relevant parameters, as previously requested. ○ The effects of environmental conditions on metal transport, including pH, redox, and the presence of organic matter, collloids and other metal ions, as previously requested. ○ Consideration of the potential transport capacity of geological faults on the site, including modelling of both vertical and horizontal hydraulic conductivities within a plausible range of values, including a simulated 'worst case' scenario of high vertical and horizontal hydraulic conductivity.

	• It is unclear if contaminant load modelling includes surface processes, such as sediment loads associated with runoff, erosive potential of stream flows during extreme events, and runoff from earthworks with leachable solutes. As the exclusion of these sources may lead to underestimation of contaminant transport, please provide a revised solute transport model that considers the impacts of these processes. • The Department notes that the EIS, the supplement to the EIS, and the response to the request for further information do not consider faults as potential pathways for contaminant transport. The Department has re-reviewed the previously supplied documentation and is of the view that provided evidence is insufficiently substantiated to justify the assumption that the faults across the Rum Jungle site act as hydraulic barriers. Further, the Department is of the view this document presents evidence that at least some of the faults are transmissive. Please undertake further surveys to assess whether or not the faults across the Rum Jungle site are transmissive or hydraulic barriers. The Department recommends this be assessed via: o Pump testing; o The use of environmental water tracers (e.g. temperature, radioactive and stable isotopes); o A flow test regime; or o Any combination of the above, noting that employing several methods can produce greater confidence in test results. • Should the faults be found to be hydraulically transmissive, please consider the risk of tailings impacted groundwater migration, including if this groundwater could be discharged along creek lines. • The Department notes that this could be a potential source of increased concentrations of copper and other contaminants of interest in Zone 5, upstream of Mt Burton; as several tributaries in Zone 5 sit along the strike of the fault that intersects the Main and Intermediate Pits. • The Department will require this information to form a view, and make recommendations to a delegate of the Minister, as to the acceptability of the proposal under the EPBC Act.

Response

As requested more detail on groundwater modelling and faults as contaminate pathways has been included at Appendix 7 (RGC 2022). The additional work presented by RGC aims to address the general uncertainty of impact certain geological structures onsite have on groundwater flow and contaminate transport.

Background

The groundwater model presented in the Draft EIS and Supplementary report (RGC 2016 and 2019) does not explicitly represent any of the mapped faults as hydraulic barriers or preferred flow paths and instead achieved modelling objectives without adding unnecessary complexity. This decision was based on hydraulic testing results, observed head responses at monitoring wells, and inferred groundwater flow fields near the fault zones indicated that the hydraulic properties of the faults are comparable to the surrounding bedrock. However, the possibility of faults acting as either preferred flow paths or hydraulic barriers has now been further assessed.

Findings of the additional modelling work indicate that faults do not appear to impart a noticeable influence on the groundwater moving through the site. The inclusion of faults in the groundwater model as hydrological barriers has minimal influence on the simulated groundwater flow and none of the additionally modelled scenarios assuming very high or low hydraulic conductivity values within the fault zone offered a better fit for current conditions observed onsite than what was presented in RGC 2019.

Of the additional scenarios presented in Appendix 7 only one could influence post-rehabilitation contaminate transport in groundwater. In this scenario the key outcome is a shorter migration time for SO_4 reporting from the central WSF to the EBFR near the Main Pit. Predicted post rehabilitation loads for both SO_4 and metals however is significantly lower than that of current conditions and this scenario is not expected to impede the Project achieving target LDWQOs or the overall success of the rehabilitation plan.

3.9. Toe Seepage from WSF

Ref. 3.15	
Comment	The SLR report outlines the potential risk of toes seepage from the WSF
Further Information Requested	• Provide further information on how DPIR estimated the assimilative capacity to mitigate the impacts of toe seepage in SLR (2020d). (NOT ADEQUATE) • Further to this, provide information on the risks, potential impacts and mitigation of the toe seepage from the WSF. In particular given there is a risk of the toe seepage from the Central Site WSF could impact the Main Pit wall. The proponent has highlighted there are concerns in relation to the stability of the Main Pit wall in SLR (2020l).(NOT ADEQUATE)
Adequacy of Response	• The SLR report at Appendix 13 of the Supplementary EIS describes estimations of the assimilative capacity to mitigate the impacts of toe seepage from the WSF. Further, the Department notes that the proposed location of the WSF, in relation to attenuation, indicated to be sufficient to reduce risk of toe seepage. However, as no evidence to justify this estimation of attenuation is included, please provide further information on how these estimations were made, as previously requested. The Department requires this information to be provided in order to

	form a view, and make recommendations to a delegate of the Minister, regarding the acceptability of the proposal under the EPBC Act. • Additionally, please include further discussion on the risks, potential impacts and proposed mitigation measures for toe seepage from the proposed WSF, as previously requested. The Department notes that seepage is likely to occur regardless of underlying geology, and recommends further discussion include consideration of the potential of transmissive fault pathways transporting contaminants from the WSF through the Main Pit, and potential risks and impacts to the stability of the Main Pit wall, given the wall's composition of a variety of natural geological sections as well as tailings and other backfill material. The Department requires this information to be provided in order to form a view, and make recommendations to a delegate of the Minister, regarding the acceptability of the proposal under the EPBC Act. • The Department notes that the WSF is **designed to mitigate erosion and manage** surface water drainage under regular dry and wet seasonal variability conditions. The Department recommends the WSF design consider the "worst case" scenarios incorporated into the Climate Change Assessment requested above, including risks of drying and cracking in the WSF capping layer allowing water infiltration and oxygen influx. The Department requires this information to be provided in order to form a view, and make recommendations to a delegate of the Minister, regarding the acceptability of the proposal under the EPBC Act. • The Department notes it is currently unclear if a geoliner is intended to be installed between the WSF and underlying substrate material. The Department recommends the proponent consider the installation of a geoliner to delay the exposure of waste rock to potential groundwater pathways. One option for this geoliner could consist of a layer of smooth high density polyethylene, potentially incorporating a geosynthetic clay liner to provide further security and long-term stability. The Department requires confirmation regarding the geoliner to be provided in order to form a view, and make recommendations to a delegate of the Minister, regarding the acceptability of the proposal under the EPBC Act. • Finally, the Department notes that while the adaptive management strategy is to be defined in Stage 3 works, existing proposed approaches are relatively high level and do not incorporate a range of scenarios. The Department recommends the consideration of further scenarios in the adaptive management strategy, including the "worst case" scenarios and relevant mitigation. The Department requires information regarding the worst case scenarios to be provided in order to form a view, and make recommendations to a delegate of the Minister, regarding the acceptability of the proposal under the EPBC Act. • The Department further recommends the development of a Stage 3 monitoring plan, in consideration of the Climate Change Assessment requested above, to outline quality assurance and controls for the post-construction period, including triggers for geotechnical stability, erosive stability, vegetation performance, and water quality. The Department notes post-construction monitoring is currently proposed for a period of 1 – 20 years: please justify this timescale for the monitoring period, as well as what performance measures would trigger extension or re-establishment of monitoring. The Department considers that these measures could be prescribed in conditions

Response

Seepage

As provided in the ready for construction WSF drawings, no geoliner is included within the base of the new WSFs. These were considered during design build up but ruled out as unnecessary due to the established hierarchy of seepage control measures outlined here:

1. Water shedding design – shedding top plateaus, shedding batters.
2. Water infiltration reduction in capping layers – compacted clay liner on batters and geosynthetic liner on plateaus
3. All placed waste rock compacted to 90% SMDD – internal compaction reduces water percolation rates
4. Revegetated surface reduces capping moisture content after the wet season
5. Modelling of water influx
6. Foundation conditions do not require liner

It is acknowledged throughout the work of RGC and SLR that there will be some basal seepage from the WSFs which cannot be eliminated, even with a basal liner. However that seepage is accounted for within the solute transport modelling completed by RGC to date. The process undertaken by RGC to estimate the attenuation of solutes in the groundwater flow modelling is included in the 2016 and 2019 modelling reports previously provided. Appendix 8 of the Supplementary report (O'Kanes 2015c) predicted basal seepage from the WSFs, this has been included in the RGC modelling work and modelled volumes from seepage from the WSF are low as demonstrated by the predicted plume heat mapping included in the Draft EIS (section 10-57).

It should be noted that the modelling preformed in the 2015 O'Kanes report assessed the design with significantly lower levels of engineering controls within the WSF than that of the design presented in the Draft and Supplementary EIS reports. As such the representation of seepage within the RGC model is conservative and likely to behave more favourably than what is modelled. The project has included additional layers of engineering control to produce a more robust design with as much conservatism as possible and to prevent seepage as far as practically possible.

The decision to lime neutralise all waste rock placed within the WSFs aims to immobilise the contaminant of concern within the WSFs however the RGC model has assumed that there will some basal plume reporting to the Main Pit.

From a geotechnical perspective by the time any basal seepage occurs and reaches the Main Pit, the backfilling operations will be complete, the pit rim will be battered and stabilised and therefore there is no risk of long-term pit wall failure as a result of WSF seepage. As the basal seepage risk from the WSF is relatively low the addition of *geoliner* between the WSF and the underlying substrate would add no measurable value to improve the overall design. As described within the NT EPAs *Contaminated Land Guideline* (2017) it is acceptable to utilise natural attenuation as part of a strategy for managing risks from contaminated groundwater where:

- The source of the contamination has been removed as far as practicable
- The lateral and vertical extent of the contamination has been defined
- And the site hydrogeology has been adequately characterised, and there is clear evidence that attenuation rates are sufficient to achieve the remediation goals at the site within a reasonable timeframe.

The Department considers that the above requirements are met in relation to the WFS design and that the use of natural attenuation is reasonable.

Further issues of climate change and "worst case scenarios" in relation to the WSF design is discussed in section 3.4 and in the attached climate change assessment (Appendix 4).

A draft monitoring plan was provided as an attachment to the Supplementary Report and has recently been updated and is available at Appendix 11.

3.10. Sensitive Receptors – Air Quality

Ref. 3.18	
Comment	The Supplement refers to the Draft EIS appendix GHD 2019a: Air Noise and Vibration Air Quality Impact Assessment for identification of sensitive receptors. This provided a conservative assessment (modelling) of impacts to air quality at a selection of sensitive receptors and proposed measures to mitigate impacts. Viewing of satellite imagery indicates that there are buildings/structures (potentially sensitive receptors) closer to sources of dust emissions than the selected sensitive receptors. This is apparent in Figure 3-6 of the Supplement (and Google Maps imagery). It is unclear if the Proponent is committed to apply the recommended mitigation measures for dust impacts, as described in GHD 2019a, including the recommendations for addressing radionuclide and combustion emissions (in Table 6-2).
Further Information Requested	• Provide a description of how the selected sensitive receptors are representative of all potential sensitive receptors. (PARTIAL) • If additional sensitive receptors are closer to sources of air emissions (including dust) identified in GHD 2019a, provide a discussion of the potential impacts, and measures to mitigate them, at those sites. (PARTIAL) • Provide a commitment that the mitigation measures will be implemented in accordance with the Air and Dust Management Plan (commitment 18; Supplement). (ADEQUATE) • For any residents in areas that may be subject to the mitigation measure of temporarily relocation, indicate the consultation that has already occurred on this matter, and provide a commitment that appropriate consultation will occur in accordance with the Stakeholder and Communication and Engagement Strategy (commitment 41; Supplement). (ADEQUATE)
Adequacy of Response	• The response states that the identified sensitive receptors are the closest to the project from an air quality impact perspective, however, the reasoning is not explained. Instead, references to existing documentation are provided. Please provide a clearer, and more direct, explanation for the discrepancy in sensitive receptor locations. • Future Air and Dust Management Plans as well as Stakeholder Communication Engagement Strategy have been committed to. The Department considers that, if

	the NT EPA were to request the development of these plans under the state legislation, these conditions could be adopted under the EPBC Act. • Consultation has occurred and has been committed to into the future. The Department considers that, if the NT EPA were to regulate this consultation under state legislation, these conditions could be adopted under the EPBC Act.

Response

The Department recognizes that due to the lag between assessment and commencement of on ground work an update to the air, noise and vibration management plans will need to be completed. This will ensure additional sensitive receptors, such as those located in proximity to borrow pits, have been captured and the impacts for human health adequately assessed. In light of the additional receptors being identified in proximity to the Clay Borrow area a preliminary desktop assessment and discussion of potential risks and mitigation measures has been included below.

Air Quality

Potential receptor is located approximately 235m north of the Clay Borrow area. Modelling done by GHD indicates that the receptor falls outside of the ground level Total Suspended Particles maximum annual average concentration and is not expected to exceed the 90 µg/m^3 objective (figure 4-2 of GHD 2019a). Ground level PM_{10} concentration modelling for the maximum annual average (25 µg/m^3) also indicates that there will be no exceedances to the receptor, however the maximum 24-hour average concentration (50 µg/m^3) will likely be exceeded, similar to receptor R8 (figure 4-3 of GHD 2019a). Ground level $PM_{2.5}$ modelling indicates that the receptor is unlikely to receive any exceedances for the maximum annual average (8 µg/m^3), however could potentially exceed the maximum 24-hour average concentration of 25 µg/m^3 (figure 4-4 of GHD 2019a). Modelling does not consider the specific duration of operations at the Clay Borrow area and assumes that earthworks will occur for all modelled days, this ensures that the worst-case meteorological conditions have been captured in the assessment. This has allowed GHD to be conservative in their assessment of exceedances.

With the consideration of local climatic and wind conditions (Figure 9) the receptor is likely to receive moderate exceedances of the maximum cumulative PM_{10} and/or $PM_{2.5}$ concentration objective by more than 10 µg/m^3 for more than one month but is unlikely to exceed them for most months. Due to the nature of the exceedance mitigation measure will be necessary to protect human health. Recommended mitigation measures adopted by the Proponent will include a combination of:

- Reduced rates of operation during poor air quality days[1]
- Reduced rates of operation during wind directions of north
- Operation of a real-time air quality monitoring system[2]
- Dust deposition gauge to monitor effect and compliance

[1] A poor air quality days as defined on the Northern Territory Environment Protection Authority air monitoring network (http://ntepa.webhop.net/NTEPA/Default.ltr.aspx). On days where air quality is very poor or severe, it is recommended that major material handling and hauling operations are ceased.
[2] Real-time air quality monitoring should be installed at the receptor location and will have telemetered alarms to alert operators when and where a trigger level is exceeded.

- Elevated controls including enhanced watering rates on haul roads and water prays during material handling activities
- Limiting of vehicle speeds on haul roads
- Sealing of access tracks to reduce impacts driven by emissions

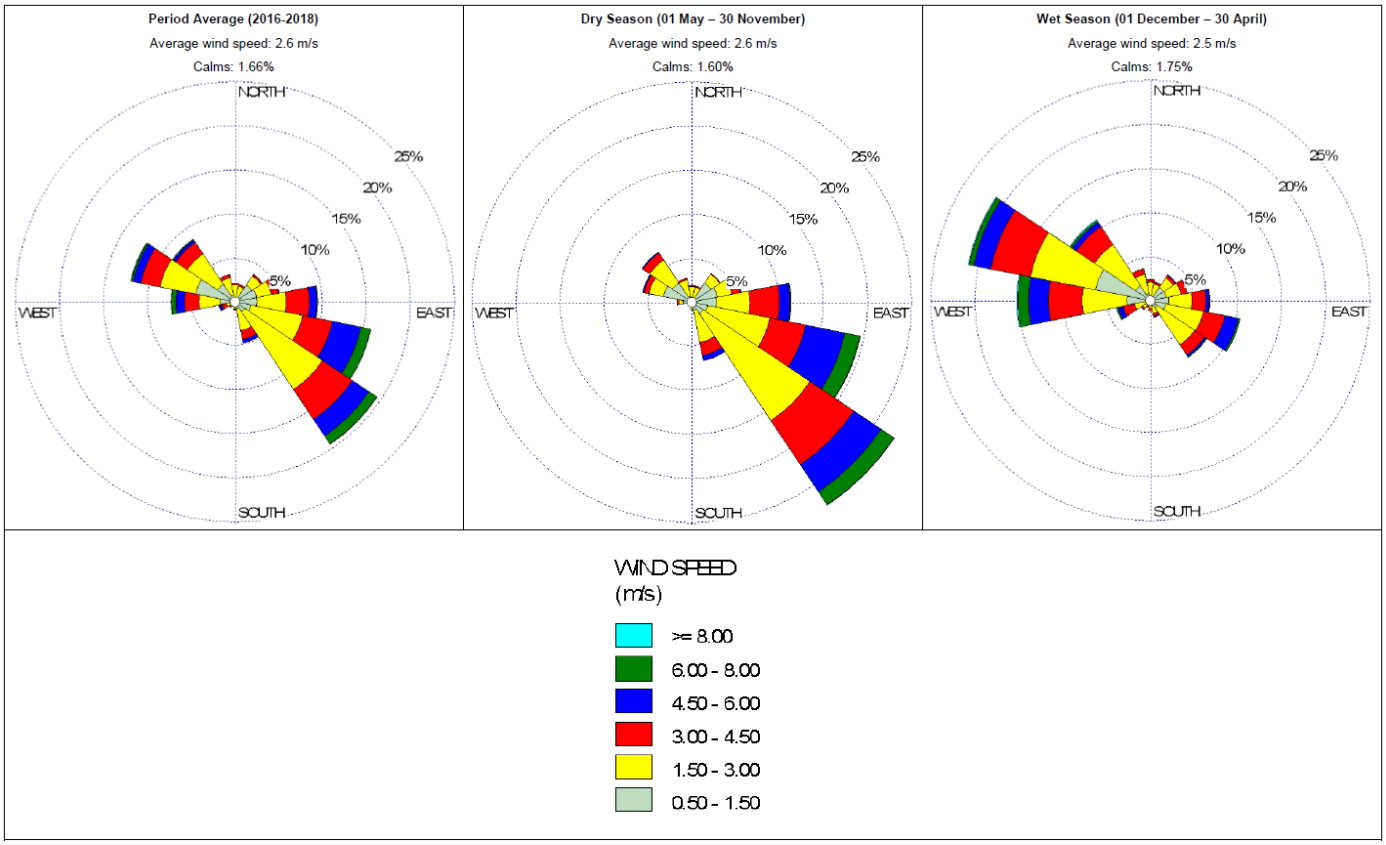


Figure 9. Wind roses at Project Site – figure 3-2 of GHD (2019a).

The mitigation measures outlined above will be incorporated in the Project's Air and Dust Management Plans along with any additional recommendations from an updated Air Quality impact assessment conducted prior to the commencement of earth works. Regardless of environmental approval conditions the Project is committed to further developing the Stakeholder Communication Engagement Strategy to ensure all sensitive receptors are adequately assessed for human health impacts.

3.11. Radiation

Ref. 3.20	
Comment	The Draft EIS and Supplement have not provided adequate information to demonstrate that radiation doses to the public will not be detrimental to human health. The public may be exposed to radiation by being present on site or nearby, or through the consumption of bush tucker (including fish). It is important that a dose assessment is undertaken early, so that if predicted doses exceed dose limits, the rehabilitation design can be altered so as to lower radiation exposure for the future. The International Commission on Radiological Protection (ICRP) and the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) use a system of dose limitation, in addition to the requirement for exposure and doses to be as low as reasonably achievable (ALARA).
Further Information Requested	Provide a site specific dose limit and a commitment to undertake a predictive dose assessment within the first two years of operation. This should be conducted in accordance with guidance by the International Commission on Radiological Protection (ICRP) and the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA). If predicted doses exceed dose limits, alterations to the project design and management may be required. (PARTIAL)
Adequacy of Response	• The Department's Supervising Scientists Branch notes that the information provided with the request for further information was previously provided with the original EIS. • The dose assessment included in the radiological assessment report (Appendix 5) which predicts potential radiation doses to public users for the site in its current (i.e. unrehabilitated) state, not the future rehabilitated state. Please provide modelling scenarios and a predictive dose assessment for the state of the site once rehabilitation activities have been completed. The Department will likely recommend to the delegate that this assessment be completed and approved by the Minister prior to commencement of the action as a condition of approval under the EPBC Act.

Response

As requested above, the Project will provide a site specific dose limit and a commits to undertake a predictive dose assessment within the first two years of operation. Under the current scheduling, this will likely be complete by 2026.

The Project acknowledges that further work is require to accurately model future ingestion exposure pathway and has already commenced additional studies on aquatic food items as of June 2021. A downstream plant and animal food sampling program was carried out in June 2021 with results currently at the laboratory for metals and radionuclide analysis. As yet, the analysis work is not complete.

Until such studies are complete comprehensive modelling cannot be effectively conducted, the Project requires this additional data for the ingestion pathway to form a more complete post rehabilitation scenario dose assessment. The Project, however, considers it reasonable to expect at this time that the modelled pathways for exposure post rehabilitation will either be the same as the current conditions or improved, the rationale for which is briefly discussed below.

There are several remediation measures outlined in the rehabilitation plan that specifically address sources of radiation currently onsite, the outcomes of which are expected to reduce the overall exposure risks post rehabilitation. Presently onsite there are areas that contain levels of radiological soils that were not adequately remediated in the 1980s and were left exposed, thus pose the most significant exposure risk, even though that risk is currently deemed low. These soils will be will be excavated during the first year of earthworks and placed in the bottom cell of the new WSF, in essence eliminating this currently existing pathway. Additionally, waste rock from Dyson's backfill, which also presents a significant potential source onsite, will be used as backfill material for the Main Pit, essentially reducing the total aboveground volume of radiological materials. These two measures alone target a significant portion of the risk related to post rehabilitation radiation exposure pathways.

Additional measures to address the long-term risk of exposure include the improved thickness of the WSF cover systems and the intentional exclusion of food species from the vegetation cover to remove a potential ingestion pathway. These steps in conjunction with the deliberate placement of high risk material within the WSF at a depth greater than 5m will have a net positive impact on exposure reduction post rehabilitation.

An estimate of the potential doses in mSv per month that could be received due to current conditions, including the current WRD cover systems and uncovered radiological soils, found that for Critical Group 1 the total committed effective dose would amount to only 0.3 mSv. It is important to note that members of the public are not considered to be within the Critical Group 1 (construction workers) classification and would receive a significantly lower committed effective dose than that of the recommended 1 mS/y. It is also important to note that it is very unlikely the site will never be open to members of the public, therefore once rehabilitation is complete the two essential groups will be the Land Management Team and Traditional Owners, Critical Groups 1 and 2. Both parties will be subject to the provisions within the Land Use and Management Plan set out by the Contaminated Sites Auditor.

The Project's objective is to not only conform with reference levels but to the overarching principal of As Low As Reasonably Achievable (ALARA). Additional studies will be necessary post rehabilitation to accurately develop the final Land Use and Management Plan, certain activities on site may always be prohibited to maintain the health and safety of land users. This is a decision that can only be made following the completion of rehabilitation activities when the actual residual levels can be measured and long-term exposure pathways accounted for and these facts can inform Traditional Owner decision making with the Contaminated Sites Auditor.

The Project has already engaged the Australian Nuclear Science and Technology Organisation to support the further development of Stage 3 Radiation Management Plans and procedures and to update the predictive dose assessment once real data for ingestion pathway becomes available.

Critically, it is very unlikely that any predicted dose would trigger change to engineering design. If anything, changes to the limitations of future post-rehabilitation land use may be the outcome (no bush food harvesting in certain locations) but this also will not affect the rehabilitation design. As such, it is reasonable to expect that this theoretical calculation can be done when the right information is available and should not be a precursor to starting works.

3.12. On-going and Long-term Management

Ref. 3.1	
Comment	Governance, reporting, engineering oversight and auditing plays a significant part in the ongoing and long-term management and success of the proposed activities including proposed mitigation and management commitments. The Supplement and Appendix 1 indicate that further information about this is available.
Further Information Requested	Provide further information about the ongoing and long-term management of this Proposal, including: • the Governance Board (e.g., participants, purpose, role, and responsibilities, for how long it will exist etc.). (N/A) • an outline of audits and technical reviews planned. (short and long-term > 20yrs) (N/A) • identifying who will take responsibility for actioning and achieving outcomes of rehabilitation management plans. (ADEQUATE) • approach to management/provisions after Stage 4 (> 20 years) to ensure the required land management of the cover systems is maintained. (NOT ADEQUATE) • reporting structures, including communication to stakeholders and the public. (PARTIAL) The information should be supported with diagrams where possible.
Adequacy of Response	• The Department considers that issue of Stage 4 management was not addressed adequately. That is, Stage 4 will not be thoroughly considered until further funding is secured. Instead, an adaptive management approach, contingent on funding and data collected during Stage 3, is proposed. • While this may be a practical reality, the Department requires this information in order to inform its view and make recommendations to the Minister in relation to the acceptability of the proposal under the EPBC Act. Please provide a range of likely management approaches/provisions that may be applied in Stage 4, for the Department's consideration. • A high-level outline of the intention and approach of stakeholder engagement (including community and Traditional Owner groups). The Department will likely require the establishment of the Stakeholder Advisory Group and the development of a Stakeholder Engagement Plan as conditions of approval.

Response

Stakeholder Engagement

As part of the Project Management Plan for Stage 3 works, a Stakeholder Engagement and Communications Strategy has been developed in line with DITT's policies and ongoing commitments of the Project. The purpose of this Strategy is to layout the strategic and operational approach to stakeholder identification, interest discovery, engagement objectives and operational engagement and communications. The purpose of the Strategy is to ensure that stakeholders are engaged with the Rum Jungle Rehabilitation Project in a manner that is aligned to their interest, influence and in some cases statutory or cultural authority.

The Strategy aims to:

- Accurately identify and analyse stakeholders and their interest in the Project
- Support Project transparency
- Operationalise the Project's governance framework
- Inform stakeholders about the former Rum Jungle rehabilitation work plan and progress against it through easily digestible communications
- Maximise local participation in the Project's opportunities which include:
    - major procurements of earthmoving and water treatment services
    - training and job opportunities within major works and minor works packages
    - participation pathways for Kungarakan and Warai people, Coomalie Community Government Council and Batchelor township through Indigenous and local employment and business development.
    - employment and business opportunities for the wider non- Indigenous Coomalie community

The stakeholder landscape has been mapped and an assessment of interest carried out in line with the IAP2 framework. An extract from this Strategy is provided below in Table 13. As the Stakeholder Advisory Group was formed as part of the development of the Stage 2A design process it will simply be reinstated to support Stage 3 program should it be approved. This Strategy is a working document therefore as work progresses and information is gained to continually improve performance, this Strategy will be updated.

Table 13 Select data from stakeholder analysis within engagement strategy

Stakeholder	Interest	Interest	Engagement or Communications	
			Frequency	**Method**
Australian Government (DISER)	Interested in all aspects of the Project	High	High - Daily	• Fortnightly Project Partners meetings • Email and phone • Monthly Reports • Project Board meetings
Project Board	Interested in all aspects of the Project	High	Medium - monthly	• Board Meetings • Monthly Reports
Kungarakan and Warai peoples	Interested in all aspects of the Project (Sacred sites custodians, landholder of 1 borrow pit source and ALRA[3] matters)	High	High – 24 hrs	• Monthly newsletters • Land use agreement (Section 19) • Face to face meetings, phone calls and emails as required • Local Descent Groups
Coomalie Community Government Council	Interested in all aspects of the Project (Landholder of 1 borrow pit source)	High	Medium - monthly	• Face to face meetings, phone calls and emails as required
Department Minister (FFA[4])	Interested in all aspects of the Department and its work	High	Medium – quarterly, as required	• As required meetings and briefs
NT Environment Protection Authority	Assessment and regulation of the Project under EP Act	High	Medium - monthly	• Statutory Reporting • Meetings as required
On site contractor's	Interested in all aspects of the Project	High	High- daily	• Morning pre- start meetings • Meetings, calls • Email
Department of Agriculture Water and the Environment (Cth)	Assessment of and regulation of the Project under the EPBC Act	Medium	Medium – as required	• As required, Statutory Reporting in future
Northern Land Council (NLC)	Statutory body interested in land use agreement (section 19) for 1 borrow pit source and community engagement activities	High	High - fortnightly	• Local Descent Groups • As required meetings etc.
National Indigenous Australians Agency (NIAA)	Interested in Project re Indigenous contracting and grant funding opportunities	Medium	High - fortnightly	• Economic Participation Working Groups • Project Board
BIITE	Interested in training and accommodation opportunities for the TO groups	High	Medium - monthly	• Operational and management meetings
Wunun Consultancy and Business Solutions, Northern Revegetation	TO Business working on Project Interested in supplier opportunities	Medium	Medium - Monthly	• As required email, phone
Ironbark Aboriginal Corporation (CDP Provider for area)	Regional employment and training interests	Medium	Low - as required	• As required meetings, phone, email
Local NGO's	General environmental interests such as impact to EBFR and when it will be improved. Also interested in indigenous engagement and cultural values. Project and business opportunities as they arise after capital works commence	High	Low - 6 monthly	• Stakeholder Advisory Group • Finniss Reynolds Catchment Group
Batchelor residents	General interest in Project: traffic and movement in and around township, job opportunities business opportunities, impact on accommodation services and daily life	Medium	Medium- quarterly	• Public information sessions • Stop Press newsletter
Downstream landowners, water users and recreational fishers (including neighbouring mine sites Brown's Oxide and Woodcutters	Interest in environmental impact of Project e.g. downstream water quality	High	Medium - quarterly	• Finniss Reynolds Catchment Group • Stakeholder Advisory Group • Public information sessions

[3] *Aboriginal Land Rights (Northern Territory) Act 1976* (Cth)
[4] Federation Funding Agreement

Stage 4 Likely Management Approaches.

The Rum Jungle Project site is NT Crown Land and will remain so until such time as resolution of the outstanding handback of land to Traditional Owners can be achieved. As such, responsibility for site maintenance remains the responsibility of the site owner. It is envisaged that this work would be delivered under a Federation Funding Agreement in line with current arrangements between the NT and Commonwealth governments with a focus on Traditional Owner employment and participation opportunities.

The management approach for this period will be informed by the Contaminated Sites Audit process and the Land Use and Management Plan, which will be developed to support the transition from Stage 3 to Stage 4. This formal statutory process is required to determine actions required to safely maintain and manage the land in Stage 4. The following elements are likely to be required:

- Monitoring of water, vegetation and erosion as outlined in the Monitoring Plan
- Vegetation maintenance as outlined in the Revegetation Management Plan
- Minor erosion repairs
- Weed control
- Fire control

The details of the Stage 4 Land Management and Use Plan will be developed and driven by the needs of Traditional Owners with the Project providing the foundation information around human health and landform stability requirements for 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 Land Use and Management Plan is a requirement to transition from Stage 3 to Stage 4 and as such will be developed towards the later years of the Stage 3 schedule.

The timing of future access may be staged whereby, for example, Traditional Owners can walk on country sooner than more intensive activity. 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. The adaptive management approach will guide actions based on observable site condition established through monitoring.

It is envisaged that prior to completion of Stage 4 long term monitoring, safe restricted access may return for the Traditional Owners of the site. It is envisaged that 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 all parties on progressive steps towards a positive future land use.

The Project's scope of work is to complete the rehabilitation plan to support the eventual hand back of land, that is, hand back of land is contingent on successful rehabilitation. The process of determining the requirements and conditions for hand back is outside of the delegated authority and responsibilities of the Department of Industry Tourism and Trade. None the less, the Project team is currently working with the respective NTG agency to establish the agreement making framework for Traditional Owners and their statutory representatives the Northern Land Council to engage in these long term planning discussions.

3.13. Cover Systems – WSF Long-term Stability

Ref. 3.4	
Comment	Although a high level of investigations and commitments have been made, there are still significant uncertainties of the long-term stability and performance of the proposed cover systems and the geo-liners. A sensitivity analysis of design assumptions was not provided. A major uncertainty is the cover system's heavy reliance on on-going and high intensity management, such as felling of trees and weed management, which cannot be guaranteed at this stage. Worst case future management scenarios, such as development of deep-rooted trees or heavy infestation of gamba grass, should be accommodated for in the cover design to reduce the risk of failure as far as feasible. The Supplement states that design revegetation trials will not be undertaken for the cover systems. Learnings would be achieved through progressive rehabilitation of cover systems and adaptive management. This approach provides only learnings from the early phases of revegetation, but not of the long-term performance of the revegetation and cover systems. It is unknown if material changes over time and from exposure to radiation, acid, saline and other solute extremes have been considered in the sourcing of materials. For example, the low permeability layers of the current WRD are displaying shrinkage cracks and formation of polygonal blocky structures partly due to the high iron content in the clay (Taylor et al. 2003). As this high iron content is typical for the region, the proposed local clay materials should be investigated and assessed (lessons learnt). For uncertainties of the erosion assessment see (7) below – Erosion – WSF.
Further Information Requested	Provide (as recommended by Taylor et al. (2003)), a cover performance assessment, including modelling, taking into account: • the properties of proposed borrow materials. (N/A) • the probable changes in material properties over time, including exposure to acid, saline and other solute extremes. (N/A) • the unavoidable pedological and biological processes with consideration of local tree and weed species root behaviour, fire regime and soil biota. (NOT ADEQUATE) • worst case scenarios for all aspects listed above. (NOT ADEQUATE) A sensitivity analysis of design assumptions must be undertaken, and information gaps addressed through targeted investigations and/or field trails. Outcomes of the sensitivity analysis and an outline of the field trails with respective commitments must be provided.
Adequacy of Response	The response restates the reliance on maintaining ideal vegetation for stability, without detailed alternatives should this approach fail.

	• Overall, there is a reliance on adaptive management measures and deferring decisions until monitoring has occurred. • While rock armour as a remediation measure is mentioned it is not sufficiently discussed, i.e. in a worst case scenario • The response redirects the reader to previously supplied documentation such as the RJ Risk Register. It states that residual risk for the WSA was reduced to Medium/Low in that register, therefore specific triggers and actions have not been developed. • This is not a satisfactory analysis of worst-case scenarios and does not meet the RFI requirements. • The response interprets worst case scenario as non-compliance with design and construction standards. It does not elaborate on the likely outcomes of this scenario. • Therefore, please provide modelling that shows worst case scenario(s) for pedological and biological processes, so that the Department can assess the acceptability of the proposed rehabilitation strategy and make a recommendation to the Minister.

Response

Additional erosion modelling under worst case scenarios (zero vegetation cover) with the impacts of climate change have now been undertaken and are available at Appendix 4. The results of the erosion modelling are also summarised above in section 3.4 of this report. It should be noted that the results indicate that the erosional performance is acceptable even with 500 years of no vegetation cover on the WSFs and erosion rates are likely to be of the order of 1.75 t/ha/yr. which is significantly below industry acceptable guidelines. Regardless of the modelled results the Department is committed to taking an adaptive management approach to erosion monitoring to ensure that impacts of climate change or loss of vegetation are mitigated. This will require a period of monitoring post construction to identify areas of high susceptibility to erosion and assess the overall performance of the landform.

3.14. Cover Materials

Ref. 3.5	
Comment	New studies of cover materials have been submitted in the Supplement (e.g. Appendices 14, 15) with detailed recommendations for the reconstruction of a Kandosol growth medium, stockpile management and soil testing at time of excavation (to confirm suitability) and long-term (to monitor soil development of revegetation). Appendix 20 also recommends that geotechnical parameters of the borrow materials should be reassessed via flume testing and/or field tests prior to construction to ensure that they comply with specification envelopes. As these are only recommendations made by respective consultants, it is unclear what will be adopted and implemented. For example, the Draft EIS and Supplement indicated that field trials would be undertaken for the clay materials (2.1, row 12) and lysimeters would be installed to monitor oxygen and water ingress (Appendices 1, 20), but is unclear if the new recommendations for long-term monitoring of soil development under revegetation (Appendix 14) and soil monitoring stations (Appendix 20) will be implemented. They were not found among the proposed monitoring in Appendix 1.
Further Information Requested	• construction of the growth medium, including stockpile management. (PARTIAL) • testing and monitoring of soils and cover systems at the WSF and Dyson's Pit. (PARTIAL) • if/how cover material recommendations outlined in respective Appendices, including 14, 15 and 20, would be adopted and implemented. (PARTIAL)
Adequacy of Response	• The response identifies a lack of A1 and A2 horizons for the growth medium, but responsibility has been deferred to a future contractor. This leaves some uncertainty as to the viability of the rehabilitation and facilitated impacts should extra material be required from elsewhere. • The Department will likely require a strategy for the A1 and A2 horizons to be incorporated into the Revegetation Management Plan, as a condition of approval, since obtaining enough suitable growth medium will be crucial to successful rehabilitation.

Response

The Project team have been working with local mine rehabilitation specialists to improve the cover material and revegetation planning for the Project. As such, several key findings have recently come to light:

1. Due to the Gamba Grass infested nature of most areas of the borrow pits (to avoid clearing good quality woodland for a rehabilitation project), it is likely that the top 150-200mm of all borrow area soils (A Horizons) will need to be stripped and quarantined form use in revegetation areas.
2. It is preferable to make adjustments to the growth media specifications to include more rocky, gravelly and cobble fractions within the WSF batter cover materials, rather than attempting to perfectly replicate local kandosols as it:
    a. Improves surface stability to improve conditions for vegetation establishment by direct seeding method
    b. Provides improved erosion protection
    c. Practically achievable layering of covers of 300mm depth to a high degree of precision on a slope is difficult to near impossible to achieve
3. Clearing of good quality vegetation for the sake of harvesting more 'perfect' topsoils to develop 'perfect' A Horizons on the revegetation area is nonsensical and causes a net detriment which is to be avoided at all costs
    a. As such, a lower quality of 'topsoil' throughout the growth media is preferable to clearing good quality vegetation for the sake of accessing more 'perfect' topsoil
4. Low nutrient covers are preferred over higher nutrient covers to avoid creating conditions for Gamba Grass to outcompete natives on the revegetation surfaces.
5. Less attention should be paid to developing a layered kandosol or dermosol cover and more attention should be paid to reducing risk posed by cover soil types as far as possible – Gamba Grass, other weeds, fire, grass competition in general and erosion.

These findings are an example of developing and changing information as the Project develops and refines the Project work plan. As such, the Department strongly encourages a pragmatic approach to conditions to allow the Project room to continue to develop best fit solutions.

With this in mind, the SLR 2020 Growth Medium for WSF Capping Design report has been considered in development of the Revegetation Management Plan, Weed Management Plan, Vegetation Clearing Procedure, Rehabilitation Media Stripping and Stockpiling Procedures. The Project will no longer adopt all recommendations from the SLR 2020 Growth Medium report as they must be moderated and balanced with local knowledge and experience in revegetation in this climate.

Further details on the sourcing of growth medium and the revegetation requirements for this material are now included in the Revegetation Management Plan (Appendix 9). The Management Plan outlines key characteristics of the growth medium that will be important to revegetation success including appropriate soil structure and nutrient levels to support native vegetation.

The Project will continue working with its team of discipline experts, mine revegetation experts and suppliers across several consultancies and contractors to continue to refine the Revegetation Management Plan and sub-plans.

While the initial RFI response did highlight the lack of available A1 and A2 horizon material at the desired texture, however, as indicated by the SLR 2020e findings this should not impact the viability of the rehabilitation plan.

Investigations into the availably material from the proposed borrow areas indicate that there is sufficient separate materials to manufacture the A Horizons to satisfy the project requirements (SLR 2020f).

3.15. Erosion WSF

Ref. 3.6	
Comment	The soil cover assumptions in the WSF erosion modelling (Appendix 10) may be unrealistically high and need to be revised. Given that flume testing results indicate highly erosive soils, the stability of the final landform depends largely on the soil cover. This is also reflected in the erosion assessment (Appendix 10), which states that the type and rate of revegetation is critical to controlling erosion. The assessment of the WSF erosion rate was based largely on total soil covers of ≥ 80 (dry season) and ≥ 95% (wet season), which mainly consisted of grass foliage cover. The vegetation surveys of the Rum Jungle site (EcoLogical 2014) indicate that such high % are typically achieved by closed gamba grass grasslands or gamba grass invaded woodlands at Rum Jungle. However, soil covers of native grasslands (WSF rehabilitation target) and woodlands are significantly less dense. Soil cover criteria for the WSF were not found in the Revegetation Strategy (App 27) and the success metrics (Table 7-2, Draft EIS). The latter's erosion criteria is that "erosion processes are self-stabilising". The erosion assessment (Appendix 10) recommends to either match the revegetation plan to the data provided in the report or to re-model soil erosion using the proposed revegetation plan. Both approaches do not take the impact of the annual fire regime into account, which may reduce soil cover, especially grass foliage cover, to < 10%. It is recognised that the proposed batter slopes were assessed under the worst-case scenario of no vegetation cover (Appendix 10). However, continuous soil cover of at least 80-95% cannot be assumed under the local fire regime and additional erosion control measures are required to ensure the long-term (500 year) stability of the landforms.
Further Information Requested	• Incorporate additional erosion control measures in the cover design that do not rely on vegetation cover. (NOT ADEQUATE) • Provide a residual impact assessment of the erosion risk, and the proposed erosion control and mitigation measures. (NOT ADEQUATE)
Adequacy of Response	• Budget and time restrictions have prevented further modelling. • While some corrective measures are mentioned such as rock armour, drainage upgrades and revegetation practices, there is likely insufficient detail to reassure the decision-maker that risk will be adequately managed. • Vegetation remains key to stability and success of rehabilitation, with alternatives only briefly described.

	• Fire exclusion is noted as being required for 5 years post rehabilitation; however, it is likely that intensive fire and weed control will be needed to maintain stability. • Overall, there is a reliance on adaptive management measures to make up for budget and time restrictions. • The Department requires detailed additional erosion control measures in the cover design to be included in the Construction Management Plan that do not rely on vegetation cover. This information is needed to inform its view, and make recommendations to the Minister in relation to the acceptability of the proposal under the EPBC Act.

Response

Additional erosion modelling under worst case scenarios with the impacts of climate change have now been undertaken and are available at Appendix 4. The results of the erosion modelling are also summarised above in section 3.4 of this report. While vegetation is still the preferred option for erosion control additional controls such as rock armouring in susceptible areas, and the use of recycled woody debris from vegetation clearing activities will be incorporated in the Construction Management Plan and the attached Revegetation Management Plan (Appendix 9). Note also the Department's response 3.17 related to incorporation of higher fraction of rocky materials into the cover system to develop more favourable conditions for revegetation establishment.

3.16. Traffic

Ref. 3.16	
Comment	The Supplement included a Traffic Impact Assessment (TIA; appendix 16), but it is unclear if all recommended actions will be carried out. Additionally, it has not addressed all the traffic and transport issues considered as required by DIPL Transport Civil Services Division (TCSD). The Proponent will need to consult with DIPL TCSD regarding further analysis required and measures to mitigate significant potential impacts to the public in relation to road safety, due to the transport of materials on public roads.
Further Information Requested	• Provide an outline of how traffic and transport issues will be addressed with DIPL TCSD. Describe the further studies and analysis that will be undertaken to identify the required mitigation measures. Provide a commitment to implement the required measures and clarify who will be responsible for any required road upgrades. (PARTIAL)
Adequacy of Response	• Vehicle strike incidents/risk to fauna have not been discussed. If this was part of the intent of the RFI, it has not been adequately addressed. In any case it should be addressed to close off on that risk to the environment. • The Department therefore considers that an impact assessment on native fauna, as well as all avoidance and mitigation measures could be included in the proposed Construction Management Plan (CMP). The Department recommends that any condition regarding the CMP include this requirement.

Response

The Proponent will develop a traffic management plan (TMP) in accordance with the *Traffic Act* 1987 and *Control of Roads Act* 1953 and include the relevant elements from the Standard Specifications for road works.

The TMP and Road Use Management Plan objectives are to ensure that any civil operations do not result in harm to a person; do not have an adverse impact on native flora and fauna; and to comply with relevant guidelines.

To manage this objective the TMP will ensure:

- Implementation of appropriate framework for safe operations within the Rum Jungle site and access roads;
- Regular monitoring of vehicle access and movements;
- Relevant traffic signals and or signs are used to notify road users of current operations;
- Implementation of appropriate air quality, noise, and vibration measures;
- Consider potential impacts on flora and fauna issues in the impacts register and implement management actions;

The monitoring of fauna strikes is also included now within the updated Environmental Monitoring Plan attached.

4. References

ANZG, 2018. Water Quality Guidelines Home [WWW Document]. URL http://www.waterquality.gov.au/anz-guidelines (accessed 10.17.18).

DPIR 2019. Draft Environmental Impact Statement, report to the Department of Environment and Natural Resources.

DPIR 2020. Supplementary Report to the Draft Environmental Impact Statement, report to the Department of Environment and Natural Resources.

Geometrik 2022. Settlement Plate in-situ illustration, accessed on 21 June 2022 at https://www.geometrik.se/en/tjansterochprodukter/produkter/sattningsmatare/sattningspegel

GHD Consulting Australia, 2019f. Rum Jungle 3 EIS Risk Register. Issued to the Department of Primary Industry and Resources November 2019.

GHD Consulting Australia, 2019c. Rum Jungle 2A - Air Noise and Vibration Air Quality Impact Assessment. Report to the Department of Primary Industry and Resources October 2019.

Hydrobiology, 2013. Environmental Values Downstream of the Former Rum Jungle Mine Site - Phase 2 (No. 13- 007- NTG01_Monitoring_V1_Final). Hydrobiology, Brisbane, Australia.

Hydrobiology, 2016. Rum Jungle Impact Assessment. Final Report (No. 14- 003- NTG01_Impact Assessment_Final_V1.4). Hydrobiology, Brisbane, Australia.

Hydrobiology, 2016a. Rum Jungle Aquatic Ecosystem Values, Early and Late Dry Season 2015, issued to the Department of Mines and Energy.

Hydrobiology, 2020. Rum Jungle Surface Water Quality Data Summaries (No. B19024_R1). Hydrobiology, Brisbane, Australia.

O'Kane (2015c) Rum Jungle – Waste Storage Facility Waste Placement and Loading Modelling. Memorandum from Pearce. J. Environmental Geochemist to O'Kane Consultants Pty. Ltd. December 2015. (Appendix 8 of the Supplementary Report).

Robertson GeoConsultants 2016. Groundwater Flow transport Model for Current Conditions Part A and Part B, issued to the Department of Primary Industry and Resources (Appendix 28 of the Supplementary Report).

Robertson GeoConsultants, 2019. Rum Jungle Physical and Geochemical Characteristics of Waste Rock and contaminated Materials (Part 1), issued to the Department of Primary Industry and Resources.

SLR Consulting Australia (2020h) Rum Jungle Mine Closure Remediation – East Branch Finniss River – River Reinstatement and Flooding Report. Report to the Department of Primary Industry and Resources, Northern Territory. (Appendix 17 of the Supplementary Report).

SLR Consulting Australia (2020d) WSF Technical Memo on Site Selection. Memorandum from SLR Consulting Australia to the Department of Primary Industry and Resources, Northern Territory Government, February 2020. (Appendix 13 of the Supplementary Report).

SLR Consulting Australia (2020e) Rum Jungle Rehabilitation – Stage 2A Detailed Engineering Design, Growth Medium for WSF Capping. Memorandum from SLR Consulting Australia to the Department of Primary Industry and Resources, Northern Territory Government, March 2020. (Appendix 14 of the Supplementary Report).

SLR Consulting Australia (2020j) Rum Jungle Rehabilitation – Stage 2A Detailed Engineering Design – Water Treatment Facility Design Report. Report to the Department of Primary Industry and Resources, Northern Territory. (Appendix 19 of the Supplementary Report).

The International Association for Public Participant's (IAP2, 2015) Quality Assurance Standard - For Community and Stakeholder Engagement.

5. Appendices

Appendix 1: SLR (2022) *Water Treatment Plant Options Assessment*, issued to the Department of Industry, Tourism and Trade.

Appendix 2: SLR (2020) *Main Pit Backfill Construction Methodology*, issued to the Department of Primary Industry and Resources.

Appendix 3: SLR (2020) *Technical Specification – Main Pit Backfill*, issued to the Department of Industry, Tourism and Trade.

Appendix 4: SLR (2022) *Potential Impact of Climate Change on Rehabilitation Design*, issued to the Department of Industry, Tourism and Trade.

Appendix 5 (a): DITT Environmental Monitoring Unit (2021) *Raw Surface Water Data from Zones 1 to 7*, issued to the Department of Industry, Tourism and Trade.

Appendix 5 (b): DITT Environmental Monitoring Unit (2021) *Raw Groundwater Data*, issued to the Department of Industry, Tourism and Trade.

Appendix 6: Hydrobiology (2022) *Compliance LDWQOs*, issued to the Department of Industry, Tourism and Trade.

Appendix 7: RGC (2022) *IR Response for Rum Jungle EIS*, issued to the Department of Industry, Tourism and Trade.

Appendix 8: SLR (2020) *WTP Specification*, issued to the Department of Primary Industry and Resources.

Appendix 9: Top End Seeds (2022) *RJ3-4-MP-009 Stage 3 Revegetation Management Plan*, issued to the Department of Industry, Tourism and Trade.

Appendix 10: EcOz (2022) *RJ3-3-MP-003 Construction Environmental Management Plan DRAFT*

Appendix 11: DITT (2022) *RJ3-4-P-018 Environmental Monitoring Plan DRAFT*

Appendix 12: DITT (2022) *RJ3-4-Pr-007 Vegetation Clearing Procedure*

Appendix 13: DITT (2022) *RJ3-4-F-004 Ground/Vegetation Disturbance Request Form*

Appendix 14: EcOz (2022) *RJ3-4-MP-019 Cycad Salvaging Procedure*

Appendix 15: DITT (2022) RJ3-4-Pr-009 *Rehabilitation Media Stripping and Stockpiling Procedure*

Appendix 16: EcOz (2022) RJ3-4-MP-011 *Weed Management Plan DRAFT*

Appendix 17: SLR (2020) *Construction Water - Issue for Implementation*, issued to the Department of Primary Industry and Resources.

Appendix 18: SRK (2020) *Rum Jungle Pit Rim Investigations Factual Report*, issued to the Department of Primary Industry and Resources.

Appendix 19: SLR (2020) *Detailed Engineering Design Report*, issued to the Department of Primary Industry and Resources.

Appendix 20: SLR (2020) *Civil and Earthworks Tech Specifications*, issued to the Department of Primary Industry and Resources.

Appendix 21: DITT (2022) *Rum Jungle Monitoring Points*, kmz file.