Northern Territory Environment Protection Authority

ASSESSMENT REPORT 90

Jervois Base Metal Project
KGL Resources Limited

September 2019

Environmental Impact Assessment Process Timelines

Date	Chronology
25/11/2013	Notice of Intent received
25/02/2014	NT EPA decision issued - Environmental Impact Statement (EIS)
27/02/2014	Australian Government decision – not a Controlled Action under the Environment Protection and Biodiversity Conservation Act 1999
09/05/2014	Draft Terms of Reference (1st Edition) released for public comment
28/05/2014	Final Terms of Reference (1st Edition) issued to Proponent
25/01/2017	Clause 14A notification received
01/03/2017	NT EPA decision on clause 14A notification - EIS
14/07/2017	Draft Terms of Reference (2nd Edition) released for public comment
11/08/2017	Final Terms of Reference (2nd Edition) issued to Proponent
19/10/2018	Draft EIS released for public exhibition for 8 weeks
14/12/2018	Draft EIS public exhibition period closed
21/12/2018	NT EPA direction to prepare EIS Supplement issued
29/07/2019	EIS Supplement received
30/09/2019	Assessment Report issued

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Chairman

30 September 2019

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Important Disclaimer

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Acronyms, initialisms and glossary

Adaptive management	A learning-oriented approach to making decisions on the management of natural resources in the presence of incomplete knowledge or uncertainty. It involves iterations of decision making, monitoring, and assessment of system responses, leading to adapted decision-making (NT EPA 2018b)
Additional Information	Additional information to the Draft EIS and the Supplement
Advisory bodies	NTG Agencies having expertise and/or administrative responsibilities in respect of the Proposal
ADWG	Australian Drinking Water Guidelines
AEP	Annual Exceedance Probability
AHD	Australian Height Datum
ALEC	Arid Lands Environment Centre
AMD	Acid and Metalliferous Drainage
ANC	Acid Neutralising Capacity
ANZECC	Australian and New Zealand Environment and Conservation Council
ARI	Average Recurrence Interval
ARMCANZ	Agriculture and Resources Management Council of Australia and New Zealand
ASLP	Australian Standard Leaching Procedure
ASX	Australian Securities Exchange
CLC	Central Land Council
DENR	Department of Environment and Natural Resources
DIPL	Department of Infrastructure, Planning and Logistics
DPIR	Department of Primary Industry and Resources
Draft EIS	Draft Environmental Impact Statement
EA Act	Environmental Assessment Act 1982
EAAP	Environmental Assessment Administrative Procedures 1984
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EL	Exploration Licence

Environment	All aspects of the surroundings of man including the physical, biological, economic, cultural and social aspects (section 3 of the Environmental Assessment Act 1982)
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999 (Australian Government)
ESCP	Erosion and sediment control plan
ESD	Ecologically Sustainable Development
GDE	Groundwater dependent ecosystem
GHG	Greenhouse gas emissions
HDPE	High Density Polyethylene
ILUA	Indigenous land use agreement
MMA	Mining Management Act 2001
MOU	Memorandum of understanding
MRCP	Mine Rehabilitation and Closure Plan
NAF	Non-acid forming
NOI	Notice of Intent
NORM	Naturally occurring radioactive materials
NT EPA	Northern Territory Environment Protection Authority
PAF	Potentially acid forming
PMF	Probable Maximum Flood
Proposal area	The land area of proposed disturbance, including all mine and ancillary infrastructure, Jervois Dam, the water supply pipeline and the borefield.
responsible Minister	Northern Territory Minister for Primary Industry and Resources
ROM	Run-of-mine
SIA	Social impact assessment
Statement of Reasons	Refers to the Statement of Reasons dated 25 February 2014 published by the NT EPA identifying why the Proposal requires assessment by EIS
The Minister	Minister for Environment and Natural Resources
The Proposal	Jervois Base Metal Project
The Proponent	KGL Resources Limited
The Supplement	The Supplement to the Draft EIS
The / this Report	Assessment Report 90 for the Jervois Base Metal Project
TPWC Act	Territory Parks and Wildlife Conservation Act 1976

TSF	Tailings storage facility
WMPC Act	Waste Management and Pollution Control Act 1998
WRD	Waste rock dump

Units and symbols

%	percent
>/<	greater than/less than
°C	degrees Celsius
$CO_{2\text{-}e}$	carbon dioxide equivalent
Bq/g	Becquerel per gram
Gj/y	Gigajoules per year
GL	gigalitre (billion litres)
ha	hectare
KL	kilolitre (thousand litres)
km	kilometre
km^2	square kilometre
L	litre
L/s	litres per second
m	metre
ML	megalitre (million litres)
ML/y	megalitre per year
Mt	mega tonne (million tonnes)
MW	megawatt (million watts)

Summary and recommendations

Environmental impact assessment (EIA) is a process for identifying the potential environmental impacts and risks of a proposed action, evaluating the significance of those impacts and risks, and determining appropriate avoidance, minimisation/mitigation measures to reduce those impacts and risks to acceptable levels.

This Assessment Report (this Report) evaluates the environmental impacts and risks of the Jervois Base Metal Project (the Proposal), proposed by KGL Resources Limited (the Proponent). This report concludes the assessment process by the Northern Territory Environment Protection Authority (NT EPA).

The Report is provided to the Northern Territory Minister for Environment and Natural Resources (the Minister) and to the Minister for Primary Industry and Resources (the responsible Minister) for consideration in the development of conditions and approvals for the Proposal under the Mining Management Act 2001 (MM Act). This Report is not an environmental approval although it will guide the decision by the responsible Minister.

The Proponent proposes to develop and operate the Proposal on mineral leases ML30180, ML30182 and ML30829, approximately 270km north-east of Alice Springs and 18km north-east of Orrtipa-Thurra (Bonya) community. The proposed mine is a brownfield site previously mined for base metals (copper, lead, zinc) between 1929 and 1983. The total mining lease area is 1,954ha and is located on the Jervois and Lucy Creek pastoral stations.

The Proposal consists of a base metals mine and includes the development of mine infrastructure areas, a processing plant, a tailings storage facility (TSF), a water supply borefield and pipeline, water dams and an accommodation village within a disturbance footprint of 402ha. Ore would be mined using open cut drill and blast and underground longhole stoping methods from three deposits. Ore processing would involve crushing, screening and floatation methods to produce copper and lead/zinc concentrates for export. The proposed mine life is 10 years.

The NT EPA identified potential impacts and risks to: groundwater and surface water hydrology from altered flows; soil, surface water and groundwater quality due to contamination from mining wastes; biodiversity values due to direct and indirect impacts; and social, economic and cultural values. Consequently, the NT EPA assessed the Proposal against the NT EPA's objectives for the key environmental factors of:

- Hydrological processes
- Inland water environmental quality
- Terrestrial environmental quality
- Terrestrial flora and fauna
- Social, economic and cultural surroundings.

The NT EPA considers the Proponent's groundwater assessment provides an adequate preliminary prediction of the potential impacts from mining including drawdown of water in adjacent landholder bores. The Proposal is not located in or near any water control districts. The Proponent's hydrogeological modelling predicts the proposed 2GL/year groundwater extraction from a new borefield in the nearby Georgina Basin Carbonate Aquifer would not reduce water availability for any users.

The Proposal involves mining below the regional groundwater table, which would require dewatering of the four open cut pits and three underground voids experiencing groundwater inflows of up to 1.8GL/year from the fractured rock aquifer. The Proponent

modelled the extent of potential drawdown associated with mine dewatering, and estimated a maximum drawdown of about 100m below the existing water table which would gradually diminish as distance from the voids increases. The EIS found that it is unlikely that drawdown due to mine dewatering would result in material impacts to sensitive receptors, other users or uses. It is unlikely that mine dewatering poses a significant risk to yields of adjacent pastoral bores and community water supplies.

The NT EPA considers that further refinements to the groundwater models are required to improve the prediction of groundwater impacts. The NT EPA has recommended the Proponent implement further measures for sustainable use of water, and develop a Groundwater Management Plan that includes a comprehensive and robust monitoring program to accurately measure any actual drawdown impacts and to refine and validate the groundwater models. The NT EPA has made further recommendations to prevent impacts to groundwater quality as a result of contaminated mine seepage or pit lake formation.

A permanent diversion of Unca Creek is proposed to divert flows around one of four open pits. The NT EPA has recommended an updated creek diversion design to demonstrate that the diversion and flood protection bunding would effectively deliver flows to downstream reaches and provide adequate long term immunity of the final void in extreme weather events. The design would be subject to an independent peer review and surface water models would be updated regularly to improve knowledge of surface water flows. The NT EPA considers that potential impacts and risks to ephemeral waterways from mine discharges are manageable. The Proponent committed to not discharge any mine affected water. Should the need arise to discharge water to the environment, the NT EPA has recommended that any mine affected water is contained within the site until monitoring results indicate that controlled discharges would not cause adverse impacts in receiving waterways.

The NT EPA notes that the Proponent's geochemical assessment concluded that ore and a portion of mine waste contains sulfides and would potentially generate acid and metalliferous drainage (AMD). The NT EPA has recommended that an AMD Management Plan be developed and implemented that includes a program for ongoing mine waste characterisation and classification. Results would be incorporated into sulfur block and geochemical models to validate model predictions, and inform detailed design of the waste rock dumps and tailings storage facility to ensure appropriate management of wastes and minimise potential leachates. The NT EPA has recommended that tailings and reactive material be returned to mine voids to minimise the volume of material requiring surface management and the long term risk of harm to land or water.

The NT EPA considers that effective, long term containment of mining waste during and post-closure, is critical to ensure protection of the receiving environment and that mine rehabilitation and closure planning should be an integral part of mine planning. The NT EPA considers that the Proponent's Mine Rehabilitation and Closure Plan is preliminary and has recommended that it be updated and approved by the relevant regulator with advice from the NT EPA prior to commencement of mining, and that it is regularly reviewed and updated throughout the mine life. The NT EPA recognises that closure decisions must be informed by a thorough and transparent evaluation, involving all relevant stakeholders, of all benefits, risks and costs of all options and considers it important that the potential for long term legacy costs to be borne by the community and government is avoided.

The NT EPA considered the potential impacts of the Proposal on biodiversity values including five threatened fauna species. The NT EPA has recommended the Proponent update its Biodiversity Management Plan in consultation with the Department of Environment and Natural Resources, Flora and Fauna Division, to avoid or manage significant impacts to these species. Further recommendations have been made by the

NT EPA related to monitoring impacts of altered surface and groundwater flows on vegetation health. The Proponent committed to voluntary offsets of unavoidable impacts to significant vegetation types impacted by the Proposal.

The NT EPA considers the Proponent's stakeholder engagement methodology and social impact assessment undertaken for the EIS provided an adequate benchmark against which the social impacts of the Proposal were assessed and management measures identified. The Proposal presents potential economic benefits for the locality and the region through employment and business opportunities. Recommendations are made to enhance opportunities and reduce social impacts by ensuring that all stakeholders, including Aboriginal people, pastoralists and potentially affected community members, are consulted and that their feedback is considered in the development of management plans.

To support the Proponent's commitment to undertake ongoing community engagement and consultation during the life of the Proposal, the NT EPA has made recommendations requiring continued engagement with, and reporting to, stakeholders and the community as the Proposal progresses.

While the NT EPA considers the potentially significant impacts and risks have been adequately identified and assessed using available information, there is inherent uncertainty in predicting future impacts. This uncertainty is due to the complexity and variability of natural systems and, in part, the lack of site specific and baseline data provided in the EIS for some environmental impacts and risks. While there is potential for significant environmental impacts to develop over the life of the Proposal, the NT EPA considers that there are acceptable solutions to manage such impacts and uncertainties should they arise during or post-mining.

Implementation of robust monitoring programs and an appropriate adaptive management framework, developed in accordance with the NT EPA Guidance on Adaptive Management (NT EPA 2018b), will enable identification of changes in environmental conditions and management to adapt and respond to these changes with appropriate mitigation and contingency measures.

The NT EPA makes 25 Recommendations as an outcome of the EIA. These recommendations are for the Proponent to consider in undertaking the action and decision-makers to consider in developing approval conditions for the proposed action.

The NT EPA recommends that the environmental commitments, safeguards and recommendations outlined in the EIS, this Report and in management plans, must be implemented by the Proponent, and reviewed and enforced by the relevant regulators throughout the life of the Proposal to deliver acceptable environmental outcomes.

The NT EPA considers that, subject to the implementation of all recommendations, the Proposal can be managed in a manner that is likely to meet the NT EPA's objectives and avoid significant or unacceptable environmental impacts and risks.

List of Recommendations

Recommendation 1

That the Proponent KGL Resources Limited ensures that the Jervois Base Metal Project is implemented in accordance with all environmental commitments and safeguards:

- **identified in the final Environmental Impact Statement for the Jervois Base Metal Project (draft Environmental Impact Statement, Supplement to the draft Environmental Impact Statement and additional information)**
- **recommended in this Assessment Report 90**
- **to the satisfaction of the relevant regulator.**

The Northern Territory Environment Protection Authority considers that all safeguards and mitigation measures outlined in the Environmental Impact Statement are binding commitments made by the Proponent.

Recommendation 2

That the Proponent provides written notice in advance to the Northern Territory Environment Protection Authority and the Responsible Minister if it alters the Jervois Base Metal Project and/or commitments, safeguards or mitigation measures in the Environmental Impact Statement in such a manner that the environmental significance of the action may change, in accordance with clause 14A of the Environmental Assessment Administrative Procedures 1984.

Recommendation 3

That the Proponent's Groundwater Management Plan must include assessment and management of any stock or drinking water bores that could be impacted by the Proposal, in agreement with the owners and/or operators of those bores. This is to include:

- **conducting a condition survey of local groundwater users to establish baseline conditions prior to commencing construction**
- **a program to monitor water levels at those bores to detect whether levels are within the range of predicted drawdown**
- **procedures for applying clear, quantitative and measureable trigger levels for groundwater drawdown and an outline of specific adaptive management responses that would be implemented if necessary**
- **proposed mitigation and management responses in the event that trigger levels are exceeded**
- **measures to ensure identified groundwater user bores remain operational or provide an alternative water bore or supplies if required, to ensure original daily flow quantities are maintained.**

The Groundwater Management Plan must be updated to the satisfaction of the relevant regulator, prior to the commencement of mining.

Recommendation 4

That approvals and decisions for the Proposal have conditions that require the Proponent to:

- **allocate clear responsibilities and accountabilities for water use and management**
- **set annual water use targets that are approved by the relevant regulator**
- **provide annual updates of the projected water balance for the Proposal in the Groundwater Management Plan, including detailed estimates for the various phases of the Proposal and specifying the source and quantity of the water to be used**
- **demonstrate how water saving considerations are integrated in Proposal planning including final design and technologies**
- **report annually on continual improvement initiatives in water use efficiency including a comparison with relevant water use targets**
- **provide details in an annual Groundwater Management Report on how water will be effectively managed during proposed operations, including minimising water consumption, maximising water reuse and minimising waste water**
- **extract water from bores only when equipped with operating flow meters**
- **record the volume of water extracted from the borefield and mine site bores**
- **report water use performance in relation to targets, and any change to approved targets in an annual Groundwater Management Report to stakeholders.**

The Groundwater Management Plan and annual Groundwater Management Report should be made publicly available on the websites of (as applicable), the Proponent, the Operator and relevant regulatory authorities.

Recommendation 5

That approvals and decisions for the Proposal have conditions that require the Proponent to update the Groundwater Management Plan to the satisfaction of the relevant regulator prior to mining. The Plan should:

- **include a framework identifying the location, timing, methods and parameters for the collection of groundwater hydrology information**
- **establish comprehensive and robust groundwater hydrology datasets**
- **include additional monitoring locations in the groundwater monitoring program to measure impacts to all third party groundwater users including communities and pastoralists**

- **include a framework, with timeframes, for progressing to a Class 2 numerical groundwater model consistent with the Australian Groundwater Modelling Guidelines**
- **actively and continually seek to improve knowledge of aquifers, groundwater levels and groundwater flows affected by the Proposal and incorporate these into the groundwater models at least annually**
- **provide details on how groundwater will be effectively managed during proposed operations including storage, consumption and minimising wastewater**
- **incorporate measures to monitor and assess density driven outflow from final voids and impacts on surrounding groundwater quality**
- **include an independent peer review by a suitably qualified independent professional**
- **include a schedule for reporting of all water monitoring data and an assessment of the impacts on groundwater hydrology in a Groundwater Management Report. The report is to be provided to the relevant regulator within six months of commencement of construction and on an agreed reporting period thereafter**
- **be updated at least annually.**

At a minimum, the Groundwater Management Report must disclose groundwater extraction and use, performance against targets, and any proposed changes to approved targets.

Recommendation 6

That before approvals or decisions are given or made for the Proposal, the Proponent or Operator shall provide to the relevant regulator an updated Unca Creek diversion design and associated modelling and monitoring plan that includes:

- **information on the hydrologic conditions of the existing watercourse and results from hydrologic, hydraulic and sediment transportation modelling used in the design of the diversion**
- **information that demonstrates how the diversion would maintain the existing regional hydrologic regime by effectively delivering the natural flows of Unca Creek to downstream reaches**
- **details on how the diversion would prevent surface and sub-surface flows reporting to the Reward pit, in a 1000 year average recurrence interval flood event (1000 year ARI event) during mining and to the Probable Maximum Flood (PMF) event post closure**
- **measures to minimise impacts on channel morphology upstream and downstream of the diversion, and sediment erodibility on diversion channels banks**
- **the location, function and description of geomorphic and riparian vegetation features within the proposed watercourse diversion**

- **details on how the diversion would incorporate similar habitats as the existing channel and be revegetated to re-establish riparian vegetation in accordance with leading practice**
- **details on how sediment transport and water quality regimes would be maintained while minimising any impacts to upstream and downstream water quality or geomorphology**
- **a program for monitoring and assessment of the performance of the diversion and methods for detecting any upstream or downstream impacts.**
- **engineering drawings depicting the physical attributes and dimensions of the diversion, and plans and specifications sufficient to complete construction and revegetation in accordance with the design**
- **all investigation and other reports relied on by the design**
- **a requirement for review and assessment of the long term stability of the diversion and performance of the diversion against the detailed design objectives, at least 2 years prior to mine closure**
- **a strategy for the long term management of the creek diversion post-closure and a requirement for the strategy to be incorporated into the Mine Rehabilitation and Closure Plan.**

The hydraulic, hydrologic and sediment transport models should be updated with monitoring data to improve knowledge of surface water flows impacted by the Proposal. The updated modelling results should be provided to the relevant regulator on an agreed reporting period that is appropriate for local conditions.

The detailed diversion design is to be peer reviewed by an appropriately qualified and experienced independent professional with relevant expertise in watercourse diversions, and implemented to the satisfaction of the relevant regulator.

Recommendation 7

That approvals and decisions for the Proposal have conditions that ensure, to the satisfaction of the relevant regulator, that all water supply pipeline and access track construction activities, including the removal of vegetation and subsequent rehabilitation, are conducted in a manner that does not cause a material change to the shape, volume, speed and flow direction of any waterway or cause an alteration to the stability of any bed or banks of a waterway.

Recommendation 8

That the Proponent ensure the design, construction and ongoing operation of the Jervois Dam is in accordance with ANCOLD guidelines (2012) or any updates. Compliance with ANCOLD guidelines must be monitored and reported by an independent engineer with appropriate qualifications and experience. The appointment of the independent engineer should be endorsed by the relevant regulator.

A report on compliance with the ANCOLD guidelines should be provided to the relevant regulator and placed on the websites of (as applicable) the Proponent, the Operator and the relevant regulator.

When the dam is no longer required for the Proposal, the Proponent should reduce the dam spillway to the current level (367.4mAHD), unless it can demonstrate by an independent expert approved by the relevant regulator that the environmental benefits of leaving the upgraded dam in place outweigh impacts to downstream ecosystems.

Recommendation 9

That approvals and decisions for the Proposal have conditions that require the Proponent to:

- **undertake kinetic leach and batch water extraction testing in accordance with leading practice AMD procedures recommended in the Australian Government guidelines for preventing acid and metalliferous drainage (DIIS 2016a)**
- **include in the above testing as a minimum:**
  - **materials representative of key lithology/alteration types, covers and tailings**
  - **different material blends (e.g. acid-generating and acid-neutralising materials) to identify management options**
  - **marginal NAF/PAF materials to confirm PAF segregation criteria**
- **undertake kinetic testing in the field in addition to the laboratory based column leach testing, to better reflect site climatic conditions and particle size distributions**
- **commence testing as soon as feasible with results assisting the development of the Acid and Metalliferous Drainage Management Plan (Recommendation 10)**
- **undertake further targeted sulfur testing to infill gaps in coverage for the S block models to validate model predictions and support planning of waste rock management**
- **incorporate the results of geotechnical and geochemical testing into a soil oxygen flux model to inform detailed cover designs for waste rock and/or tailings**
- **use geotechnical and geochemical testing results to regularly refine and update the hydrogeochemical models to improve understanding of the post closure risks of AMD and saline drainage.**

Results of all investigations and testing should be reported to the relevant regulator for endorsement within six months of commencement of the Proposal and on an agreed reporting period thereafter, and inform the development of any proposed management measures.

Recommendation 10

That approvals and decisions for the Proposal have conditions that require the Proponent to develop an Acid and Metalliferous Drainage Management Plan to the satisfaction of the relevant regulator prior to ground disturbing works that:

- **is prepared in accordance with leading practice Acid and Metalliferous Drainage management recommended in the Australian Government guidelines for preventing acid and metalliferous drainage (DIIS 2016a)**
- **incorporates all commitments made by the Proponent in the Environmental Impact Statement for Acid and Metalliferous Drainage prevention, monitoring, management and mitigation**
- **covers all phases of the Proposal, including pre-operation, operation, care and maintenance, rehabilitation/closure, post-closure and relinquishment**
- **ensures all historic metalliferous materials and their leachates are contained and isolated from the receiving environment during all stages of the Proposal**
- **includes a program for ongoing testing and classification of waste rock and tailings (solids, leachates and decant water) to inform appropriate management strategies**
- **incorporates the results of ongoing mine waste characterisation and classification into the sulfur block, geochemical and hydrogeochemical models at least once every six months, to refine the models, validate model predictions and enable ongoing assessment of potential Acid and Metalliferous Drainage water quality impacts**
- **establish targets for acid and metalliferous drainage acids, salts or metals/metalloids and identifies mitigation strategies to enable compliance with the targets should they be exceeded.**

The Acid and Metalliferous Drainage Management Plan should be submitted to the relevant regulator within six months of the commencement of the Proposal as part of the Mining Management Plan, and updated at least annually.

Recommendation 11

That approvals and decisions for the Proposal have conditions that require the Proponent to:

- **design, construct and operate the process water dam in accordance with ANCOLD guidelines (2012)**
- **update the draft Water Management Plan prior to commencement of mining, to the satisfaction of the relevant regulator**
- **adopt the recommendations of the surface water monitoring program independent peer review including:**
  - **the addition of boron, chromium, cobalt, molybdenum, selenium, silver, uranium, vanadium, hardness and total recoverable hydrocarbons to the testing suite**
  - **the addition of in-situ field testing for electrical conductivity, pH and turbidity**
  - **the addition of up-gradient and lowland reference sampling points in a neighbouring stream with similar geology and hydrology**

- **contain all mine-affected water within the mine site until monitoring indicates that controlled discharge, if necessary, can occur without adverse impacts**
- **ensure that water quality meets discharge criteria appropriate to maintain a 95% level of species protection**
- **undertake an assessment of all chemicals used in mining activities (e.g. processing and water treatment), including an assessment of their behaviours and breakdown products in tailings and tailings decant/seepage and their potential to contaminate the environment**
- **have all chemicals used in mining activities approved by the relevant regulator, clearly identified in the Mining Management Plan and included in monitoring programs of water storages and receiving environments as part of the Water Management Plan**
- **demonstrate that discharge water quality can be effectively managed to prevent adverse impacts on the receiving environment in terms of the declared beneficial uses and water quality objectives.**

Should discharge of water from the mineral lease be required, the Proponent must apply for a Waste Discharge Licence under the Water Act 1992.

Recommendation 12

That approvals and decisions for the Proposal have conditions that require the Proponent to update the surface water monitoring program, as part of the Water Management Plan, to the satisfaction of the relevant regulator prior to commencement of the Proposal. The program should:

- **be developed by a suitably qualified professional with experience in aquatic ecosystems of the arid region of Central Australia**
- **be developed specifically for the arid region of Central Australia and, in the absence of specific guidelines for the arid region, take into account the guiding principles of Australian & New Zealand Guidelines for Fresh & Marine Water Quality (ANZG 2018) and other relevant guidelines**
- **be updated based on an assessment of the receiving environment water quality and include clear objectives, targets, indicators, performance criteria, locations and timing**
- **be capable of detecting changes in receiving environment water and alluvial sediment quality and potential impacts associated with the Proposal, to inform appropriate management and mitigation measures**
- **be capable of establishing baseline water and alluvial sediment quality and distinguishing between historic and Proposal related mining impacts**
- **include site specific trigger levels as recommended in Australian & New Zealand Guidelines for Fresh & Marine Water Quality (ANZG 2018)**
- **incorporate a review system to determine the adequacy of the program to meet its monitoring objectives**

- **establish comprehensive and robust surface water quality datasets using event based monitoring records**
- **be updated at least annually**
- **report all monitoring data with an assessment of the impacts on the receiving environment in a Water Management Report to be provided to the relevant regulator within six months of commencement of construction and on an agreed reporting period thereafter.**

Public disclosure of the Water Management Plan and Water Management Reports should be provided on the websites of (as applicable) the Proponent, the Operator and relevant regulatory authorities.

Recommendation 13

That approvals and decisions for the Proposal have conditions that require the Proponent to include in the Mine Rehabilitation and Closure Plan (referred to in Recommendation 25):

- **closure objectives and completion criteria for pit voids that are acceptable to the relevant regulator**
- **a robust monitoring program designed to validate and update modelling and determine whether or not the trajectory for pit water quality indicates closure criteria for final pit void condition can be met**
- **an assessment of the timing and impacts of density driven outflows of pit void water on surrounding groundwater quality**
- **an assessment of the long term (up to 1000 years or equilibrium, whichever is sooner) groundwater quality impacts of full/partial backfilling of pits with tailings and PAF waste rock at closure**
- **analysis of the risk to Unca Creek environmental values of diversion failure taking into account an above-ground TSF and the Reward Pit void, including any backfill scenario**
- **a contingency plan outlining trigger levels for actions, specific responses and mitigation measures, and consequences for rehabilitation and closure activities**
- **a requirement for an independent external audit of the pit void monitoring program and modelling by a suitably qualified and experienced auditor prior to relinquishment. The appointment of the auditor is to be endorsed by the relevant regulator. The auditor is to assess if closure criteria can be met at closure and post-closure. The auditor is to report to the relevant regulator.**

The Mine Rehabilitation and Closure Plan must be submitted for approval by the relevant regulator on the advice of the Northern Territory Environment Protection Authority prior to mining and on an agreed reporting period thereafter.

Recommendation 14

That approvals and decisions for the Proposal require, the Proponent or Operator to provide to the relevant regulator an updated erosion and sediment control plan for the Proposal. The plan must outline all permanent and temporary erosion and sediment control measures proposed to be installed for the Proposal. The updated plan must be prepared by a suitably qualified person and approved by a Certified Professional in Erosion and Sediment Control, in accordance with the International Erosion Control Association Best Practice Erosion and Sediment Control guideline (as amended from time to time) or higher standard. An independent, suitably qualified and experienced auditor must be engaged to review and approve the plan, and to inspect and approve that the work is undertaken according to the plan.

Recommendation 15

That the design, construction, management and closure of the waste rock dumps and tailings storage facility should be overseen by an appropriately qualified and experienced independent technical expert, approved by the relevant regulator, to provide:

- **objective and independent expert review to the relevant regulator:**
  - **on the adequacy of the design of the waste rock dumps and tailings storage facility to ensure long-term containment of waste and leachate**
  - **on the proposed performance monitoring program for the waste storages including potential seepage and leachates**
  - **on decommissioning and final rehabilitation to minimise long-term risks and consequences to the environment, community and future land use from the waste storages**
- **regular independent inspection and audit reports to the relevant regulator to ensure construction, management and closure is in accordance with the endorsed design and design objectives**
- **an independent assessment of the Proposal's management of tailings and waste rock, based on performance monitoring results, in an annual report to the relevant regulator and the Proponent**
- **an independent assessment of the quality assurance and quality control methods, procedures and tests used to verify that the technical specifications are met during construction**
- **assurance that the waste storages, if left to remain as landforms in perpetuity, are constructed and rehabilitated to an agreed suitable standard to achieve the closure objectives.**

The independent expert review and associated reporting and auditing should be made publicly available on the websites of (as applicable) the Proponent, the Operator and the relevant regulator.

Recommendation 16

That approvals and decisions for the Proposal have conditions that require the Proponent to:

- **establish water quality criteria for any mine affected water used for dust suppression, to the satisfaction of the relevant regulator**
- **assess for and treat any soil contamination on the mine site consistent with the National Environment Protection (Assessment of Site Contamination) Measure 1999 prior to mine closure.**

Recommendation 17

The Proponent's voluntary offset strategy should be developed and implemented in consultation with the Department of Environment and Natural Resources Flora and Fauna Division prior to the clearing of sensitive or significant vegetation.

Recommendation 18

That all approvals and decisions in relation to the Proposal include conditions that require the Proponent to implement measures to avoid, manage and mitigate the risk of fauna vehicle strikes and other traffic related incidents in a Biodiversity Management Plan. As a minimum, the Plan should:

- **be based on an identification and assessment of vehicle-related risks to native fauna associated with a 24 hour hauling operation**
- **require internal recording and reporting of fauna injuries and deaths, with regular audits of this data to determine whether additional management measures are required.**

If any threatened fauna species are impacted by Proposal-related traffic, additional traffic management measures should be implemented in consultation with the Department of Environment and Natural Resources Flora and Fauna Division.

Recommendation 19

That approvals and decisions for the Proposal have conditions that require the Proponent to prepare and implement a Vegetation Health Monitoring and Management Plan to the satisfaction of the relevant regulator, on advice from the Department of Environment and Natural Resources, prior to mining. The Plan should include:

- **a detailed baseline map of all riparian vegetation and groundwater dependent vegetation communities potentially impacted by the Proposal, including riparian vegetation along Unca Creek downstream of the Jervois Dam and *Eucalyptus camaldulensis* and *Corymbia opaca* trees in the cone of drawdown associated with mine dewatering and groundwater extraction**
- **methods and procedures for monitoring vegetation health and condition using measurable attributes appropriate for semi-arid vegetation communities**

- **a program to detect significant vegetation stress potentially attributable to the Proposal and assess whether there has been adverse impact (significant alteration beyond natural variation)**
- **a vegetation management trigger-response framework**
- **corrective action measures to be implemented if triggers are exceeded**
- **requirements for regular reporting including a detailed summary of monitoring, analysis of results, contingency actions undertaken and an evaluation of the effectiveness of the program.**

Reports should be provided to the relevant regulator and placed on the websites of (as applicable) the Proponent, the Operator and the relevant regulator.

Recommendation 20

That approvals and decisions in relation to the Proposal include conditions that require the Proponent to provide an updated Biodiversity Management Plan prior to authorisation. The updated Plan shall include:

- **methods for monitoring changes in fauna habitat quality related to the Unca Creek channel diversion and groundwater drawdown**
- **methods and criteria that will be used to identify hollow bearing trees**
- **methods on how appropriate habitat for fauna will be determined**
- **methods to measure parameters such as presence of dieback; tree condition; regeneration; dust accumulation on foliage; thinning of ground cover; plant establishment, growth, diversity and cover; weed density and distribution; and feral fauna abundance**
- **the number, distribution and size of monitoring sites, sampling frequency, methods to collect baseline data and selection of control/reference sites**
- **a strategy for management and monitoring of potential impacts to the grey falcon**
- **a strategy for management and monitoring of potential impacts to the Australian painted snipe.**

The updated Plan should be prepared and implemented in consultation with the Department of Environment and Natural Resources Flora and Fauna Division, and approved by the relevant regulator.

Recommendation 21

That approvals and decisions in relation to the Proposal include conditions that require the Proponent to prepare and implement a Trench Inspection Procedure, to the satisfaction of the relevant regulator, in consultation with the Department of Environment and Natural Resources.

Recommendation 22

That prior to commencement of the Proposal, the Proponent must, to the satisfaction of the relevant regulator:

- **develop and implement a Community and Stakeholder Engagement Plan providing for:**
    - **information on recruitment to maximise local employment and training opportunities and to manage impacts on demand for local workers**
    - **publication of a community complaints telephone contact number and email to allow community members to contact the Proponent in the event of any issues or concerns**
    - **development and implementation of a complaints management procedure that requires complaints to be recorded, investigated and abatement measures to be carried out if required, for handling community complaints and grievances for the duration of the Proposal**
    - **effective ongoing stakeholder engagement and consultation on key mining operations (such as hydrological studies) and agreed post-mining closure, rehabilitation, land uses and access**
    - **a commitment to prioritise local businesses in procurement processes and to identify and implement actions for additional benefits for the affected communities**
- **update the Social Impact Management Plan for approval by the relevant regulator, and then update it regularly during construction and operation. The Social Impact Management Plan is to be informed by details of the matters outlined in the Traffic Management Plan and the Community and Stakeholder Engagement Management Plan listed above**
- **publish a social impact management report prior to commencement of construction and then annually during operation of the Proposal. The report is to detail the effectiveness of the Social Impact Management Plan measures to manage the social impacts and benefits of the Proposal. The report will also detail the effectiveness of community and stakeholder engagement.**

The reports should be provided to the relevant regulator and placed on the websites of (as applicable) the Proponent, the Operator and the relevant regulator.

Recommendation 23

As soon as practicable and within six months (or a longer period agreed in writing with the relevant regulator) of completion of the water supply pipeline, the Proponent or Operator must:

- **reshape all disturbed land in the pipeline corridor to a stable landform similar to that of surrounding undisturbed areas**
- **ensure that all disturbed land in the pipeline corridor is reinstated to the pre-disturbed land condition**

- **take all reasonable and practicable measures to:**
    - **re-establish surface drainage lines**
    - **reinstate the top layer of the soil profile**
    - **promote establishment of vegetation of the same species and density of cover to that of the surrounding undisturbed areas**
- **ensure that the maintenance requirements of rehabilitated land in the pipeline corridor are no greater than that required for the land prior to disturbance**
- **ensure that the water quality of any water courses intersecting the pipeline corridor meets criteria for subsequent uses and does not have potential to cause environmental harm**
- **commence a program of rehabilitation monitoring and reporting for three years after completion of pipeline construction, or until demonstration by an independent suitably qualified person, that rehabilitation objectives have been met. Rehabilitation monitoring reports must be submitted to the relevant regulator at least annually until rehabilitation objectives have been met.**

Recommendation 24

That approvals and decisions for the Proposal have conditions that require the Proponent to backfill tailings and potentially acid-forming waste rock into mine voids, unless otherwise approved by the relevant regulator.

PAF waste rock that is to be returned to mine voids should be stored temporarily in a safe, stable and non-polluting manner.

Subject to the outcomes of Recommendation 13 in this Report, tailings stored in the TSF should be backfilled to pit voids for long term storage.

Recommendation 25

Prior to the commencement of mining, the Proponent must prepare an updated Mine Rehabilitation and Closure Plan (MRCP), that demonstrates the closure option has been determined based on a thorough and transparent evaluation of the benefits, risks and costs of all options. The MRCP should demonstrate that the chosen closure option delivers a superior environmental outcome to other options, measured against the principles of Ecologically Sustainable Development. The MRCP should be approved by the relevant regulator with advice from the NT EPA. This updated Plan must:

- **contain approved Closure Objectives that provide concrete, site-specific and typically measurable statements of what closure activities or measures aim to achieve**
- **address all aspects of rehabilitation and mine closure, including post-mining land use and rehabilitation objectives as agreed with stakeholders, landform designs, schedules for rehabilitation, completion criteria and monitoring of rehabilitation success**

- **demonstrate that there would be no ongoing costs borne by the community and government in future in relation to post-mining land use**
- **include site-specific closure criteria taking into account external threats, physical conditions of the site, species composition, structural diversity and ecosystem functionality of the revegetation, external exchanges and landscape integrity, and an overall condition of the final landform and rehabilitated ecosystems that is similar to the pre-mining condition**
- **include details of the rehabilitation trials and investigations that would inform appropriate landform covers and target ecosystems for all areas to be rehabilitated**
- **provide for ongoing monitoring and maintenance of the site post-mining, in accordance with an approved monitoring and maintenance program that includes a trajectory to achieving closure criteria, until closure criteria are achieved and the site has been relinquished**
- **include details of reporting requirements to the relevant regulator on the performance of progressive rehabilitation works to inform decision-making to ensure successful post-mining rehabilitation**
- **include provisions for independent external audits by suitably qualified and experienced auditors of the development and implementation of the plan at least annually following commencement of operations, at closure and prior to relinquishment of the mineral lease**
- **include investigation of the long-term settling process of tailings and waste rock to inform construction of appropriate landform covers**
- **require independent periodic external audits by suitably qualified and experienced auditors approved by the relevant regulator of any backfilling of mine voids including the backfill design, geotechnical information, placement, compaction, drainage and settlement of material layers and placement of any PAF material below the lowest expected groundwater level.**

1 Introduction

1.1 Purpose of this report

KGL Resources Limited (the Proponent), proposes to develop and operate the Jervois Base Metal Project (the Proposal) located about 270km north-east of Alice Springs. The Proposal involves re-opening Jervois Mine to extract copper and other base metals including lead, zinc and potentially silver and gold from three deposits. The life of mine is 10 years.

The Proposal has been assessed by the Northern Territory Environment Protection Authority (NT EPA) at the level of Environmental Impact Statement (EIS) under the Environmental Assessment Act 1982 (EA Act). The NT EPA has prepared this Assessment Report (this Report) in accordance with section 7(2)(g) of the EA Act and clause 14(3) of the Environmental Assessment Administrative Procedures 1984 (EAAP).

In February 2014, the Australian Department of the Environment and Energy determined that the proposed action was not a controlled action and did not require assessment and approval under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).

The purpose of this report is to ensure that matters with the potential to affect the environment to a significant extent are fully examined and reported. This Report is provided to the Northern Territory Minister for Environment and Natural Resources (the Minister) who will provide the report to the Minister for Primary Industry and Resources (the Responsible Minister) to be taken into account in decisions made by the Northern Territory (NT) Government.

This Report it is not an environmental approval however it will guide the decisions and conditions of approvals, authorisations and other matters.

1.2 Scope of the assessment

The NT EPA assessed the potentially significant environmental impacts and risks associated with the Proposal in line with the NT EPA's environmental factors and objectives and in accordance with the requirements of the EA Act.

The matters relating to the environment that the NT EPA considered necessary to be dealt with in the EIS for the Proposal were identified in the initial Terms of Reference issued in May 2014 (NT EPA 2014c), which were developed in accordance with clauses 8(3) to (6) of the EAAP.

The Proponent submitted a notice of alteration to the Proposal under clause 14A of the EAAP on 25 January 2017. The NT EPA issued new Terms of Reference to the Proponent in August 2017 to incorporate the changes to the Proposal (NT EPA 2017b).

Based on the Notice of Intent and the notice of alteration to the Proposal under clause 14A of the EAAP, the NT EPA identified the following potential environmental impacts and risk categories that contributed to the decision to assess the Proposal at the level of an EIS:

- impacts on biodiversity from land clearing and mining activities
- risk to the value, status and condition of the Jervois Range Site of Botanical Significance

- risks to the quality of and accessibility/availability to shared regional surface and groundwater resources from the development, operation and closure of the Proposal
- uncertainties with regards to the extraction and processing of the ore and associated management of water, tailings and waste streams, including potentially acid forming material
- increased risk of soil erosion and dust generation
- increased demand and/or impact on existing services and infrastructure, including road, railway and air transport networks
- potential for disturbance to heritage places and objects
- impacts on social, economic and cultural surroundings.

The Draft EIS for the Proposal was placed on public exhibition for eight weeks between 19 October 2018 and 14 December 2018. A total of 12 submissions were received, nine from NT Government advisory agencies and three from the public.

1.3 Information before the NT EPA

In making this Report, the NT EPA had regard to:

- the Notice of Intent
- the Notice of alteration
- the Terms of Reference (NT EPA 2017)
- the Draft EIS
- the Supplement to the Draft EIS
- the Addendum to the Supplement
- comments from the public on the draft Terms of Reference and Draft EIS
- comments from NT Government agencies on the draft Terms of Reference, Draft EIS, Supplement to the Draft EIS and Addendum to the Supplement
- technical and other reports and guidelines that are noted in the References (section 8) to this Report.

1.4 Approval and regulatory framework

The Proposal will require approval and regulation by the NT Government. The framework for the approvals and conditions relevant to the Proposal are summarised below.

The NT EPA provides this Report to the Minister. The Minister is required to provide a copy of this Report to the Responsible Minister, together with any written comments made by the Minister in relation to this Report. If the Minister makes a comment in relation to this Report, the Minister must comply with reporting obligations to the NT EPA, under section 8B of the EA Act.

The Mining Management Act 2001 (MM Act) is the primary legislation for the authorisation of mining activities and the regulation of mining sites in the Territory. The Responsible Minister, taking into consideration this Report, will decide whether to grant an authorisation for the Proposal under the MM Act and the conditions that may be

applied. In addition to authorisation under the MM Act, a range of other regulatory approvals may also be required for the proposed activities including clearing native vegetation, fauna handling, impacting heritage sites or sacred sites, accessing water, building accommodation facilities and storing or transporting hazardous chemicals.

Section 8A(2) of the EA Act requires the Responsible Minister to give the NT EPA notice of the decision as soon as practicable, but within seven days, after making the decision. Alternatively, if the decision by the responsible Minister is contrary to this Report, the responsible Minister must comply with reporting obligations to the NT EPA and the Legislative Assembly in accordance with section 8A(3) of the EA Act.

The provision of this Report to the Minister concludes the examination of the EIS by the NT EPA. The EIS and supporting documents can be viewed on the NT EPA website at: https://ntepa.nt.gov.au/environmental-assessments/register/jervois-base-metal-project.

2 The Proposal

A detailed description of the Proposal is presented in the EIS (Draft EIS Chapter 2). The following section provides an overview of the Proposal and its components that comprise the proposed action.

The Jervois Mine is a brownfield site previously mined for base metals (copper, lead, zinc), with a total mining lease area of 1,954ha enveloped within a 3,800ha mineral exploration licence (EL). Remnant mine infrastructure includes a water supply dam (Jervois Dam), tailings storage facilities, waste rock dumps, processing plant and equipment, open pits, underground voids, run of mine (ROM) pads, water storages, a camp, roads and access tracks. The Proponent is proposing to re-open the mine. Mining and associated operations would occur primarily on Mineral Leases ML30180, ML30182 and ML30829 within EL25429.

2.1 Proponent

The Proponent is KGL Resources Limited (ABN: 52 082 658 080), an Australian company listed on the Australian Securities Exchange (ASX). The principal activity of the company is the exploration and development of the Jervois Base Metal Project which it acquired in 2011 through acquisition of Jinka Minerals Limited, a 100% owned subsidiary of KGL Resources Limited.

The Proponent intends to transition its business from exploration to mine development and ore processing. The Proposal would be the Proponent's first development project.

The Proponent has stated that it has not been subject to any proceedings under Australian Government, State or Territory law with respect to the protection of the environment or the conservation and sustainable use of natural resources.

2.2 Proposal description

The Proposal comprises the following key activities:

- open cut and underground mining of base metal deposits of up to 2 million tonnes per year (Mt/y)
- processing and production of up to 150,000t/y of copper and lead/zinc concentrate
- transport of copper and lead/zinc concentrate in road trains to Alice Springs and transfer via rail to Darwin and/or Adelaide Port for export.

The Proposal includes the development of:

- mining infrastructure, including four open-cut pits, three underground mines, a processing plant, waste rock dumps and a tailings storage facility (TSF)
- water storage infrastructure, including the Jervois Dam for mine water supply, a process water dam, an underground dewatering dam and five sediment dams
- a borefield and a 48.5km pipeline for water supply
- a 1.7km permanent diversion of Unca Creek and associated flood protection bunds
- supporting infrastructure such as roads, drainage, power generation and supply facilities and an accommodation village.

A detailed description of the Proposal is presented in Chapter 2 of the Draft EIS with updates outlined in Chapter 2 of the Supplement.

2.2.1 Location

The Proposal is located approximately 270km east-north-east of Alice Springs (approximately 385km by road) and about 17km north-east of Orrtipa-Thurra (Bonya) community (Figure 1) in Central Australia.

Road access to the Proposal is via the fully sealed Stuart Highway (68km), the Plenty Highway (296km), and Lucy Creek Road (20km). The first 96km of the Plenty Highway is sealed and the remainder of the route to the Proposal is unsealed.

The Proposal area is defined by the area of proposed disturbance, including the mine site, Jervois Dam, the water supply pipeline and the borefield. The mine site and Jervois Dam areas are covered by three mineral leases (ML30180, ML30182, ML30829) totalling 1,954ha, entirely within the Jervois Pastoral Lease (Perpetual Pastoral Lease 962) owned by Jervois Pastoral Company Pty Ltd and covering an area of 273,600ha. The mineral leases are held by Jinka Minerals Limited (Figure 2). The borefield and the northern section of the water supply pipeline are located on the Lucy Creek Station Pastoral Lease (Perpetual Pastoral Lease 1007).

The Lucy Creek and Jervois homesteads are located 24km north and 35km south of the Proposal area respectively (Figure 1).

2.2.2 Regional context

The climate of the region is semi-arid desert with dry, hot summers and short, dry winters with a mean average rainfall of 227mm, which falls predominantly between December and March. Average annual evaporation is 3,120mm and exceeds average annual rainfall by more than 10 times. Regional topography is typified by plains and low, rolling hills and braided river systems. Higher relief is provided by isolated ranges such as the Jervois and Toko Ranges.

The mine site is situated on the south-eastern ridge of the Jervois Range. The proposed mining activity is focused along the range of low hills and rises running north to south through the surrounding area. Several ephemeral gullies and deeply etched creeks drain into the area from the Jervois Range contributing to the Plenty and Marshall Rivers, which flow into the Georgina Basin. Arthur Creek provides the main drainage from north and west of the Jervois Range, which also drains into the Georgina Basin.

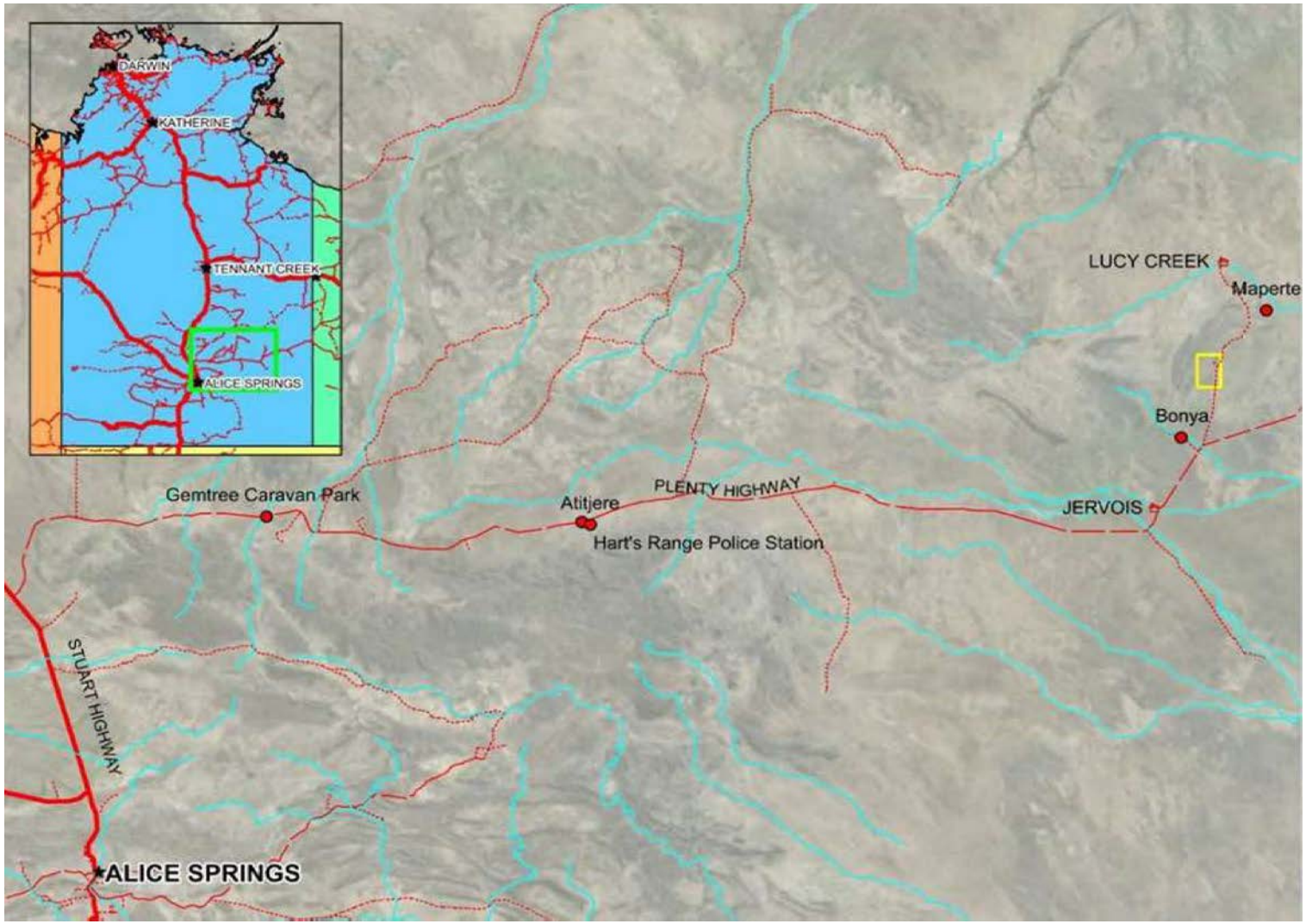

Figure 1 Proposal location. Legend: exploration licence (yellow), roads (red), watercourse (blue), community (red circle). Source: Draft EIS.

The Proposal is located within the Central Desert Region local government area. The current land use at the Proposal area is predominantly cattle grazing with some small scale historical mining. The site includes an abandoned mine with remnant mine infrastructure. The extent of the historic mining and exploration activities limits the potential for use of the Proposal area for grazing.

Five large scale resource projects proposed to be located in central Australia are all expected to commence within five years. Refer to section 5.6.4 for further discussion.

2.2.3 Overview of components

Proposal components are summarised in Table 1 and their location shown in Figure 2.

Table 1 Key components and footprint of the Proposal

Project aspect	Description		Scope	
Schedule	Detailed planning Construction Operation and progressive rehabilitation Closure		2019-2020 (2yrs) 2020-2021 (2yrs) 2021-2030 (10yrs) 2031-2032 (2yrs)	
Whole of Proposal	Total area of mineral leases (ML30180, ML30182, ML30829)		1954ha	
	Total area of exploration licence EL25429		~3800ha (38km^2)	
	Total disturbance area (existing and proposed)		402ha (136ha previously disturbed)	
	Copper resource (estimated)		25.2Mt	
	Workforce		360 jobs (construction) 300 jobs (operations)	
Mining	Open pit mines (four): • Reward open pit (2021 – 2026) • Reward south open pit (2026 – 2028) • Bellbird north open pit (2023 – 2027) • Bellbird south open pit (2023 - 2027)		 800m L x 250m W x 150m D 450m L x 200m W x 100m D 410m L x 210m W x 100m D 150m L x 100m W x 100m D	
	Underground mines (three): • Rockface underground (2021 – 2026) • Reward underground (2025 - 2030) • Bellbird underground (2027 - 2030)		 760m deep 700m deep 420m deep	
	Mining methods: Open pit drill and blast / Underground longhole stoping			
	Ore to be extracted		2Mt/y	
	Waste rock to be extracted		87Mt	
Processing	Method: Crushing, grinding and flotation plant			
	Output: Two base metal concentrates (copper concentrate with 2% copper grade, lead/zinc concentrate)		150,000t/y	
	Tailings storage facility capacity: (ANCOLD standards, composite HDPE/soil liner, basin underdrainage system, decant abstraction system)		20Mt	
Disturbance area summary	**Component**	**Existing (ha)**	**Additional (ha)**	**Total (ha)**
	Accommodation village	0	23	23
	Mine infrastructure area	65	26	91
	Solar array	0	10	10
	Open pits	17	16	33
	Jervois Dam	7	20	27
	Water storage (excluding mine infrastructure area and Jervois Dam)	0	1	1
	Tailings storage facility	14	71	85

Project aspect	Description		Scope	
	Borrow pits	5	12	17
	Underground decline portal and workshop	1	5	6
	Explosives magazine	0	2	2
	Topsoil stockpiles and waste rock dumps	11	78	89
	Borefield and pipeline	14	1	15
	Roads and tracks	2	1	3
	Total	**136**	**266**	**402**
Water use and management	Water demand: 2333 – 2761ML/y (6392 – 7564KL/day)			
	Sources: Rainfall runoff (excluding Jervois Dam) 61 to 96 ML/y Groundwater inflows 1,036 to 1,841 ML/y Supply from Jervois Dam 81 to 86 ML/y Supply from borefield 714 to 1,178 ML/y			
	Discharge: Up to 11ML/y from sediment dams only (if water verified as meeting the discharge criteria)			
	Permanent diversion of a 1.7km section of Unca Creek channel			
Operations	Operating hours: 24 hours, 7 days/week			
Transport	Haulage: 25 return trips per day			
	Route: Road No. 194 to the Plenty Highway then along the Plenty Highway to the Stuart Highway			
Greenhouse gas emissions	Land clearing (one-off)		3,954t $CO_{2\text{-}e}$ (one-off)	
	Construction (one-off)		8,164t $CO_{2\text{-}e}$ (one off)	
	Power generation (assuming 20% solar)		22,859t $CO_{2\text{-}e}$/y	
	Other operational equipment		43,269t $CO_{2\text{-}e}$/y	
	Lube and hydraulic oil		11t $CO_{2\text{-}e}$/y	
	Total estimated emissions		66139 t $CO_{2\text{-}e}$/y (992,085t $CO_{2\text{-}e}$ (life of Proposal)	
Energy requirements	Hybrid diesel and solar power station (20-30% from solar)			
	Diesel power station capacity		12MW	
	Energy requirements (operations)		938,795Gj/y	
	Diesel requirements mining fleet (operations)		26.5ML/y	
Closure	Progressive rehabilitation Rehabilitation after closure		Year 8 - 11 6 months	
	Open pits: Backfilled where possible and practicable (Supplement Table 2.1-4) Abandonment bund installed and left to form pit lakes			
	Underground voids: Secured and allowed to flood, or, cement paste backfilling of tailings (and potentially acid-forming (PAF) material) into underground voids (preferred option - subject to feasibility studies in detailed planning stage)			

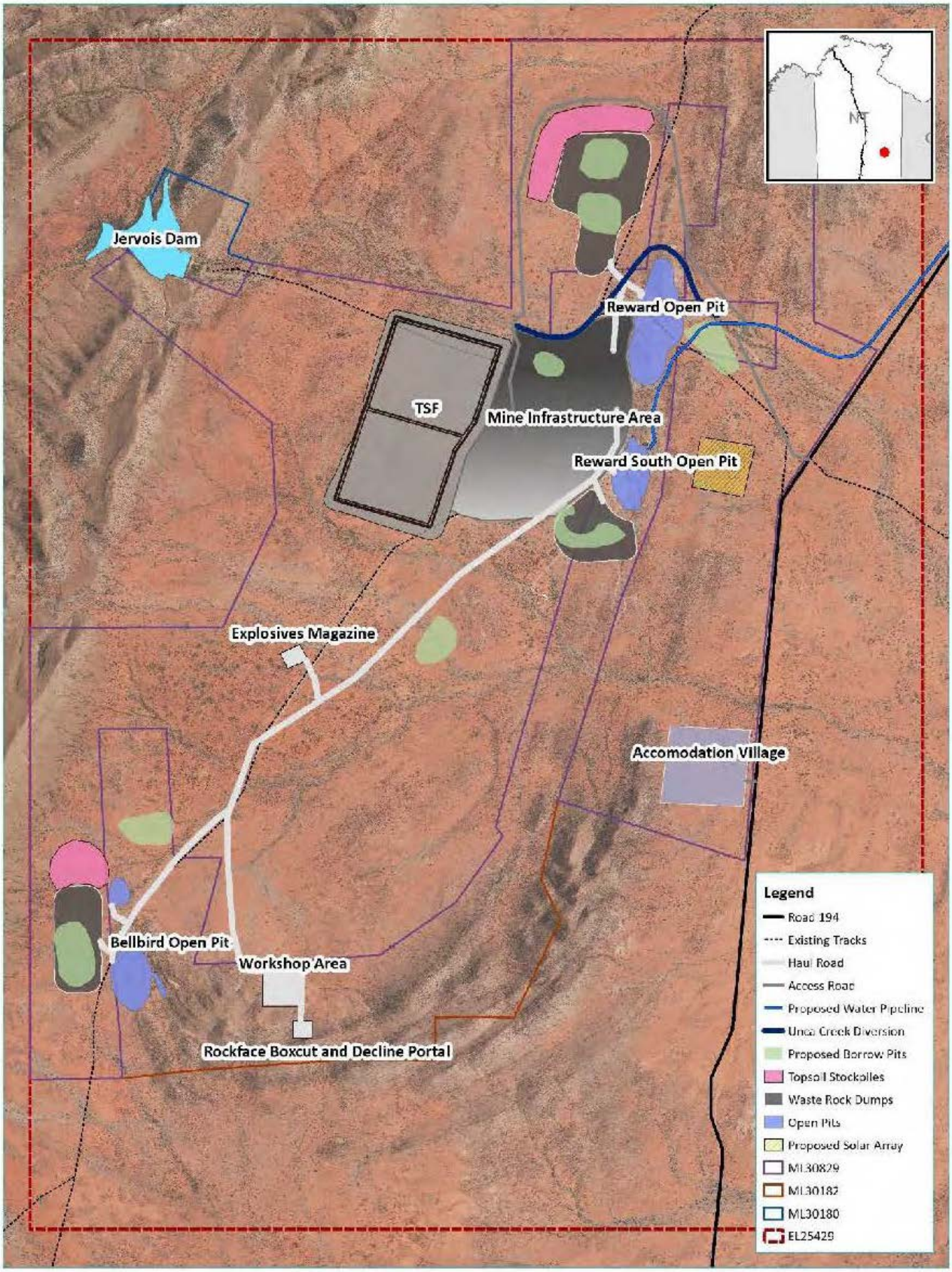

Figure 2 Proposed mine site layout (source: Supplement)

2.2.4 Construction

Construction of mine infrastructure is scheduled to take approximately 14 months, commencing in February 2020, with operations commencing early in 2021. Proposed activities during the construction phase include mobilisation of bulk earthmoving equipment; clearing, grubbing and stockpiling of topsoil; transportation of construction materials and equipment; construction of mine and water supply infrastructure; TSF construction and village construction. Borrow material and potentially overburden from the Reward open pit would provide suitable material for site preparation and construction of mine site infrastructure. The existing access track and intersection with the Lucy Creek Access Road would be upgraded to provide access to the Proposal area.

The Proposal includes raising the wall and spillway of the existing Jervois Dam by 2.6m (from 367.4mAHD to 370mAHD) to increase the dam storage capacity by 666ML from 279ML to 945ML. This would include inundating an additional surface area of approximately 20ha around the edge of the existing dam footprint. Material required to increase the capacity of Jervois Dam would be sourced from borrow pits within the Proposal area. Where possible, borrow pits would be located in areas of previous disturbance.

A 48.5km underground pipeline would be constructed to deliver water from the borefield to the mine site infrastructure. Pipeline construction methods would include clearing of vegetation where required; stockpiling of topsoil for use in rehabilitation; stockpiling of trench spoil separate to topsoil; trenching, pipe placement, connection and trench backfilling; and rehabilitation with stockpiled topsoil and seeding if necessary. The pipeline construction is scheduled to take approximately one month based on an estimated installation of up to 2km of pipe per day.

The base and outer wall of the TSF would be established early in the construction phase following upgrade of the Jervois Dam and prior to construction of the open pits to access ore. The TSF has been designed with a low permeability compacted composite soil base and high density polyethylene (HDPE) liner at the base and within walls. The TSF covers an area of 85ha and would be constructed to contain a 1% annual exceedance probability (AEP) event, with a spillway to withstand a 0.01% AEP flood event, in accordance with ANCOLD requirements.

The permanent diversion of Unca Creek would be constructed prior to development of the Reward open pit, to divert flows around the northern side of the pit. The diversion channel would have a length of about 1.7km and a 30m base width, with varying channel widths up to about 180m. Flood protection bunds would be constructed adjacent to Unca Creek to protect the TSF and final void from inundation up to the probable maximum flood (PMF) event. The bunds would be incorporated into the rehabilitated final landform aiming to form a self-sustaining structure requiring no long term maintenance.

Construction traffic would comprise light vehicle traffic associated with the workforce from Alice Springs, and heavy vehicle traffic transporting plant, equipment and materials. Detailed descriptions of expected transport requirements are presented in Section 6.2 of Supplement Appendix A9. The construction workforce is estimated at 360 people, with a majority (>90%) being contractors.

2.2.5 Operation

A total of 20Mt of ore is expected to be mined over a 10 year mine life using open pit drill and blast and underground longhole stoping mining methods. Ore would be processed onsite using a crushing, grinding and flotation plant, producing copper and lead/zinc concentrate. Processing requires approximately 1,200ML per year of water, to be supplied from the Jervois Dam, the planned borefield on Lucy Creek Station and groundwater inflows to the underground voids and open pits. Waste material would be stored in a tailings dam with two cells and a capacity of 20Mt. Mining is expected to generate 87Mt of waste rock which would be stored in three waste rock dumps.

Open pit activities include drilling and blasting waste rock and ore, generally on five metre high benches, using top hammer diesel hydraulic drill rigs with ammonium nitrate fuel oil and emulsion explosives. Ore and waste rock would then be loaded and hauled to the ROM pad for processing and to waste rock dumps using 190t and 120t excavators loading 90t dump trucks.

Longhole stoping would be used to mine the underground deposits. Longhole stoping uses a production drill to drill holes to a pre-determined pattern and can cater for ore reserves which vary in thickness and gradient. Access for equipment and personnel would be by decline, excavated by conventional drill and blast methods. Rockface decline would be developed from a box cut portal in fresh rock excavated into the natural ground surface by drill and blast. The Reward and Bellbird declines would be developed from portals in fresh rock in the respective open pit walls.

Ground control in stopes would be achieved through a combination of cable bolts and pillars being left in narrower or lower grade areas of stopes and backfill. Backfill design would be completed in the next phase of project development in conjunction with optimisation of the stoping design and sequence. Backfill is likely to include cemented and uncemented rock fill, using development and open pit waste rock. Paste fill, using tailings, may also be considered for Reward Underground, located adjacent to the processing plant.

Transport of the concentrated product is proposed by road to Alice Springs and rail to Darwin and/or Adelaide Ports for export to international markets. Triple-trailer road train movements are anticipated to be 25 return trips (50 movements) per 24 hour day, seven days per week for approximately 47 weeks of the year during the scheduled 10 years of operation.

The Proponent predicted the maximum water demand for the mine site to be 7.6ML/day (2,761ML/year). Water sources would consist of groundwater extracted from the borefield, surface water from Jervois Dam, groundwater inflows to the pits and underground voids, and rainfall runoff collected in sediment dams.

The main operational water requirements are for:

- dust suppression for the pit, haul roads and WRD (up to 1,888ML/y)
- processing plant water (up to 767ML/y)
- potable water for mine operations centre (up to 11ML/y).

On site power generation is proposed using diesel and solar powered generators, with diesel transported to the site in tankers by licensed contractors. Diesel is proposed to be stored on site in self-bunded tanks, including a 1.5ML tank located at the mine infrastructure area and possibly another 0.5ML tank in the Rockface/Bellbird area. This allows provision of a four week supply to mitigate any risk associated with fuel supply during wet weather events. Operational diesel requirements would be about 26.5ML per year.

The proposed location of the solar array associated with the power generation system covers an area of about 10ha and is located to the east of the mine infrastructure area. Solar is expected to generate 20-30% of the power demand.

The Proposal would provide up to 300 jobs at full production (80 full-time positions and 220 contractors) comprising of about 60% local residents (Alice Springs and surrounds), 30% from other regions of the NT and 10% from other areas of Australia.

All personnel, other than those residing in Orrtipa-Thurra or on nearby pastoral stations, would reside in the on-site accommodation village during their rostered work periods. The onsite accommodation village would have capacity for 360 persons. This capacity

allows for 30 vacant rooms to manage peak times, such as during maintenance shutdowns. On-site resident workers would travel to and from the mine site on a bus-in-bus-out or fly-in-fly-out basis. Flights would operate from Alice Springs to the local airstrip (either Orrtipa-Thurra or Lucy Creek).

A sewage treatment plant with the capacity to service up to 360 personnel would be constructed to cater for the accommodation. Design of the onsite sewage treatment plant would follow the AS/NZS 1547:2012 On-site Domestic Wastewater Management 2012, AS/NZS 1546.1 Australian Standard On-site domestic wastewater treatment units: Septic Tanks 2008 (Standards Australia 2008) and Australian Guidelines for Water Recycling: Managing Health & Environmental Risks (Phase 1) 2006 (NHMRC 2006).

2.2.6 Closure

Decommissioning, closure and final rehabilitation is expected to occur during the period 2027 to 2030, although the EIS indicates that progressive rehabilitation would commence as areas become available throughout the life of the mine. The EIS states that, in general, the purpose of mine closure and rehabilitation is to return the land to as close as is reasonably possible to its pre-disturbance condition, i.e. resilient, self-sustaining native vegetation of local provenance suitable for a post mining land use and as habitat for flora and fauna. Land around the borefields would remain for pastoral use. Open voids would remain within the mine site area. Some infrastructure may be left to be used by the Orrtipa-Thurra community subject to the outcomes of future consultation on mine closure. At this stage, the base case is that the Proponent would remove all infrastructure, apart from the water bores and a downgraded airstrip, from the Proposal area.

Specific domains would be closed and/or rehabilitated as follows:

- Backfilled pits – Final land use would be a stabilised modified landform providing traditional land use and resilient, self-sustaining native vegetation of local provenance
- Open pits – Left as pit voids with an abandonment bund rehabilitated with resilient, self-sustaining native vegetation of local provenance. It is expected that these would form pit lakes over time
- Underground mine voids - Decline portals would be secured to prevent unauthorised access by building a hydraulic plug incorporating non-acid forming (NAF) waste rock, allowing the underground workings to flood naturally. Cement paste backfill options would be assessed, as this would reduce tailings and PAF material requiring surface management. Portals would either remain within open pit modified landforms or, in the case of Rockface, be landscaped into a modified landform
- Service and ventilation shafts would be secured by building engineered concrete plugs to prevent unauthorised access but allow the underground workings to flood naturally
- Waste rock dumps - Bellbird and Reward waste rock dumps would remain above ground with a closure outcome of being physically and chemically stable with a cover design to limit acid drainage and mobilisation of salts and metals
- Tailings storage facility - Constructed TSF is proposed to be returned to underground and pit void, or remain above ground, covered and made non-polluting/non-contaminating (Draft EIS)

- Dams - Some water dams would be rehabilitated to provide ephemeral drainage while others would remain in place with a closure outcome that is physically stable and safe to fauna and humans

- Infrastructure - All infrastructure not required by landowners (Traditional Owners or the pastoralist) following mine closure is expected to be removed including water treatment and sewerage, workshops and administration buildings, accommodation village, processing plant, power station, water supply pipeline. The access road, haul roads and other site roads would be rehabilitated unless required/agreed by post-mining land owners. The airstrip would be left for use by landowners

- Water infrastructure - Bore fields would be decommissioned unless required for end land use or otherwise requested and agreed between the Proponent and Traditional Owners and/or pastoralists, with appropriate licences and permits.

3 Consultation

3.1 Proponent consultation

The Proponent consulted with stakeholders over several years, particularly the NT Government, the Orrtipa-Thurra community and the leaseholders of the Jervois and Lucy Creek pastoral properties (Supplement section 3). Ongoing relationships have been developed with the Orrtipa-Thurra community which has led to a Memorandum of Understanding (MOU) agreement between the Proponent and the community. The purpose of the MOU is to assist the community with employment and business opportunities.

Consultation and negotiation between the Proponent, the Central Land Council (CLC) and Traditional Owners between 2015 and 2017 resulted in the signing of an Indigenous Land Use Agreement (ILUA) (DI2016/003) for the Proposal. Details on the contents of the ILUA (including the location of sacred sites) remain confidential between the parties. The ILUA covers an area of about 38km^2 on EL25429.

Formal engagement with stakeholders was undertaken as part of the Social Impact Assessment (Draft EIS Appendix C9) between February and March 2018. Stakeholder briefings and interviews were held in Alice Springs, Orrtipa-Thurra, the Proposal area, Harts Range and Gemtree Caravan Park.

Consultation was guided by the International Association for Public Participation's Core Values (IAP2 2016) and included stakeholder meetings, briefings and third-party individual interviews. Consultation resources and methods included a project fact sheet, individual stakeholder phone calls and emails, presentations, updates to the Proponent's website, and ASX. A summary of the organisations that were briefed and interviewed is provided in the Draft EIS (section 4.7.1).

The key matters raised by stakeholders during the Proponent's consultation were related to employment and training opportunities, use of local businesses, potential upgrades of local infrastructure, increased traffic, impacts to water resources, reduced community cohesion, potentially reduced tourist numbers and productivity of other sectors, workplace safety, and cumulative impacts associated with five concurrent major proposals in Central Australia.

During preparation of the Supplement, the Proponent consulted with stakeholders in relation to Proposal-related traffic (Supplement Appendix A9 section 5).

3.2 Public submissions

There were three formal opportunities for public comment under the environmental assessment process. The first two opportunities were to inform the development of each edition of the Terms of Reference for the EIS (for the initial Proposal and amended Proposal), and to comment on the Draft EIS.

The draft Terms of Reference were advertised for public comment between 9 May 2014 and 23 May 2014 (first edition) and 14 July 2017 and 28 July 2017 (second edition). Three submissions were received on the first edition and one submission was received on the second edition. These were taken into consideration in the finalisation of each edition of the Terms of Reference.

The Draft EIS for the Proposal was on public exhibition for eight weeks between 19 October 2018 and 14 December 2018. Comments were received from the CLC, Arid Lands Environment Centre (ALEC) and Tourism Central Australia.

The key issues raised by the CLC related to:

- ensuring sacred sites protection information and heritage information relating to the location of any archaeological findings remains confidential
- ensuring native title holders are consulted on the management of archaeological finds
- whether groundwater will be treated before use if found to be acidic
- whether seepage from the TSF would be captured by the pit lake
- if the water assessment covers the full life of mine expectancy
- whether groundwater seepage is suitable for release to the environment, including for dust suppression
- traffic safety on the unsealed section of the Plenty Highway
- impacts to the mature bloodwood and ironwood habitat
- how diverting the water course near the Reward Pit will impact on riparian vegetation, hydrology and flora in the area
- potential impacts to *Eremophila cordatisepala*, *Rattus villosissimus* and *Sauropus rigens*
- storage of PAF material prior to rehabilitation
- how sufficient funding for rehabilitation works will be obtained
- importance of training local employees.

The key issues raised by the ALEC related to:

- potential impacts to groundwater dependent ecosystems (GDEs) from groundwater drawdown
- long-term management of acid and metalliferous drainage (AMD) to avoid impacts to water quality
- how the Proposal will be regulated under new legislation (Environment Protection Act 2019 and amended Water Act 1992)
- closure and rehabilitation including compliance and reporting measures.

The key issues raised by Tourism Central Australia related to:

- whether or not environmental impacts arising from mining operations will be made public

- whether or not additional programs including carbon sequestration and/or a vegetation rehabilitation program will be undertaken to protect the environment
- road safety.

The Proponent responded to these issues in section 3 of the Supplement. The Supplement is available to the public on the NT EPA's website (https://ntepa.nt.gov.au/environmental-assessments/register/jervois-base-metal-project).

In preparing this Report, the NT EPA has considered each submission in relation to the Proposal's potential environmental impacts and risks.

The NT EPA acknowledges that the Proponent proposes to continue to engage with relevant stakeholders during implementation of the Proposal.

3.3 Consultation by the NT EPA

The NT EPA consulted with nine NT Government advisory bodies in respect of the Notice of Intent, Terms of Reference, Draft EIS, Supplement and Addendum to the Supplement when preparing this Report. The agencies consulted include Departments of the Chief Minister; Infrastructure, Planning and Logistics; Primary Industry and Resources; Health; Tourism, Sport and Culture; Environment and Natural Resources; and Police, Fire and Emergency Services. In addition, the NT EPA consulted with the Aboriginal Areas Protection Authority and Power and Water Corporation.

The NT EPA has considered relevant environmental issues raised by stakeholders in making this Report.

4 Key environmental factors

Having regard to the Notice of Intent, the Draft EIS and Supplement, and comments from the public and advisory bodies during the EIS review, the NT EPA assessed the Proposal for its potential impacts on the NT EPA's factors and objectives. The NT EPA has identified the following key environmental factors that may be significantly impacted by the Proposal, and that are assessed in this Report (Table 2).

Table 2 Key environmental factors

Theme	Key environmental factor	Objective
Water	Inland water environmental quality	Maintain the quality of groundwater and surface water so that environmental values including ecological health, land uses, and the welfare and amenity of people are protected.
	Hydrological processes	Maintain the hydrological regimes of groundwater and surface water so that environmental values are protected.
Land	Terrestrial flora and fauna	Protect the NT's flora and fauna so that biological diversity and ecological integrity are maintained.
	Terrestrial environmental quality	Maintain the quality of land and soils so that environmental values are protected.
People and communities	Social, economic and cultural surroundings	Protect the rich social, economic, cultural and heritage values of the Northern Territory.

The NT EPA has considered the importance of other environmental factors during the course of its assessment. Those factors that were not identified as key environmental factors or that were addressed through consideration of the above factors are summarised at Appendix 1 of this Report.

The key environmental factors are discussed in section 5 of this Report. The description of each factor shows why it is relevant and how it would be affected by the Proposal. The assessment of each environmental factor contains recommendations for implementing the Proposal in a manner which protects the values associated with the factor. It concludes with a judgement by the NT EPA about whether or not the Proposal can meet the NT EPA's environmental objective for each factor.

5 Assessment of environmental factors

5.1 Overview

This section evaluates the Proposal and presents the views of the NT EPA on the environmental acceptability of the Proposal. The environmental acceptability of this Proposal was considered with regard to the principles of Ecologically Sustainable Development (ESD) through analysis of:

- the Proposal (particularly the components or activities that are likely to significantly impact the environment)
- the existing environment (particularly environmental values and sensitivities)
- the potential environmental impacts and risks of the Proposal and the evaluation of the significance of those impacts and risks
- the proposed avoidance or mitigation measures to reduce potential impacts and risks to acceptable levels and to meet NT EPA objectives.

Recommendations are made in this Report to add to, emphasise or clarify any commitments made by the Proponent, where the proposed avoidance or minimisation/ mitigation measures are considered insufficient, or where a safeguard is deemed particularly important. In this Report, the recommendations (in bold) are preceded by text that identifies issues and undertakings associated with the Proposal. For this reason, the recommendations should not be considered or read in isolation.

The NT EPA acknowledges that detailed design and operational plans for the Proposal have not been finalised. Minor and insubstantial changes are expected in the design of the Proposal following the conclusion of the EIA process. It is necessary for approval mechanisms to accommodate subsequent changes to the environmental safeguards described in the EIS and recommendations in this Report.

If the Proponent is able to demonstrate to the NT EPA that changes are unlikely to increase potential impacts on the environment, then an adequate level of environmental protection can be achieved by modifying the conditions through relevant statutory approvals governing the Proposal. Otherwise, further environmental assessment may be required.

The NT EPA considers that this assessment is valid for five years from the date of this Report. If the Proposal has not substantially commenced in this period, the NT EPA requests that it be notified in writing by the Proponent.

The NT EPA considers that commitments made by the Proponent in the EIS are binding commitments and must be fulfilled for the duration of the Proposal and makes Recommendations 1 and 2.

Recommendation 1

That the Proponent KGL Resources Limited ensures that the Jervois Base Metal Project is implemented in accordance with all environmental commitments and safeguards:

- **identified in the final Environmental Impact Statement for the Jervois Base Metal Project (draft Environmental Impact Statement, Supplement to the draft Environmental Impact Statement and additional information)**
- **recommended in this Assessment Report 90**
- **to the satisfaction of the relevant regulator.**

The Northern Territory Environment Protection Authority considers that all safeguards and mitigation measures outlined in the Environmental Impact Statement are binding commitments made by the Proponent.

Recommendation 2

That the Proponent provides written notice in advance to the Northern Territory Environment Protection Authority and the Responsible Minister if it alters the Jervois Base Metal Project and/or commitments, safeguards or mitigation measures in the Environmental Impact Statement in such a manner that the environmental significance of the action may change, in accordance with clause 14A of the Environmental Assessment Administrative Procedures 1984.

The remainder of this section identifies and discusses, in relation to each key environmental factor (NT EPA, 2018a)., the environmental values and potential impacts and risks to these values based on the likely significance of potential impacts, the Proponent's investigations and studies, and the Proponent's commitments to identify, avoid, mitigate, monitor and manage the potential impacts and risks

In defining its environmental objectives, the NT EPA also had regard to the principles of ESD articulated in the Intergovernmental Agreement on the Environment (Australian Government 1992). The NT EPA has summarised its consideration of ESD in Appendix 2.

5.2 Hydrological processes

5.2.1 Environmental objective

Maintain the hydrological regimes of groundwater and surface water so that environmental values are protected.

5.2.2 Environmental values

Groundwater hydrology

The Proposal is located in a semi-arid climatic zone characterised by low rainfall and high evaporation. In an environment with scarce water resources, the efficient use of water and protection of groundwater resources is of high importance.

There are two distinct groundwater systems within the Proposal area, the Georgina Basin and the Arunta Region. The mine site is within the Arunta Region groundwater system (discussed below), while the mine will source its process supply water from a borefield in the southern Georgina Basin Carbonate Aquifer, located approximately 20km north of the mine site.

The Georgina Basin Carbonate Aquifer is part of the regionally extensive Georgina Basin that underlies approximately one quarter of the Northern Territory and extends beneath the northwest of Queensland. Reported groundwater recharge estimates for the region range from 0.2mm to 12mm per year. The carbonate aquifer has value as a water source for human and stock consumption (Supplement Appendix A4).

The Proposal borefield is located on Lucy Creek pastoral station (Perpetual Pastoral Lease 1007) and is not in or near any water control districts (Supplement Appendix A4). The Proponent's water supply investigations included construction of two test production bores which typically yielded ~10L/s. Current nearby users of the carbonate aquifer are pastoralists (nearest pastoral bore 1km from borefield; domestic water supply bore 17km from borefield) and Maperte outstation (water supply) located about 18km northeast of the borefield. Maperte outstation is currently unoccupied but may be used from time to time.

The mine site is located in the Arunta Region groundwater system, characterised by local aquifers in fractured rock. Recent groundwater investigations of the fractured rock system (Supplement Appendix A4) reported four of 15 bores intersected groundwater at 33 to 51m depth, while the remaining bores had seepage or no free water observed. The findings indicated that aquifers are of limited lateral extent (1-100m) with a limited connection between adjacent aquifers.

Orrtipa-Thurra community and Jervois Station use groundwater from the fractured rock aquifer of the Arunta Region for human consumption and stock watering. They are located 18km and 30km south-west of the proposed mine site respectively.

Groundwater aquifers may support habitat for GDEs including vegetation and subterranean fauna.

Surface water hydrology

The Proposal is located in the upper catchment of the Hay River Basin, which extends from the Dulcie Ranges south-east towards the Simpson Desert. Drainage lines that intersect the Proposal area, including Unca Creek and its tributaries, flow north-east towards Arthur Creek but flood out through a broad drainage plain to the south-east. Arthur Creek and the Marshall River converge into the Hay River about 60km downstream of the Proposal and ultimately drain into Lake Eyre approximately 620km south of the Proposal.

Advice from the Department of Environment and Natural Resources (DENR) Water Resources Division on the Draft EIS indicates that surface water connection of Unca Creek to Arthur Creek is believed to only occur under extreme flooding conditions, with a likely recurrence interval of several decades. Under these circumstances the Hay River may flow into the Great Artesian Basin Water Control District, directly recharging the Jurassic aquifer of the Great Artesian Basin in the NT.

Surface water in and surrounding the Proposal area is ephemeral and the creeks hold water during and immediately after rain events. There are no known accurate records of surface water hydrology in the Proposal area, however water levels in Unca Creek (G0070009) are available from DENR for the period 1972 – 2011 (Supplement Appendix A4 Section 3.3). Unca Creek runs immediately north of the historic mine site. Its upstream catchment (~22km^2) was dammed when the existing Jervois Dam was constructed in 1972 for previous mining operations.

Surface water features in the region support flora and fauna, and recharge groundwater resources. The catchment is sparsely populated with isolated communities.

5.2.3 Potential impacts

Groundwater hydrology

The Proposal may impact on environmental values that depend on the existing hydrological groundwater regime through:

- long term groundwater abstraction and mine pit dewatering, potentially leading to drawdown of water levels, which may contribute to a reduction in the volume of groundwater available to current and future users of regional aquifers
- post-mining changes to groundwater flows relating to
    - the recovery of groundwater levels
    - residual final voids and underground workings
- seepage from water-holding mining infrastructure resulting in localised groundwater mounding.

Surface water hydrology

The Proposal may impact on environmental values that depend on the existing hydrological surface water regime. Construction and operation of the Proposal may result in the following direct impacts on surface hydrology:

- change to natural flow regime due to the Jervois Dam upgrade
- change to flow path from:
    - permanent diversion of the Unca Creek channel
    - construction of the water supply pipeline
- flooding impacts from a potential dam failure.

Potential impacts on water quality are discussed in section 5.3 under Inland water environmental quality.

5.2.4 NT EPA assessment

Groundwater hydrology

Groundwater drawdown impacts on receptors – borefield extraction

The proposed water supply borefield would extract up to 2GL of water per annum for 10 years (20GL over life of mine) from six production bores in the southern Georgina Basin Carbonate Aquifer (Supplement Appendix A4). This rate of water extraction is considered substantial and would cause localised drawdown of groundwater levels that could adversely impact on existing groundwater users and GDEs in the area.

The Proponent's impact assessment approach involved a desktop review of available groundwater information and a range of field studies focussed largely on installation and sampling of monitoring and production bores, existing bore surveys, stygofauna sampling, aquifer testing and extract water quality. Predictive numerical modelling was undertaken to assess the impact of the Proposal on the groundwater hydrological regime. The Proponent has committed to further validation and development of the Class 1 groundwater model with additional baseline information and data collected during extraction.

The Proponent has conducted hydrogeological investigations in and around the Proposal area since 2018. In total, the Proponent drilled 26 investigation bores

(Figure 3) to determine baseline groundwater levels, water quality and estimate aquifer hydraulic parameters. Of the investigation bores, 11 were installed in the borefield area.

Potential impacts to groundwater hydrology from the proposed borefield and mine site abstraction were assessed by the Proponent, and conceptual and numerical groundwater models developed with outputs based on a mining period of 10 years. The Proponent's drawdown analysis modelling predicts that, for the 10 years scheduled life of mine, a maximum drawdown from borefield abstraction of 4 to 5m can be expected at the closest pastoral bores; and drawdown of less than 1 to 2m would be observed at the Lucy Creek homestead bore. Drawdown of less than 1m is predicted at the Maperte outstation bore. The EIS stated that the process water supply would result in water table drawdown of about 2m over an area of approximately 110km^2.

All model scenarios predict that groundwater levels would reach a state of approximate dynamic equilibrium within 150 years and that by 1,000 years after mine closure, significant recovery would occur such that no areas would have a drawdown of over 0.5m (Supplement Appendix A4). While a number of existing bores used for stock, domestic and community water supply would be affected by drawdown of groundwater levels, the EIS concluded that the predicted drawdown would be unlikely to reduce water availability or yield at any receptor including pastoral users, communities and groundwater dependent vegetation.

The NT EPA considers that the preliminary groundwater modelling predictions are based on limited data and will need to be validated with actual monitoring data to upgrade the existing Class 1 model to a Class 2 model in accordance with the Australian Groundwater Modelling Guidelines (Barnett et al. 2012).

The proposed groundwater extraction would be regulated through a Groundwater Extraction Licence issued under the Water Act 1992, which would consider drawdown impacts on other users and beneficial uses. The Proponent predicts the extraction to be within the capacity of the aquifer stating that a small fraction (~0.0015%) of this groundwater resource would be removed (Supplement Appendix A4).

The Proponent committed to monitoring drawdown and potential impacts on receptors and to enter into 'make good' arrangements with landowners, such as deepening bores or providing off-take from the pipeline, if existing groundwater supplies were impacted. Contingency measures would be implemented if groundwater drawdown impacts are greater than those forecast by numerical modelling, as detailed in the Groundwater Management Plan (Supplement Appendix C2).

While modelling indicates the predicted groundwater drawdown is unlikely to impact on water supplies (Draft EIS, chapter 8), the NT EPA considers it appropriate to monitor actual impact to verify it is no greater than predicted. The Proponent must implement mitigation measures if needed, and the NT EPA has made Recommendation 3 requiring the assessment and management of any stock or drinking water bores potentially impacted by the Proposal.

The Proponent proposes an adaptive management approach in preparing the Groundwater Management Plan, to manage potential unknown impacts of groundwater drawdown. This includes developing management objectives, targets/triggers, actions to mitigate risks, monitoring programs, evaluating monitoring data and changing the management regime when triggers are reached. The NT EPA considers that adaptive management planning for the Proposal should be consistent with its Guidance on Adaptive Management (NT EPA 2018b).

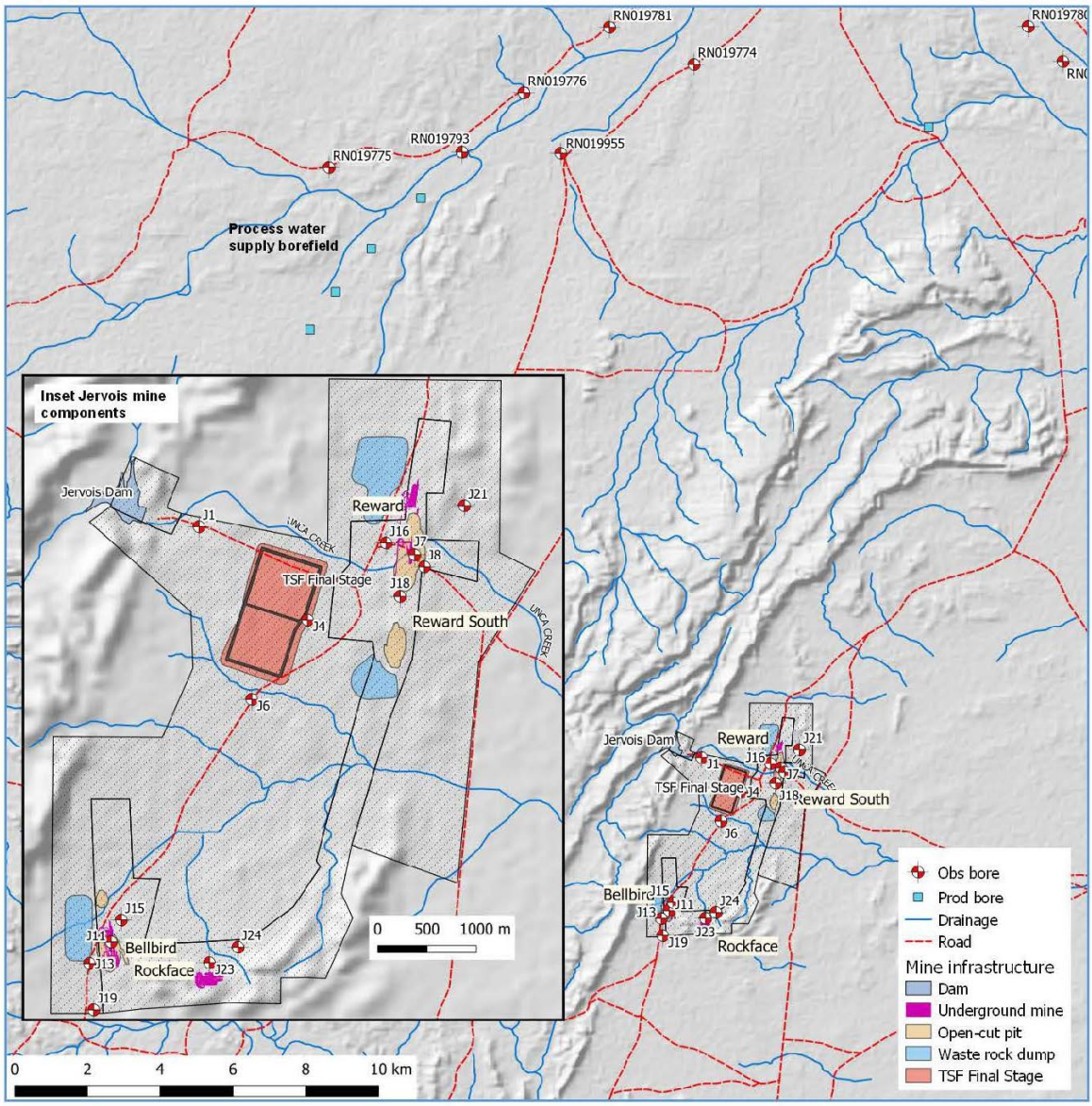

Figure 3 Location of mine components and groundwater bores (source: Supplement Appendix A4)

The NT EPA supports the Proponent's commitment to implement the Groundwater Management Plan, and considers that the plan should be revised to incorporate additional requirements in accordance with recommendations 3, 4 and 5.

Continual review and updates of the groundwater modelling using data from the monitoring program will be required to improve its predictive capacity and enable ongoing assessment of potential impacts from groundwater drawdown as mining progresses.

Groundwater drawdown impacts on receptors – mine dewatering

Dewatering of inflows to the surface and underground mine voids would extract up to 14GL over the life of mine (Supplement Appendix A4). The Proponent has conducted hydrogeological investigations in and around the mine site, and has drilled 15 investigation bores (Figure 3) in the fractured rock aquifer system to determine baseline groundwater levels, water quality and estimate aquifer hydraulic parameters (Supplement Appendix A4). A conceptual groundwater model and numerical groundwater model were developed with outputs based on the scheduled 10 year mine life.

The Proponent's modelling predicted that drawdown from the proposed mine dewatering would not impact sensitive receptors including pastoral stock bores and the Orrtipa-Thurra community borefield during the mine life. However in the long term, drawdown (up to 1000 years) in the Arunta region fractured rock aquifer is predicted to impact sensitive receptors due to the slow expansion of the drawdown cone associated with formation of the pit-lakes. Mine pits and underground excavations extend below the water table and groundwater level decline is expected due to dewatering during operations and formation of the pit lakes as terminal groundwater sinks post-closure. The Proponent's modelling and assessment indicate a probable maximum drawdown of 0.5-1m within 3km of the tenement boundary for the 10 year mine life; and up to 2m at the closest pastoral bore and the Orrtipa-Thurra community water supply.

The NT EPA acknowledges that the proposed groundwater extraction for mine water supply is not likely to have a significant impact on the extensive regional Georgina Basin Carbonate Aquifer. Mine dewatering may reduce groundwater availability for users. Accordingly, the NT EPA considers that the Proponent should be responsible for monitoring any impacts to water users and implementing corrective measures if required in accordance with Recommendation 3.

Recommendation 3

That the Proponent's Groundwater Management Plan must include assessment and management of any stock or drinking water bores that could be impacted by the Proposal, in agreement with the owners and/or operators of those bores. This is to include:

- **conducting a condition survey of local groundwater users to establish baseline conditions prior to commencing construction**
- **a program to monitor water levels at those bores to detect whether levels are within the range of predicted drawdown**
- **procedures for applying clear, quantitative and measureable trigger levels for groundwater drawdown and an outline of specific adaptive management responses that would be implemented if necessary**
- **proposed mitigation and management responses in the event that trigger levels are exceeded**
- **measures to ensure identified groundwater user bores remain operational or provide an alternative water bore or supplies if required, to ensure original daily flow quantities are maintained.**

The Groundwater Management Plan must be updated to the satisfaction of the relevant regulator, prior to the commencement of mining.

Water stewardship

The Proposal is located in a semi-arid region where groundwater is a shared resource with high value. While the Georgina Basin is known to be a large groundwater resource, it is not part of a Water Control District. The aquifer storage, sustainable yield and consumptive pool have not been quantified. Mining within the region could affect water availability for other potential uses in the future. The NT EPA considers that the Proponent should minimise groundwater extraction, maximise water re-use and demonstrate best practice in water stewardship as recommended by the International Council on Mining and Metals (ICMM 2014). The ICMM water stewardship framework recommends effective management of water at operations, collaboration to achieve responsible and sustainable water use, and the application of strong and transparent corporate water governance.

Recommendation 4

That approvals and decisions for the Proposal have conditions that require the Proponent to:

- **allocate clear responsibilities and accountabilities for water use and management**
- **set annual water use targets that are approved by the relevant regulator**
- **provide annual updates of the projected water balance for the Proposal in the Groundwater Management Plan, including detailed estimates for the various phases of the Proposal and specifying the source and quantity of the water to be used**
- **demonstrate how water saving considerations are integrated in Proposal planning including final design and technologies**
- **report annually on continual improvement initiatives in water use efficiency including a comparison with relevant water use targets**
- **provide details in an annual Groundwater Management Report on how water will be effectively managed during proposed operations, including minimising water consumption, maximising water reuse and minimising waste water**
- **extract water from bores only when equipped with operating flow meters**
- **record the volume of water extracted from the borefield and mine site bores**
- **report water use performance in relation to targets, and any change to approved targets in an annual Groundwater Management Report to stakeholders.**

The Groundwater Management Plan and annual Groundwater Management Report should be made publicly available on the websites of (as applicable), the Proponent, the Operator and relevant regulatory authorities.

Groundwater flow impacts

As mining progresses, the open pits and underground voids are predicted to act as groundwater sinks, which is likely to cause localised changes in groundwater flow direction. Post-closure, while the groundwater system is generally expected to recover to a state of equilibrium (predicted to occur after about 150 years), the pit voids would continue to influence local groundwater behaviour. The Proponent's Groundwater Impact Assessment (Supplement Appendix A-4) concluded that the pit lakes would behave as evaporative hydrogeological sinks, which the Proponent indicates would mitigate impacts to the regional groundwater aquifer in the long term. However, salinity in the pit void waters would likely increase with time due to evaporative concentration (average evaporation rate exceeds rainfall by more than 10 times) (Supplement Appendix A4). This effect has the potential to cause density-driven flow of saline water out of the pit into the surrounding aquifer in the long term (McCullough et al. 2013).

Depending on the final closure criteria for mine pit voids, and particularly if it is determined that tailings should be backfilled into the Reward pit at closure, there is a risk that rebound of the groundwater to the surrounding groundwater level could occur and the pit could cease to be a sink and become a flow-through system allowing lateral

groundwater flow. This would only occur if the pit was backfilled up to or above the regional groundwater level.

While these issues are unlikely to be significant due to the low hydraulic conductivity of the aquifer, they will need to be investigated as part of mine closure planning in accordance with recommendations 5 and 13.

Seepage impacts on groundwater levels

Seepage from the TSF could result in localised groundwater recharge which has the potential to cause mounding. Groundwater levels are expected to rise by a few metres beneath the immediate footprint of the TSF, with no rise expected beyond 100m in any direction (Supplement Appendix A4).

The TSF would be designed with an underdrainage system to intercept seepage for collection and recycling in the mine water circuit. Seepage that is not intercepted and recycled would infiltrate to the water table. The volume of seepage is uncertain and dependent on the performance of the underdrainage system. The TSF design specification identifies a target leakage rate of 1kL/ha/day, which is equivalent to 63kL/day or 23ML/y. The Proponent's particle tracking of seepage water indicates that the cone of drawdown associated with mine dewatering and post-closure pit lake development would effectively capture seepage and prevent migration offsite.

The NT EPA considers that tailings seepage is not likely to have a significant impact on third party users or on groundwater hydrology.

Potential impacts of tailings seepage on water quality are discussed at section 5.3.4 of this report.

Recommendation 5

That approvals and decisions for the Proposal have conditions that require the Proponent to update the Groundwater Management Plan to the satisfaction of the relevant regulator prior to mining. The Plan should:

- **include a framework identifying the location, timing, methods and parameters for the collection of groundwater hydrology information**
- **establish comprehensive and robust groundwater hydrology datasets**
- **include additional monitoring locations in the groundwater monitoring program to measure impacts to all third party groundwater users including communities and pastoralists**
- **include a framework, with timeframes, for progressing to a Class 2 numerical groundwater model consistent with the Australian Groundwater Modelling Guidelines**
- **actively and continually seek to improve knowledge of aquifers, groundwater levels and groundwater flows affected by the Proposal and incorporate these into the groundwater models at least annually**
- **provide details on how groundwater will be effectively managed during proposed operations including storage, consumption and minimising wastewater**
- **incorporate measures to monitor and assess density driven outflow from final voids and impacts on surrounding groundwater quality**

- **include an independent peer review by a suitably qualified independent professional**
- **include a schedule for reporting of all water monitoring data and an assessment of the impacts on groundwater hydrology in a Groundwater Management Report. The report is to be provided to the relevant regulator within six months of commencement of construction and on an agreed reporting period thereafter**
- **be updated at least annually.**

At a minimum, the Groundwater Management Report must disclose groundwater extraction and use, performance against targets, and any proposed changes to approved targets.

Surface water hydrology

Change to natural flow regime from Jervois Dam upgrade

Jervois Dam was constructed in 1972 to capture overland flow and supply water for historic copper mining activities. It provides the largest and most permanent source of surface water in the region. As part of the Proposal, the dam embankments and spillway would be repaired and upgraded to increase the storage capacity from 279ML to 945ML (a 239% increase) to provide a source of water for the Proposal, particularly in the first four years of operations until groundwater inflows to the underground voids increase.

The upgrade and use of the Jervois Dam would delay first flows and reduce surface water flows to Unca Creek during operations and post-closure. Prolonged reduced availability of surface water for downstream significant riparian vegetation, compounded with potential groundwater drawdown impacts, could result in vegetation health decline. The upgrade of Jervois Dam would increase the water take and holding time, altering the natural surface water flow regime in Unca Creek downstream of the dam. The dam could store an additional 666ML which would result in reduced frequency of overflow events. Modelling predicts that the upgraded dam would overflow once every nine years (post-closure if the dam is retained), in comparison to once every fourth year under existing conditions.

The maximum predicted daily flow over the spillway increases by 500ML/day (~10%) for the upgraded dam as a result of the proposed larger spillway, resulting in a minor increase to peak flood levels and velocities (up to 0.2m/s) downstream of the Jervois Dam.

The EIS stated that the change in stream flow would have a significant effect along Unca Creek within the Proposal area, up to the point of the Unca Creek tributary confluence (approximately 1km east of EL25429) where the catchment size doubles and the effect would likely decrease. The Proponent concluded that the delay and reduction in flows would not have a significant impact on downstream ecosystems. The NT EPA considers that potential impacts on downstream ecosystems as a result of restricted flows, coupled with groundwater drawdown, are uncertain and makes Recommendation 19 to ensure that any impacts to significant vegetation are monitored, measured, reported and managed to protect ecological values including beyond the life of mine.

The Proponent considered that the minor increases to peak flood levels and velocities as a result of the Proposal would not have a significant impact on existing downstream land uses. The Proponent discussed post closure options of either leaving the upgraded dam in place, reducing the spillway to pre-mining level or complete removal of the dam, and stated that the final decision would be made in consultation with the post mining

landholder. The NT EPA considers that, if the dam is left in place post closure following consultation with stakeholders, the spillway level should be reduced to at least the existing level unless the Proponent is able to demonstrate that the environmental benefits of retaining the dam outweigh the impacts to downstream ecosystems (Recommendation 8).

A surface water quality monitoring program was included in the EIS as part of the surface water impact assessment (Supplement Appendix A3). While the Proponent committed to monitoring water quality upstream and downstream of the Proposal as well as surface water storages on site, there was no proposed monitoring of volume or flows. The NT EPA considers that flow monitoring, including subsurface flows, should be conducted downstream of Jervois Dam during operations to inform the water quality monitoring program and validate catchment yield assumptions in the surface water models. Where monitoring results indicate considerable variance from modelled flow predictions, the surface water models should be recalibrated against observed flows and updated in accordance with Recommendation 6.

Change to surface water flow paths

The proposed Reward pit intersects the existing Unca Creek channel and floodplain, and therefore the Proposal would divert Unca Creek around the northern boundary of the pit. The permanent diversion of Unca Creek would divert surface water from an upstream catchment of approximately 22km^2 (Supplement Appendix A3 section 3.2) through an engineered trapezoidal channel with a base width of 30m. This would impact on localised hydrological processes and significant riparian vegetation by altering flows through cessation of flow in a ~1.7km length of the creek.

The NT EPA considers that the permanent loss of up to 2ha of riparian vegetation associated with the Unca Creek diversion is not significant on a regional scale and could not be avoided should the Proposal be approved for implementation.

It is important that the diversion channel is designed to effectively deliver the surface water flows from the catchment above the mine pit to the downstream channel and thus maintain its environmental values. The Proponent designed the diversion with a flood protection bund that would prevent ingress of water into the Reward pit for events up to and including the 0.1% annual exceedance probability (1000 year average recurrence interval) during mining, and to the PMF event under the final landform conditions (post closure). If the flood protection bund were to fail post closure, runoff from the upstream catchment may not be delivered downstream. The NT EPA considers that the Proponent must demonstrate that the diversion is designed and constructed to maintain stream flow values, prior to commencement of mining.

Recommendation 6

That before approvals or decisions are given or made for the Proposal, the Proponent or Operator shall provide to the relevant regulator an updated Unca Creek diversion design and associated modelling and monitoring plan that includes:

- **information on the hydrologic conditions of the existing watercourse and results from hydrologic, hydraulic and sediment transportation modelling used in the design of the diversion**
- **information that demonstrates how the diversion would maintain the existing regional hydrologic regime by effectively delivering the natural flows of Unca Creek to downstream reaches**
- **details on how the diversion would prevent surface and sub-surface flows reporting to the Reward pit, in a 1000 year average recurrence**

interval flood event (1000 year ARI event) during mining and to the Probable Maximum Flood (PMF) event post closure

- **measures to minimise impacts on channel morphology upstream and downstream of the diversion, and sediment erodibility on diversion channels banks**
- **the location, function and description of geomorphic and riparian vegetation features within the proposed watercourse diversion**
- **details on how the diversion would incorporate similar habitats as the existing channel and be revegetated to re-establish riparian vegetation in accordance with leading practice**
- **details on how sediment transport and water quality regimes would be maintained while minimising any impacts to upstream and downstream water quality or geomorphology**
- **a program for monitoring and assessment of the performance of the diversion and methods for detecting any upstream or downstream impacts.**
- **engineering drawings depicting the physical attributes and dimensions of the diversion, and plans and specifications sufficient to complete construction and revegetation in accordance with the design**
- **all investigation and other reports relied on by the design**
- **a requirement for review and assessment of the long term stability of the diversion and performance of the diversion against the detailed design objectives, at least 2 years prior to mine closure**
- **a strategy for the long term management of the creek diversion post-closure and a requirement for the strategy to be incorporated into the Mine Rehabilitation and Closure Plan.**

The hydraulic, hydrologic and sediment transport models should be updated with monitoring data to improve knowledge of surface water flows impacted by the Proposal. The updated modelling results should be provided to the relevant regulator on an agreed reporting period that is appropriate for local conditions.

The detailed diversion design is to be peer reviewed by an appropriately qualified and experienced independent professional with relevant expertise in watercourse diversions, and implemented to the satisfaction of the relevant regulator.

The 48.5km length of the water supply pipeline route transects minor ephemeral waterways and drainage areas. The associated clearing of the pipeline corridor and open trench pipe installation would have the potential to impact on these waterways. The NT EPA considers that work should be undertaken in a manner that does not cause a material change to the shape, volume, speed and flow direction of the waterway or cause an alteration to the stability of the bed or banks of the waterway, including the removal of vegetation and subsequent rehabilitation.

Recommendation 7

That approvals and decisions for the Proposal have conditions that ensure, to the satisfaction of the relevant regulator, that all water supply pipeline and access track construction activities, including the removal of vegetation and subsequent rehabilitation, are conducted in a manner that does not cause a material change to

the shape, volume, speed and flow direction of any waterway or cause an alteration to the stability of any bed or banks of a waterway.

Flooding impacts from a potential Jervois dam failure

Failure of the upgraded Jervois Dam would potentially result in a flood wave downstream of the Proposal. This risk was raised in stakeholder submissions to the Draft EIS. While mine infrastructure may be impacted, no dwellings, population centres or public roads downstream would be affected. The Proponent advised that the Jervois Dam wall had failed under a previous operation, and that this had flooded the previous mine site camp, although it is not known when this occurred. The NT EPA considers that adherence to the requirements of ANCOLD guidelines (ANCOLD 2012) in upgrading the dam for the Proposal would minimise the risk of future dam failure.

The Proponent carried out a flood modelling assessment (Supplement Appendix A3 section 8) and developed hydraulic and hydrologic models to simulate the flood behaviour of Unca Creek and its tributaries. The models were used to estimate peak flood levels, depths and extents in the Proposal area for the 10%, 1% and 0.1% AEP and the PMF events under current (pre-mining), operational (during mining) and final landform (post-closure) conditions. Results for the 0.1% AEP and PMF events were used to size the proposed creek diversion and crest heights of the flood protection bund and to assess the flood immunity of the final void.

The Proponent assessed the overall risk of a dam failure as low based on the likelihood of failure being rare and the consequence major. The NT EPA considers that the risk of dam failure should be minimised by designing, building and maintaining the upgraded Jervois Dam in accordance with the ANCOLD guidelines (2012). To ensure the risk of dam failure is minimised, the NT EPA makes recommendations 8 and 11 which provide for an appropriately qualified and experienced, independent engineer to review the design, construction and operation of water dams to ensure they comply with ANCOLD guidelines.

In a worst case scenario of a complete failure of Jervois Dam, the maximum volume of water released to the downstream environments would be 945ML. The Proponent's modelling indicates the resulting flood wave would likely dissipate rapidly downstream of the dam due to the flat terrain and wide floodplains east of the Proposal area. The potential impacts of dam failure on the environment are likely to be short term, localised, limited to riparian habitats and are not likely to be significant.

The EIS states that the Jervois Dam may remain in place post-closure as it is an existing dam and may have some value to Traditional Owners and/or the post-mining landholder. The presence of the dam is consistent with surrounding pastoral land use. If the dam was to remain post-closure, there would potentially be residual risks and costs associated with the integrity of the dam and its maintenance in the long term, which are likely to be borne by the community and government.

Recommendation 8

That the Proponent ensure the design, construction and ongoing operation of the Jervois Dam is in accordance with ANCOLD guidelines (2012) or any updates. Compliance with ANCOLD guidelines must be monitored and reported by an independent engineer with appropriate qualifications and experience. The appointment of the independent engineer should be endorsed by the relevant regulator.

A report on compliance with the ANCOLD guidelines should be provided to the relevant regulator and placed on the websites of (as applicable) the Proponent, the Operator and the relevant regulator.

When the dam is no longer required for the Proposal, the Proponent should reduce the dam spillway to the current level (367.4mAHD), unless it can demonstrate by an independent expert approved by the relevant regulator that the environmental benefits of leaving the upgraded dam in place outweigh impacts to downstream ecosystems.

5.2.5 Conclusion against the NT EPA objective

With the implementation of relevant management plans and recommendations identified above, the NT EPA considers that the Proposal could be conducted in such a manner that its objective for hydrological processes is likely to be met.

5.3 Inland water environmental quality

5.3.1 Environmental objective

Maintain the quality of groundwater and surface water so that environmental values including ecological health, land uses, and the welfare and amenity of people are protected.

5.3.2 Environmental values

Surface water quality

Unca Creek is in the upper headwaters of the Hay River catchment which feeds into Lake Eyre in the north of South Australia. The Proposal area is intersected by Unca Creek and its tributaries, which flow in a north-easterly direction for about 35km before joining Arthur Creek. Watercourses in the region are ephemeral and generally flow only during runoff producing rainfall events.

There is limited data available on surface water quality in the Proposal area due to the lack of permanent surface water flows. Flows in local watercourses are unpredictable and of low frequency, and may occur once every year or in some cases, every two years. Flow events require heavy rainfall, and are often short, rapid and mobilise large amounts of sediments similar to ‘first flush’ type events.

Environmental surface water values and uses to be protected include aquatic ecosystems, primary industries (including stock watering, irrigation and general water uses), recreation and aesthetics, and cultural and spiritual aspects.

The Proponent conducted preliminary surface water investigations with a limited number of samples that were analysed for a range of physico-chemical and toxicant parameters. Metals analysis of samples included total metals, which are suitable for comparison against stock water and irrigation guidelines, but not dissolved metals. Total metals are generally not suitable for comparison against ecosystem guidelines, including the Australian and New Zealand guidelines for fresh and marine water quality (ANZECC & ARMCANZ 2000; ANZG 2018) (the water quality guidelines), as guideline values are relevant to the dissolved fraction.

The Proponent’s samples contained high levels of suspended solids and therefore total metals concentrations are unlikely to be representative of water quality at the sampling sites. An indication of baseline water quality may be derived from two sites with low suspended solids, Jervois Dam and Unca Creek, immediately downstream of Jervois Dam and upstream of the historic Jervois mine site. The preliminary results from these sites indicated that both sites had good water quality with pH close to neutral, and low electrical conductivity, salinity, turbidity and metal concentrations (Addendum to the Supplement).

The Proponent classified the condition of Unca Creek and its tributaries in the vicinity of the Proposal area as a Level 2: slightly to moderately disturbed ecosystem in

accordance with the water quality guidelines. The NT EPA accepts that pastoral activities and the presence of the legacy mine site has led to a moderate level of disturbance. The Proponent proposed to adopt water quality objectives sourced from the water quality guidelines.

Groundwater quality

At the proposed borefield (Georgina Basin Carbonate Aquifer) groundwater quality is generally fresh to brackish and marginally unsuitable for human consumption due to elevated salinity (>1000mg/L Total Dissolved Solids (TDS)) in some bores. Most bores are suitable for pastoral use. The chemical composition of groundwater is strongly influenced by the carbonate rocks of the aquifer (Supplement Appendix A4).

At the proposed mine site (fractured rock system) groundwater quality is not potable due to elevated salinity but is suitable for pastoral and industrial use (Draft EIS Supplement Appendix A4).

Environmental values and uses supported by groundwater quality, in both the borefield and mine site areas, are primary industries (stock watering bores), residential (domestic bores) and potentially GDEs.

Details of groundwater users are provided in section 5.2.2 of this Report.

5.3.3 Potential impacts

Surface water quality

Construction, operation and closure of the Proposal have the potential to result in direct impacts on surface water quality from the following sources:

- AMD from historic and proposed mined materials
- discharge of contaminated mine water
- dust suppression with contaminated water
- fuel and chemical spills
- mobilisation of sediment and/or contaminants during clearing, mining and closure activities, and from post-closure landforms.

Contamination of surface water also has the potential to impact groundwater quality indirectly through seepage to groundwater aquifers.

Groundwater quality

Construction, operation and closure of the Proposal have the potential to result in direct impacts on groundwater quality from the following sources:

- contaminated seepage (e.g. tailings facilities and waste rock dumps)
- sewage and grey water
- contaminated pit void water (post closure)
- naturally occurring radioactive materials (NORM).

5.3.4 NT EPA assessment

Surface water quality

Potential acid and metalliferous drainage (AMD)

The potential for AMD and saline drainage was assessed by the Proponent through geochemical analysis of 662 waste rock and ore samples from Rockface and Reward deposits.

In addition, the geochemistry of ten representative ore feed and ten synthetic tailings samples were investigated to provide an indication of the range of ore and tailings materials likely to be produced. Analysis was also undertaken for 22 samples from existing historic mine materials for an initial guide to potential legacy geochemistry issues.

Representative sample subsets were investigated to further characterise AMD potential (net acid producing potential (NAPP), acid neutralising capacity (ANC), net acid generation (NAG)) and AMD geochemistry, including water extractions for an assessment of initial elemental solubility.

The outcomes of these investigations were used to develop S block models to better define proportions of AMD rock types for Rockface, Reward and Bellbird deposits. The modelling estimated the total volume of PAF waste materials to be less than 5%, occurring mainly around the ore bodies. The ore itself is high in sulfur and classified as PAF, indicating that tailings, primary ore stockpiles and residual ore zones in underground workings will be a potential source of AMD.

The NT EPA considers that the Proponent's modelling provides limited reliability in terms of estimating the volume of PAF waste that would be generated during mining, and that there is potential for significantly larger than expected volumes of PAF to be encountered, based on drill core acid base sampling results provided in the Draft EIS (Draft EIS Appendix B to Appendix C1). The NT EPA considers that the Proponent should carry out ongoing testing and classification of mined waste to validate block modelling predictions and assumptions and to inform strategies for the effective segregation and management of all problematic materials (Recommendation 9).

Kinetic NAG testing of PAF materials showed lag times may range from months to years before acid conditions develop from exposure to atmospheric oxidation. In order to provide further information on the behaviour, rates and chemistry of leachates, the Proponent committed to complete kinetic leach column testing. The NT EPA recommends the Proponent undertake further kinetic tests of different material blends (e.g. acid-generating and acid consuming materials) to explore management options and marginal NAF/PAF materials to confirm PAF segregation criteria. The NT EPA also recommends up-scaling the kinetic laboratory investigations through field trials (e.g. barrel leach tests) to better reflect site climatic conditions and particle size distributions (Recommendation 9).

The NT EPA notes the EIS presented limited geochemical data of Bellbird deposit, stating that the geology is similar to the other deposits. Bellbird was included in the metallurgical test work of ore feed and tailings, and S block modelling. The NT EPA recommends addressing uncertainty about the geochemical characteristics of mine waste, particularly for the Bellbird deposit, through kinetic leach testing (Recommendation 9) and development of the AMD Management Plan (Recommendation 10).

The Proponent developed conceptual S block, geochemical and hydrogeochemical models to predict the impact of mine drainage on surface water and groundwater, and to assess management options for mine waste materials during operations and closure

(Supplement Appendix A5). The Proponent's Acid Mine Drainage Study (Draft EIS Appendix C1) and Preliminary Follow Up Geochemical Assessment (Supplement Appendix A5) made several recommendations focussed on further geochemical testing and modelling to better understand the characteristics of mine waste materials and to inform development of PAF waste rock management options. The NT EPA considers that implementation of these recommendations by the Proponent and/or Operator is important to avoid potential impacts to water quality as a result of AMD.

Recommendation 9

That approvals and decisions for the Proposal have conditions that require the Proponent to:

- **undertake kinetic leach and batch water extraction testing in accordance with leading practice AMD procedures recommended in the Australian Government guidelines for preventing acid and metalliferous drainage (DIIS 2016a)**
- **include in the above testing as a minimum:**
  - **materials representative of key lithology/alteration types, covers and tailings**
  - **different material blends (e.g. acid-generating and acid-neutralising materials) to identify management options**
  - **marginal NAF/PAF materials to confirm PAF segregation criteria**
- **undertake kinetic testing in the field in addition to the laboratory based column leach testing, to better reflect site climatic conditions and particle size distributions**
- **commence testing as soon as feasible with results assisting the development of the Acid and Metalliferous Drainage Management Plan (Recommendation 10)**
- **undertake further targeted sulfur testing to infill gaps in coverage for the S block models to validate model predictions and support planning of waste rock management**
- **incorporate the results of geotechnical and geochemical testing into a soil oxygen flux model to inform detailed cover designs for waste rock and/or tailings**
- **use geotechnical and geochemical testing results to regularly refine and update the hydrogeochemical models to improve understanding of the post closure risks of AMD and saline drainage.**

Results of all investigations and testing should be reported to the relevant regulator for endorsement within six months of commencement of the Proposal and on an agreed reporting period thereafter, and inform the development of any proposed management measures.

Waste rock samples showed strong enrichment in a variety of metals/metalloids with concentrations increasing with proximity to ore, similar to the trends observed with PAF materials. Initial solubility testing on waste rock indicated that water would not liberate significant amounts of acids, salts or metals/metalloids. However, under acidic conditions aluminium (Al), cadmium (Cd), cobalt (Co), copper (Cu), iron (Fe), manganese (Mn), nickel (Ni), sulfate, zinc (Zn) and lead (Pb) could mobilise as the

solubility of metals/metalloids increases with decreasing pH. The results indicated that sulfate and elevated Cu, Mn and Zn are likely to be generated during the lag period.

The investigations indicated that tailings would have up to 1% S and would likely be PAF. Tailings showed enrichment of a similar suite of metals/metalloids to waste rock and ore, with mobilisation of Cd, Co, Cu, SO_4, Mn and Zn during the lag period.

Sampling and analysis of historic mine materials showed varying acid and salinity generating potential, generally high levels of metals and some degree of elevated metals/metalloids in water extracts, particularly Cd, Co, Cu, Mn, Ni, Pb and Zn.

The NT EPA supports the Proponent's commitment to collect, manage and treat historic mine materials as PAF material on site, and considers that this approach, if undertaken in accordance with an approved AMD management plan, would likely minimise the potential impacts of any legacy AMD issues on the receiving environment.

The Proponent proposes to develop a Waste Rock and Spoil Disposal Plan to manage AMD issues associated with project development, mine waste classification and ongoing management and monitoring of water quality criteria specific to AMD. The NT EPA recommends preparation of an AMD Management Plan in line with leading practice AMD management recommended in the Australian Government guidelines for preventing AMD (DIIS 2016) (Recommendation 10) that is implemented to manage all AMD issues associated with the Proposal. This should include ongoing geochemical testing of all mined materials, tailings and seepage.

Recommendation 10

That approvals and decisions for the Proposal have conditions that require the Proponent to develop an Acid and Metalliferous Drainage Management Plan to the satisfaction of the relevant regulator prior to ground disturbing works that:

- **is prepared in accordance with leading practice Acid and Metalliferous Drainage management recommended in the Australian Government guidelines for preventing acid and metalliferous drainage (DIIS 2016a)**
- **incorporates all commitments made by the Proponent in the Environmental Impact Statement for Acid and Metalliferous Drainage prevention, monitoring, management and mitigation**
- **covers all phases of the Proposal, including pre-operation, operation, care and maintenance, rehabilitation/closure, post-closure and relinquishment**
- **ensures all historic metalliferous materials and their leachates are contained and isolated from the receiving environment during all stages of the Proposal**
- **includes a program for ongoing testing and classification of waste rock and tailings (solids, leachates and decant water) to inform appropriate management strategies**
- **incorporates the results of ongoing mine waste characterisation and classification into the sulfur block, geochemical and hydrogeochemical models at least once every six months, to refine the models, validate model predictions and enable ongoing assessment of potential Acid and Metalliferous Drainage water quality impacts**

- **establish targets for acid and metalliferous drainage acids, salts or metals/metalloids and identifies mitigation strategies to enable compliance with the targets should they be exceeded.**

The Acid and Metalliferous Drainage Management Plan should be submitted to the relevant regulator within six months of the commencement of the Proposal as part of the Mining Management Plan, and updated at least annually.

Discharge of contaminated water

Discharge of mine-affected contaminated water has the potential to impact on water quality in Unca Creek and its tributaries. The NT EPA supports the Proponent's surface water management strategy, which separates, uses and manages surface water according to its quality. Implementation of the strategy would ensure all potentially contaminated water is captured within the mine site, monitored and managed in accordance with the Proponent's Water Management Plan.

Potentially contaminated mine water includes dewatered pit water, tailings return water and runoff from areas where chemicals, contaminants or oxidised ore may be present such as runoff from the process plant, ROM and product stockpiling areas, which is captured in the process water dam. The EIS stated that water in the process water dam is likely to contain elevated salinity, metals and sulfates compared to surface water quality in the receiving environment. The Proponent's modelling indicated that uncontrolled discharges from the process water dam were unlikely to occur.

The EIS states that the proposed sediment dams have been sized to capture runoff from a 10% AEP 24-hour design storm event (a rainfall depth of 98.4mm).

The NT EPA considers that any exposed PAF material has the potential to create AMD and impact the quality of stormwater runoff. The Proponent's AMD Management Plan should ensure prevention of any uncontrolled release of AMD affected water.

Runoff from the WRDs may also become contaminated if water quality is influenced by AMD, chemical spills or contaminants other than sediment. The Proponent's monitoring program would include sediment dam water quality. If monitoring results indicate any contamination, water from the sediment dams would be transferred to the process water dam for reuse.

The NT EPA supports the Proponent's commitment not to discharge mine affected water and considers that if discharge is required, the water quality should meet discharge criteria that maintains 95% species protection level as agreed through the Mining Management Plan, or the Waste Discharge Licence if one is required (Recommendation 11).

Contaminated water from the TSF would mainly consist of runoff, decant water and tailings leachates in the form of seepage. The underdrainage system would be designed to collect the majority of seepage and divert it into the process water dam for reuse. Similarly, all runoff and decant water would be collected and diverted to the process water dam for reuse in the mine water circuit.

The underground dewatering dam would temporarily store intercepted groundwater. The quality of groundwater inflows to the pits and underground workings would potentially deteriorate over time during mining operations due to exposure and oxidation of sulfides in pit walls. The underground dewatering dam would overflow into the adjacent process water dam, which also has capacity for excess water from sediment dams, the TSF and the mine water circuit.

The process water dam is a critical component of the Proponent's water management system and its design and construction will be particularly important to ensure the receiving environment is protected during standard operating conditions and in significant weather events. The NT EPA considers that the process water dam should be designed, constructed and operated in accordance with ANCOLD guidelines (2012).

In its advice to the NT EPA on the EIS, the Water Resources Division of DENR raised a concern that the nationally significant groundwater resources of the Great Artesian Basin located downstream of the Proposal could be impacted by pollution under extreme flooding conditions. Although these flooding events might only occur once in several decades, all efforts should be made by the Proponent to mitigate to the greatest extent practicable, the possibility of contaminated surface water flows entering the Hay River system through appropriately designed containment infrastructure capable of containing contaminated water during extreme weather events.

The Proponent has committed to design its flood protection bunding for events up to the 0.1% AEP event during operations, and up to the PMF event post-closure. In the case of an extreme weather event up to the PMF, the Proponent's flood protection bunding would prevent release of mine affected water from the site into Unca Creek, if appropriately designed, constructed and maintained. The NT EPA considers that the risk of a significant localised or regional impact on groundwater quality from extreme weather events is low.

The EIS proposes a program to monitor surface water quality of receiving environments downstream of the Proposal area and surface water storages (including process water dam, Jervois Dam, underground dewatering dams and WRD sediment dams).

The NT EPA advises all chemicals used in mining activities (e.g. processing, water treatment) and their breakdown products should be assessed, approved by the relevant regulator, clearly identified in the Mining Management Plan and included in monitoring programs of water storages and receiving environments. The NT EPA supports the Proponent's commitment not to release process water or contaminated water and recommends additional precautionary measures to ensure sensitive semi-arid environments and groundwater resources are protected from all aspects of the Proposal.

Recommendation 11

That approvals and decisions for the Proposal have conditions that require the Proponent to:

- **design, construct and operate the process water dam in accordance with ANCOLD guidelines (2012)**
- **update the draft Water Management Plan prior to commencement of mining, to the satisfaction of the relevant regulator**
- **adopt the recommendations of the surface water monitoring program independent peer review including:**
    - **the addition of boron, chromium, cobalt, molybdenum, selenium, silver, uranium, vanadium, hardness and total recoverable hydrocarbons to the testing suite**
    - **the addition of in-situ field testing for electrical conductivity, pH and turbidity**
    - **the addition of up-gradient and lowland reference sampling points in a neighbouring stream with similar geology and hydrology**

- **contain all mine-affected water within the mine site until monitoring indicates that controlled discharge, if necessary, can occur without adverse impacts**
- **ensure that water quality meets discharge criteria appropriate to maintain a 95% level of species protection**
- **undertake an assessment of all chemicals used in mining activities (e.g. processing and water treatment), including an assessment of their behaviours and breakdown products in tailings and tailings decant/seepage and their potential to contaminate the environment**
- **have all chemicals used in mining activities approved by the relevant regulator, clearly identified in the Mining Management Plan and included in monitoring programs of water storages and receiving environments as part of the Water Management Plan**
- **demonstrate that discharge water quality can be effectively managed to prevent adverse impacts on the receiving environment in terms of the declared beneficial uses and water quality objectives.**

Should discharge of water from the mineral lease be required, the Proponent must apply for a Waste Discharge Licence under the Water Act 1992.

The NT EPA considers that the Proponent's surface water monitoring program requires further review and development to adequately and effectively detect and quantify any impacts to the receiving environment (Recommendation 12). For example, the location of downstream monitoring sites in relation to potential contaminant sources should be reviewed and monitoring sites at and immediately downstream of mining activities established.

In semi-arid environments surface water flows can occur sporadically. The updated monitoring program should include additional receiving environment monitoring, such as creek sediment quality and subsurface alluvial groundwater quality, to detect potential impacts with greater certainty and efficiency. The monitoring program should accommodate for the lack of sufficient baseline data and existing contamination from historic mining activities, and results should inform management and mitigation measures to be implemented during operations, rehabilitation and closure.

As specific guidance for assessing and managing water quality of temporary inland waters in arid environments in Australia is being developed and is not currently available (ANZG 2019), the Proponent should seek advice from suitably qualified professionals with expertise and demonstrated experience in the assessment and management of water quality in the Central Australia region.

The NT EPA considers that a program for monitoring water quality impacts in the receiving environment is important to detect potential impacts to the receiving environment waters associated with the construction, operation, rehabilitation and closure of the Proposal.

Recommendation 12

That approvals and decisions for the Proposal have conditions that require the Proponent to update the surface water monitoring program, as part of the Water Management Plan, to the satisfaction of the relevant regulator prior to commencement of the Proposal. The program should:

- **be developed by a suitably qualified professional with experience in aquatic ecosystems of the arid region of Central Australia**

- **be developed specifically for the arid region of Central Australia and, in the absence of specific guidelines for the arid region, take into account the guiding principles of Australian & New Zealand Guidelines for Fresh & Marine Water Quality (ANZG 2018) and other relevant guidelines**
- **be updated based on an assessment of the receiving environment water quality and include clear objectives, targets, indicators, performance criteria, locations and timing**
- **be capable of detecting changes in receiving environment water and alluvial sediment quality and potential impacts associated with the Proposal, to inform appropriate management and mitigation measures**
- **be capable of establishing baseline water and alluvial sediment quality and distinguishing between historic and Proposal related mining impacts**
- **include site specific trigger levels as recommended in Australian & New Zealand Guidelines for Fresh & Marine Water Quality (ANZG 2018)**
- **incorporate a review system to determine the adequacy of the program to meet its monitoring objectives**
- **establish comprehensive and robust surface water quality datasets using event based monitoring records**
- **be updated at least annually**
- **report all monitoring data with an assessment of the impacts on the receiving environment in a Water Management Report to be provided to the relevant regulator within six months of commencement of construction and on an agreed reporting period thereafter.**

Public disclosure of the Water Management Plan and Water Management Reports should be provided on the websites of (as applicable) the Proponent, the Operator and relevant regulatory authorities.

Overall, the NT EPA finds that there is a low risk of mine affected water contaminating receiving surface waters on a local or regional scale. All mine affected, contaminated water would be contained in the mine water management system. The process water dam, if designed and constructed to ANCOLD (2012) standards as recommended in this Report is unlikely to overflow into the nearby Unca Creek. Bunds would be designed to accommodate extreme weather events up to 0.1% AEP. The Proponent does not propose to discharge any mine affected water. If discharges are required, all active discharges would be regulated through the Mining Authorisation (Mining Management Act 2001) or a Waste Discharge Licence (Waste Management and Pollution Control Act 1998), which will require appropriate compliance and flow monitoring locations, and establishment of release limits and contaminant trigger levels (NT EPA 2014).

Dust suppression with contaminated water

The Proponent's estimated water demand for dust suppression is significant at 1,874ML/y (5ML/day). To minimise extraction of groundwater and surface water, the Proponent proposes to use process water for dust suppression in mine site catchments draining to the internal water management system.

The potential impacts of using contaminated water for dust suppression during mining are considered to be more relevant to terrestrial environmental quality as a potential diffuse soil contamination risk, rather than a water quality risk. Soils may act as a sink for

accumulation of contaminants from application of water for dust suppression. This is discussed in section 5.4 of this Report.

Fuel and chemical spills

Contaminated runoff from hazardous material spills has the potential to cause impacts to receiving surface waters through reduction in water quality and degradation of in-stream habitats.

The Proponent assessed the risk of hazardous material spills (including fuels and chemicals) contaminating surface water as 'medium', with a residual risk rating of 'low' after implementation of proposed prevention and mitigation measures. The Proponent intends to avoid contamination of surface waters by designing facilities to prevent release of contaminants, and adopting hydrocarbon and chemical handling, storage and spill response procedures in compliance with relevant legislation and standards. Accidental spills would be managed in accordance with the Waste Management Plan or Emergency Response Plan. Further information is provided in section 5.4 of this Report.

The Proponent's exposure pathway assessment indicated that there are few potentially complete pathways that would link a human health or environmental receptor with a potential source of contamination (Supplement Appendix A6). The assessment concluded that there are limited complete exposure pathways and therefore a limited risk to human health or the environment.

The Proponent's risk assessment addressed scenarios where there is a potential source of contamination and identified risk management and mitigation measures to reduce the risk to acceptable levels through the implementation of the Environmental Management Plan and associated sub-plans.

Based on the information provided, the NT EPA concludes that impacts on surface water quality as a result of hazardous material spills are unlikely to be significant and can be prevented, managed and mitigated in accordance with the Proponent's commitments and management plans.

The Proponent has obligations under the MM Act and WMPC Act to prevent environmental harm. Any uncontrolled discharge or spill of hazardous materials that could cause environmental harm must be reported to the relevant regulator.

Mobilisation of soils/sediment and/or contaminants

As outlined above, initial geochemical investigations indicated that remnant materials from historic mining activities have the potential to contaminate the receiving environment if mobilised. Disturbance and mobilisation of these historic materials may occur during implementation of the Proposal, particularly during construction activities. The Proponent has committed to collecting and managing historic PAF materials. However, the investigation indicated that some historic materials were metalliferous without being PAF and as a precautionary measure, the NT EPA has made recommendations to minimise the risk of contamination of receiving environments from these materials. In particular, the NT EPA recommends the Proponent undertake further geochemical investigation and sampling to inform adequate prevention, management and mitigation measures (Recommendation 9). The NT EPA further recommends that all historic metalliferous materials and their leachates should be managed in accordance with an AMD management plan (Recommendation 10).

The risk of significant impacts from mobilisation of sediment in general is discussed under the Terrestrial Environmental Quality factor in section 5.4 of this Report. The NT EPA's assessment concluded that within the mine site, soil erosion would have limited consequence on the receiving environment under the proposed suite of soil and water management measures.

Groundwater quality

Contaminated seepage

Materials, wastewaters and runoff stored in the TSF, the process water dam and WRD sediment dams have the potential to produce contaminated seepage which could impact on groundwater quality.

The chemical composition of seepage (leachates) from tailings stored in the TSF was not provided. However, initial geochemical investigations indicated that tailings from sulfide ore processing would likely be PAF with high concentrations of metals/metalloids and with the potential to produce AMD. Further details about tailings management are provided in the AMD discussion above.

Although the TSF would be constructed with a low permeability base, an underdrainage system and a HDPE liner in some walls, the EIS predicts that seepage of tailings leachate would still occur (see 5.2.4 of this Report) and would likely impact groundwater quality.

The EIS predicted that water in the process water dam would likely contain elevated levels of salinity, metals and sulfates compared to baseline surface water quality. The Proponent committed to lining the process water dam to reduce seepage rates; however, some seepage of contaminated water would still occur with the potential to impact groundwater quality.

The EIS indicated that seepage from the unlined WRDs and WRD sediment dams has a low to moderate probability of containing elevated salinity, acidity and metals.

The Proponent's local bore investigations and mine site groundwater modelling predictions indicated that seepage would move slowly down gradient into local aquifers, which were considered limited in extent and hydraulic connectivity. Particle tracking modelling predicted that seepage from the TSF and WRDs would likely be captured by the drawdown cone of adjacent pits during operation and post-closure (see section 5.2.4 of this Report).

Based on the information provided in the EIS, the NT EPA considers that seepage from the TSF, the process water dam and WRD is unlikely to have a significant impact on regional groundwater quality and poses a low risk to other users with respect to reducing water quality or availability in nearby pastoral bores and community water supplies. Potential impacts to community water supplies are discussed further in sections 5.2.4 and 5.6.4 of this Report. Impacts on the Orrtipa-Thurra community water supply are unlikely to occur due to the distance from the mine site (18km), the low hydraulic conductivity of the fractured rock aquifer and the likely capture of seepage within the pit voids.

The EIS proposes to measure groundwater quality annually at all observation bores and quarterly at pumping bores and three WRD/TSF seepage monitoring bores. The independent peer review assessed the groundwater monitoring program as best practice and fit for the purpose of assessing the environmental impact of mine dewatering and groundwater extraction.

The EIS proposes to assess groundwater quality against pastoral use criteria, as this is the current beneficial use of the groundwater in the mine area. If seepage from the TSF and WRD causes unacceptable impacts to pastoral use, the EIS proposes to implement design and seepage management measures such as pumping and treating seepage from beneath the TSF/WRDs using interceptor bores.

The NT EPA supports the Proponent's commitment to an ongoing review of groundwater data and modelling by an independent technical specialist during operations and post-

closure and the implementation of contingency measures should unacceptable impacts to groundwater from TSF leachate be measured.

Fuel and chemical spills

Spills of hazardous materials and fuels present a very low risk to groundwater at this site due to the relatively deep groundwater table (20 – 30m below ground level). Further assessment of potential impacts from fuel and chemical spills and mitigation measures is provided in section 5.4.4 of this Report.

Sewage management and treatment

The EIS states that sewage and grey water would be treated in licensed onsite sewage treatment facilities including a treatment plant and septic tank systems that have been designed and installed in accordance with relevant standards and guidelines, including AS/NZS 1547:2012 On-site Domestic Wastewater Management 2012, AS/NZS 1546.1 Australian Standard On-site domestic wastewater treatment units: Septic Tanks 2008 and Australian guidelines for Water Recycling: Managing Health & Environmental Risks (Phase 1) 2006. The proposed sewage treatment facility would be licensed by the Northern Territory Department of Health. Approvals would be obtained in accordance with the Draft Guidelines for Wastewater Works Design Approval of Recycled Water Systems 2014 and Guidance for Completion of Wastewater Works Design Approval Applications. Treated water would be recycled and reused on site where practicable. The Proponent committed to develop a recycled water management plan at the detailed design stage which would include appropriate risk management and monitoring.

The NT EPA considers that the sewage management system has not been adequately described in the EIS, however considers it appropriate that the required additional information be provided to the relevant regulator for approval prior to commencement of the Proposal. The NT EPA supports the Proponent's commitment to manage and treat sewage effluent onsite, and to reuse or recycle treated wastewater in accordance with the Northern Territory Department of Health requirements.

Contaminated pit void water (post-closure)

The Bellbird pit, Reward pit and Reward South pit are expected to form local groundwater sinks beyond the life of the mine. The Reward and Bellbird open pit voids are predicted to form shallow lakes with water depth of 10-15m (Supplement Appendix A-5). Hence the majority of the pit void will remain exposed to air indefinitely.

The EIS indicates that the primary inputs to the pit voids affecting pit lake water quality would be groundwater seepage and direct rainfall including runoff from pit walls. Contaminated seepage from the TSF and possibly WRDs into groundwater is also expected to contribute post-closure through drawdown into the open pits and underground operations closest to these landforms. The down gradient seepage from these landforms is expected to be slow due to the low permeability of the fractured rock groundwater system but is expected to break through and contribute during operations and over a sustained period post-closure.

Indicative pit water chemistry and the chemical contributions from various mine landforms and water dams have been estimated through preliminary geochemical investigations and groundwater modelling conducted for the life of mine. Water quality in pits is predicted to fluctuate in early post-closure and to stabilise near neutral in the longer term due to the alkaline groundwater and the eventual depletion of sulfide mineralisation in the pit wall surface due to oxidation. No time period is proposed for when this is likely to occur. The semi-arid environment would typically result in evaporative concentration of solutes in the pit lakes and the model predicts that sulfate will increase to 2500mg/L after 30 years and continue to increase until equilibrium is reached, possibly after 150 years post-closure.

The predictions are considered preliminary and the model is being further developed to provide more certainty regarding pit void inputs. However, current information suggests that under the proposed mine closure scenario, pit lakes will be a legacy at the mine site for an extended period following closure. They are likely to contain poor quality water and present a physical hazard due to their depth (>80m from ground level to the pit lake surface).

The alternatives to maintaining the pits as voids have not been discussed in any detail in the EIS. While the Draft EIS (Appendix C-1) indicated that backfilling of tailings into the Reward pit at closure as well as backfilling pits with PAF waste rock were preferred options, this is not considered likely given the Proponent's presentation in the Supplement around resource sterilisation and feasibility. This is discussed further in section 6 of this Report.

Confounding this potential management strategy is the risk associated with the diversion of Unca Creek, the integrity of the diversion into the long term, and the implications of diversion failure with respect to the Reward pit (with or without tailings backfill) and downstream environmental values.

The Supplement recommends groundwater quality monitoring for at least 10 years post mining. It is unclear if the Proponent intends to commit to long term monitoring and whether the monitoring includes pit voids. The surface water quality monitoring program and groundwater monitoring should include monitoring of pit void conditions post-closure to validate modelling predictions and determine whether appropriate closure criteria are likely to be met (Recommendation 13).

If pit water quality departs significantly from modelled predictions such that the trajectory for longer term water quality in the pit voids indicates a poor quality outcome, contingency measures must be developed and implemented by the Proponent as required to ensure that appropriate closure criteria developed for the pit voids can be met. Upon closure and prior to relinquishment of the mineral lease, an audit of monitoring data and pit water quality modelling should be conducted by an independent and suitably experienced third party to assess whether the closure criteria for pit voids can be met.

Recommendation 13

That approvals and decisions for the Proposal have conditions that require the Proponent to include in the Mine Rehabilitation and Closure Plan (referred to in Recommendation 25):

- **closure objectives and completion criteria for pit voids that are acceptable to the relevant regulator**
- **a robust monitoring program designed to validate and update modelling and determine whether or not the trajectory for pit water quality indicates closure criteria for final pit void condition can be met**
- **an assessment of the timing and impacts of density driven outflows of pit void water on surrounding groundwater quality**
- **an assessment of the long term (up to 1000 years or equilibrium, whichever is sooner) groundwater quality impacts of full/partial backfilling of pits with tailings and PAF waste rock at closure**
- **analysis of the risk to Unca Creek environmental values of diversion failure taking into account an above-ground TSF and the Reward Pit void, including any backfill scenario**

- **a contingency plan outlining trigger levels for actions, specific responses and mitigation measures, and consequences for rehabilitation and closure activities**

- **a requirement for an independent external audit of the pit void monitoring program and modelling by a suitably qualified and experienced auditor prior to relinquishment. The appointment of the auditor is to be endorsed by the relevant regulator. The auditor is to assess if closure criteria can be met at closure and post-closure. The auditor is to report to the relevant regulator.**

The Mine Rehabilitation and Closure Plan must be submitted for approval by the relevant regulator on the advice of the Northern Territory Environment Protection Authority prior to mining and on an agreed reporting period thereafter.

Naturally occurring radioactive materials

In its advice to the NT EPA on the EIS, the Department of Primary Industry and Resources (DPIR) indicated that, while regionally the area hosts uranium and thorium and/or potassium-40 radionuclides, this combined radioactive signature is more likely from the granites in the area. Waste rock characterisation undertaken for the EIS (Draft EIS Appendix C5) also indicated that waste rock does not show uranium concentrations above 80ppm or thorium concentrations above approximately 250ppm, and thus radioactivity can be considered to be below the 1Bq/g criterion for NORM (ARPANSA 2005). These results corroborate that NORM are unlikely to be present and are unlikely to be an issue for the Proposal area.

5.3.5 Conclusion against the NT EPA objective

With the implementation of relevant management plans and recommendations identified above, the NT EPA considers that the Proposal could be conducted in such a manner that its objective for inland water environmental quality is likely to be met.

5.4 Terrestrial environmental quality

5.4.1 Environmental objective

Maintain the quality of land and soils so that environmental values are protected.

5.4.2 Environmental values

The north western portion of the Proposal area is made up of sedimentary sandstone, limestone and conglomerate of the Jervois Range, with the remaining area overlying pre-Cambrian gneiss and schists within the Bonya Metamorphics of the Arunta Block. The mine water supply borefield about 20km north of the mine site is located in the carbonate sediments of the Georgina Basin. The topography of the Proposal footprint consists of bold ranges, undulating plains and low hills and rises.

The Proposal area has been previously disturbed by mining and exploration activities and contains historic TSFs, WRDs, decommissioned processing equipment, open pits, prospecting trenches, a ROM pad, water storages and evaporation ponds, a camp, exploration pads, access roads and tracks.

Soils across the Proposal area comprise well drained, light to moderately textured soils including rudosols, kandosols and tenosols with low electrical conductivity and cation exchange capacity. Soils are neutral, non-saline, prone to slaking and are unlikely to be sodic or dispersive. The average depth of topsoil across the area is 10cm.

Soil habitats in the Proposal area support biological diversity and downstream surface water and groundwater quality.

5.4.3 Potential impacts

Construction, operation and closure of the Proposal have the potential to result in the following impacts to terrestrial environmental quality:

- soil erosion and sedimentation resulting in impacts to water and soil quality
- soil contamination from:
    - storage and use of chemicals
    - disturbance of historic mining areas containing contaminants
    - mine waste structures including TSF and WRDs.

5.4.4 NT EPA assessment

Soil erosion and sedimentation

During construction and operation of the Proposal, soil erosion by wind and water could result in mobilisation of sediment to surrounding areas, potentially impacting on the terrestrial environmental quality of surrounding habitats.

The Proponent's soil landscape assessment (Draft EIS Appendix C4) identified both surface soils and subsoils were generally prone to slaking when wet, however considered that there was a low risk of soils being dispersive and/or sodic.

In response to erosion related concerns raised by DPIR on the proposed 25 degree slope of the waste rock dump design in the Draft EIS, the Proponent committed to a reduced slope of 18 degrees with benches and batters to retain topsoil and allow vegetation to establish.

The Proponent committed to the development and implementation of an Erosion and Sediment Control Plan (ESCP) consistent with the Best Practice Erosion and Sediment Control guideline (IECA 2008). A preliminary erosion and sediment control plan was provided in the EIS (Draft EIS Appendix 5F) with a commitment to update the plan for approval by a Certified Professional in Erosion and Sediment Control and the relevant regulator as part of the mining authorisation process. Implementation of the ESCP would be monitored by a suitably qualified third-party auditor, to the satisfaction of the relevant regulator.

The NT EPA expects soil erosion within the mine-site to have limited consequence on the receiving environment provided these issues are managed under the proposed suite of soil and water management measures. Similarly, dust generated by wind erosion is not likely to be a significant matter if the proposed air quality management measures (e.g. dust suppression) are implemented during mine construction and operation.

The NT EPA supports the Proponent's commitments to manage erosion and sedimentation through implementation of the ESCP and makes Recommendation 14 requiring the proposed mitigation measures to be implemented to minimise impacts to terrestrial environmental quality.

Recommendation 14

That approvals and decisions for the Proposal require, the Proponent or Operator to provide to the relevant regulator an updated erosion and sediment control plan for the Proposal. The plan must outline all permanent and temporary erosion and sediment control measures proposed to be installed for the Proposal. The updated plan must be prepared by a suitably qualified person and approved by a Certified Professional in Erosion and Sediment Control, in accordance with the International Erosion Control Association Best Practice Erosion and Sediment Control guideline (as amended from time to time) or higher standard. An

independent, suitably qualified and experienced auditor must be engaged to review and approve the plan, and to inspect and approve that the work is undertaken according to the plan.

Soil contamination

The Proposal includes onsite fuel storage capacity of approximately 2 million litres of diesel which would provide four weeks supply for the processing plant, mobile equipment and power generation. Storage and use of a range of other potentially hazardous substances are proposed including explosives, fire suppression chemicals, copper and other concentrates, acids, alkalis, flocculants, grinding media, flotation chemicals and perchlorates. Submissions received on the Draft EIS raised concerns about the potential for hazardous materials such as fuels and chemicals to contaminate land if stored and used inappropriately.

The Proponent's proposed risk controls include complying with relevant legislation, standards and guidelines; regular inspection programs to ensure structural integrity of storage vessels, tanks, bunds and containment systems; spill management measures as part of the Environmental Management Plan (Draft EIS Chapter 5) and development and implementation of an Emergency Response Plan that would require approval by the relevant regulator as part of the mining authorisation process. In addition, the Proponent is required to comply with the provisions of the NT work health and safety legislation which would further reduce the potential for significant impacts from hydrocarbon or chemical spills on land and soil quality.

The NT EPA considers that impacts on terrestrial environmental quality as a result of spills of hazardous substances are unlikely to be significant and can be managed in accordance with the Proponent's commitments and relevant management plans.

Proposed activities would disturb areas impacted by historic mining that potentially contain contaminants of concern which, if released, could impact on land and soil quality. Public submissions raised concerns related to potential contamination from historic mine materials and the Proponent's strategy for managing these materials to prevent impacts on the receiving environment. In its submission on the Draft EIS, the NT EPA raised concern on the limited availability of contamination baseline data and requested the Proponent collect baseline data to establish the level of impact from historic mining and natural background conditions.

The Proponent provided a Contaminated Land Preliminary Site Investigation which was limited in scope to a site inspection and desktop review of relevant available information and did not include a field sampling investigation. However, as part of the AMD study for the EIS, the Proponent provided data on the acid forming characteristics of 22 historic mine material samples taken from the existing TSF, waste rock stockpiles and ore stockpiles. Of these samples, two were classified as PAF and an additional three were tentatively classified as PAF (Draft EIS Appendix C1 Appendix A), indicating that some historic material would potentially generate AMD.

The Proponent committed to undertake ongoing geochemical characterisation of mine waste materials to inform development of waste rock and tailings management options to prevent AMD. AMD issues are discussed in further detail in section 5.3 of this Report, and the NT EPA has made Recommendation 9 for further testing and regular update of the Proponent's hydrogeochemical modelling to improve understanding and management of AMD risks, and Recommendation 10 for the development of an AMD Management Plan.

The Proponent identified contaminants of potential concern that could be associated with historic mining including acids, alkalis, explosives, metals, polychlorinated biphenyls, hydrocarbons, solvents, and volatile and semi-volatile organic compounds. The conceptual site model in the EIS (Supplement Section 4.1) identified contaminant

sources, release mechanisms, exposure pathways and receptors and indicated contamination could impact aquatic and terrestrial ecosystems and beneficial water uses. However, the EIS concluded that the proposed mitigation measures, including implementation of the suite of environmental management plans would be adequate to manage potential contamination risks to an acceptable level.

Mine waste structures including the TSF and WRDs will contain contaminants that have the potential to contribute to reduced soil quality in the Proposal area if the design, construction and management is not effective in maintaining stability and minimising the release of any contaminated runoff and seepage.

The NT EPA considers that by designing, constructing and operating mine waste storage facilities to meet the closure objectives, risks associated with contamination of land outside waste storage facilities will be reduced to acceptable levels. The NT EPA considers that adherence to relevant guidelines such as ANCOLD (2012), along with implementation of the proposed ESCP, should minimise the risk of instability and erosion of post-closure landforms in the short-term. The NT EPA makes Recommendation 25 in Section 6.1 to improve site rehabilitation measures and mine closure outcomes.

The NT EPA recommends periodic inspection, review and auditing of the mine waste facilities by independent technical experts. This would include performance monitoring of these facilities and an assessment of the overall performance and long-term integrity, as part of a rigorous regulatory process (Recommendation 15).

Recommendation 15

That the design, construction, management and closure of the waste rock dumps and tailings storage facility should be overseen by an appropriately qualified and experienced independent technical expert, approved by the relevant regulator, to provide:

- **objective and independent expert review to the relevant regulator:**
  - **on the adequacy of the design of the waste rock dumps and tailings storage facility to ensure long-term containment of waste and leachate**
  - **on the proposed performance monitoring program for the waste storages including potential seepage and leachates**
  - **on decommissioning and final rehabilitation to minimise long-term risks and consequences to the environment, community and future land use from the waste storages**
- **regular independent inspection and audit reports to the relevant regulator to ensure construction, management and closure is in accordance with the endorsed design and design objectives**
- **an independent assessment of the Proposal's management of tailings and waste rock, based on performance monitoring results, in an annual report to the relevant regulator and the Proponent**
- **an independent assessment of the quality assurance and quality control methods, procedures and tests used to verify that the technical specifications are met during construction**
- **assurance that the waste storages, if left to remain as landforms in perpetuity, are constructed and rehabilitated to an agreed suitable standard to achieve the closure objectives.**

The independent expert review and associated reporting and auditing should be made publicly available on the websites of (as applicable) the Proponent, the Operator and the relevant regulator.

The NT EPA considers that the Proponent must demonstrate how the preferred final landform meets the closure objectives (Recommendation 25). The potential for any future post closure costs associated with long term management of the Proposal to be left to the community and the government must be avoided. The closure objectives and the principles of ESD must be met and hence, the NT EPA has made Recommendation 25 in Section 6.1 of this Report.

The NT EPA is satisfied with the proposed short term erosion and sediment control measures and supports the Proponent's commitment to commence rehabilitation trials within the second year of operations and rehabilitate progressively. However, the rehabilitation strategy must be sufficient to ensure that disturbed areas can sustain native vegetation prior to relinquishment. Accordingly, the NT EPA makes Recommendation 25, requiring the Proponent to prepare a more detailed Mine Closure Plan in consultation with the NT EPA to submit to the relevant regulator that better demonstrates that disturbed areas can be effectively stabilised and rehabilitated for a post-mining land use.

The demand for dust suppression water for the Proposal is significant, ranging from 1.5 to 1.9GL per year of operations. For dust suppression in areas where drainage is captured in the mine water management system (WRDs, TSF, open cut pits, mine infrastructure area and some haul roads) use of process water is proposed as the first preference and raw water as the second preference. For all areas where drainage is not captured in the water management system, use of raw water for dust suppression is proposed.

The NT EPA considers that the ongoing use of process water for dust suppression throughout mining operations may present a risk of diffuse soil contamination within the mine site as it acts as a sink. While the EIS indicates that runoff from the mine site components would be captured during operations, the NT EPA considers that water used for dust suppression should be of a quality that minimises contamination of the site and the potential for environmental impacts post closure. The use of process water for dust suppression should be managed through the Water Management Plan, ensuring that the distribution of contaminants through dust suppression control measures does not prevent the achievement of the agreed post-closure land use for the site.

Recommendation 16

That approvals and decisions for the Proposal have conditions that require the Proponent to:

- **establish water quality criteria for any mine affected water used for dust suppression, to the satisfaction of the relevant regulator**
- **assess for and treat any soil contamination on the mine site consistent with the National Environment Protection (Assessment of Site Contamination) Measure 1999 prior to mine closure.**

The NT EPA expects that implementation of the above recommendations would effectively mitigate potential impacts to soil and land quality.

Conclusion against the NT EPA objective

With the implementation of relevant management plans and recommendations identified above, the NT EPA considers that the Proposal could be conducted in such a manner that its objective for terrestrial environmental quality is likely to be met.

5.5 Terrestrial flora and fauna

5.5.1 Environmental objective

Protect the NT's flora and fauna so that biological diversity and ecological integrity are maintained.

5.5.2 Environmental values

Terrestrial flora values

The Proposal is located within the Channel Country bioregion with the majority of the mine site area (88%) and the southern section of the proposed pipeline corridor located in the Jervois Range Site of Botanical Significance. The EIS described the overall Proposal area as Acacia shrubland habitat, with low levels of weed infestation.

The disturbance footprint is intersected by Unca Creek and its tributaries, and minor drainage areas, which generally flow only during runoff-producing rainfall events (ephemeral). Downstream of the Jervois Dam, the Unca Creek catchment is flat and open with wide expanses of sandy flats and spinifex grass, with scattered vegetation along the creek and drainage feature channels. Unca Creek surface water connection to Arthur Creek occurs only under extreme flooding conditions, approximately 45km south-east of the Proposal area.

Vegetation surveys identified eight vegetation communities within the Exploration Licence (EL) area of the mine site (Draft EIS section 4.1) and eight vegetation types within the proposed pipeline corridor and borefield (Supplement section 4.2.1). Field surveys used standard methods, however vegetation descriptions were not consistent with standards of the National Vegetation Information System (DoEE 2018) making it difficult to compare vegetation communities mapped for the EL with those mapped for the pipeline (Brocklehurst 2007, Neave 2004). The vegetation types and communities identified are well represented in the Channel Country bioregion (Baker 2005) and are not listed as threatened ecological communities under the EPBC Act. About 19% of the bioregion is protected within conservation reserves (NSW NPWS 2003).

Significant vegetation types (riparian vegetation and vegetation containing large trees with hollows), as defined in the Land Clearing Guidelines (DENR 2019a), occur within the Proposal area.

Riparian vegetation has a critical role in the maintenance of instream ecological processes as well as providing physical stability to waterways, ameliorating water quality impacts and providing critical habitat and resources for a range of plant and animal species (DENR 2019a). Riparian woodland occurs along watercourses and drainage channels, comprising 123ha (3.2%) of the EL area.

The Proposal area contains 2.56ha of mature bloodwood and ironwood woodland which is considered as significant vegetation and of high value due to the presence of large trees with hollows suitable for fauna (DENR 2019a).

Groundwater dependent vegetation communities are important groundwater dependent ecosystems (GDEs) especially in the arid environments of central Australia. They typically contain certain tree or shrub species that may fully or partially rely on groundwater. This includes *Eucalyptus camaldulensis* (River Red Gum), *Corymbia opaca* and *Corymbia aparrerinja,* which were recorded within the riparian vegetation communities within the Proposal area. GDEs may occur along Unca Creek and Arthur Creek near Lucy Homestead, where riparian vegetation may access groundwater within shallow alluvial soils.

The Draft EIS identified a mature Mulga woodland stand (3.55ha) as 'regionally exceptional' due to the vegetation community's age (estimated at 150 to 200 years) and location (fire protected grove east of Rockface Pit).

Only one threatened flora species was identified to occur within a 20km radius of the Proposal, the perennial sedge *Bolboschoenus caldwellii* (Endangered TPWC Act).The EIS also investigated three flora species listed as Near Threatened (TPWC Act) that occur within a 20km radius, the small shrubs *Eremophila cordatisepala*, *Sauropsis rigens* and *Sida intricata.*

Terrestrial fauna values

Information on fauna in and around the Proposal area was obtained from field surveys conducted in 1999, 2012, 2013, 2017, 2018 and 2019 including targeted surveys for threatened fauna species. These were informed by desktop studies and databases (DENR 2019b) to identify fauna species that have been or could be present in and around the Proposal area. Fauna surveys were undertaken generally in accordance with standard techniques and methods.

Surveys recorded a total of 118 native terrestrial fauna species. This included 18 mammals, 83 birds, 14 reptiles and three amphibians. Invertebrates were not included in the survey reports. Four non-native mammals, cat (*Felis catus*), European rabbit (*Oryctolagus cuniculus*), house mouse (*Mus musculus*) and cattle (*Bos taurus*), were recorded in the Proposal area.

The following threatened species were either confirmed as occupying the Proposal area or have suitable habitat that may be impacted by the Proposal:

- Australian painted snipe *Rostratula australis* (Endangered EPBC Act / Vulnerable TPWC Act)
- black-footed rock wallaby (MacDonnell Ranges race) *Petrogale lateralis* (Vulnerable EPBC Act)
- curlew sandpiper *Calidris ferruginea* (Critically endangered EPBC Act / Vulnerable TPWC Act)
- grey falcon *Falco hypoleucos* (Vulnerable TPWC Act)
- red goshawk *Erythrotriorchis radiatus* (Vulnerable EPBC/TPWC Act).

The NT Fauna Atlas (DENR 2015) shows records of the following listed threatened species within a 20km radius of the Proposal area: crest tailed mulgara (*Dasycercus cristicauda*), greater bilby (*Macrotis lagotis*), golden bandicoot (*Isoodon auratusIsoodon auratus*) and common brushtail possum (*Trichosurus vulpecula*). However, the likelihood of these species to occur within the Proposal was assessed as low due to absence of suitable habitat, a large distance from the nearest record, no recent records and/or that the species is no longer considered to occur in the region.

5.5.3 Potential impacts

Construction and operation of the Proposal would have the potential to impact flora and fauna values:

- directly through:
    - clearing and inundation of native vegetation
    - mortality or injury to fauna
- indirectly through habitat degradation as a result of:

  - changes to surface water and groundwater hydrology
  - introduction and spread of weeds
  - changes to the fire regime
  - introduction and spread of exotic/feral fauna
- cumulatively, resulting in a decline in threatened flora and fauna.

The combination of direct and indicted impacts may lead to significant reduction in habitat, landscape connectivity and habitat quality for threatened flora and fauna species.

Potential issues post closure are discussed in section 6.1.

5.5.4 NT EPA assessment

Direct impact - removal of native vegetation due to clearing and inundation

The Proposal has a total disturbance footprint of 382ha and would result in the direct removal of approximately 246ha of native vegetation. The main vegetation types to be cleared would be:

- *Acacia siberica* low sparse shrubland (107ha)
- Corymbia and *Acacia siberica* tall open woodland on floodplains and at the base of ranges (69.9ha)
- Triodia hummock grassland (14.24ha)
- *Eucalyptus camaldulensis* tall woodland in in drainage channels and rocky creek beds (3.35ha)
- *Acacia aneura* tall woodland in in fire protected valleys and upper reaches of drainage lines (2.46ha).

An additional 20ha would be inundated through upgrade of the Jervois Dam. The EIS indicated that no surveys were undertaken in this area, but mapped the vegetation as *Eucalyptus camaldulensis* tall woodland. The loss of this potential riparian habitat was not taken into account in the EIS, arguing that it would be only temporary with riparian vegetation re-establishing around the new extent of Jervois Dam.

The vegetation communities that would be cleared for the Proposal are relatively common throughout the region and most are not considered to be sensitive and significant vegetation types. The Proponent has committed to avoid impacts to significant vegetation communities where possible. Where impacts to significant vegetation communities cannot be avoided, the Proponent has committed to a voluntary offset strategy which includes habitat enhancement measures (Recommendation 17).

The NT EPA considers that clearing of the above vegetation types is unlikely to have a significant impact on vegetation at a regional scale and supports the Proponent's commitments to avoid or offset impacts to significant vegetation communities.

The Proponent committed to physically demarcate and exclude the Mulga Woodland stand in the south-east of the Proposal area, identified in the Draft EIS as regionally exceptional.

The Proposal would remove 5.91ha of sensitive and significant vegetation as defined in the Land Clearing Guidelines (DENR 2019a), including 3.35ha of riparian vegetation and 2.56ha mature bloodwood and ironwood woodland containing tree hollows suitable for fauna (Taylor et al. 2003). In addition, up to 20ha of riparian vegetation associated with

the upgrade of Jervois Dam would be inundated, which could not be avoided or mitigated should the Proposal be approved for implementation.

The NT EPA supports the Proponent's commitment to develop and implement an offset strategy as part of a Biodiversity Management Plan that may partially compensate for impacts to these sensitive and significant vegetation types. This offset is voluntary as there is currently no offset policy in the NT. Existing offset policies under the Australian Government's EPBC Act do not apply, as the Proposal is not a 'controlled action'. Given a commitment is made by the Proponent, the NT EPA makes Recommendation 17 to ensure the proposed offset strategy meets its objectives.

Recommendation 17

The Proponent's voluntary offset strategy should be developed and implemented in consultation with the Department of Environment and Natural Resources Flora and Fauna Division prior to the clearing of sensitive or significant vegetation.

Direct impacts – mortality and injury to fauna

Clearing

Clearing activities have the potential to injure or kill wildlife. The NT EPA supports the proposed measures of staged clearing, targeted pre-clearing surveys for native fauna and breeding places, and management of encountered fauna to minimise injury.

Vehicle strike

The Proposal would result in an increase in vehicle movements, which may increase the risk for fauna to be killed or injured by vehicle strikes. The NT EPA supports the Proponent's commitment to prepare and implement a Traffic Management Plan that would include measures for reducing the risk of road-strike. The EIS did not provide details of the proposed measures to reduce traffic related impacts to fauna, only stating that vehicle movements within the Proposal area would be subject to restricted speed limits. The NT EPA recommends the increased risk for vehicle strikes associated with a 24hr mine and haulage operation should be addressed in the Biodiversity Management Plan. All injured or killed fauna should be recorded and reported. Additional traffic management protocols and preventative measures should be developed if threatened species are affected by vehicle strikes or traffic related activities.

Recommendation 18

That all approvals and decisions in relation to the Proposal include conditions that require the Proponent to implement measures to avoid, manage and mitigate the risk of fauna vehicle strikes and other traffic related incidents in a Biodiversity Management Plan. As a minimum, the Plan should:

- **be based on an identification and assessment of vehicle-related risks to native fauna associated with a 24 hour hauling operation**
- **require internal recording and reporting of fauna injuries and deaths, with regular audits of this data to determine whether additional management measures are required.**

If any threatened fauna species are impacted by Proposal-related traffic, additional traffic management measures should be implemented in consultation with the Department of Environment and Natural Resources Flora and Fauna Division.

Contact or consumption of contaminated water/hazardous materials

The consumption of hazardous materials by fauna could cause significant health impacts, or death of animals and potentially to unborn offspring. Effects can be immediate or cumulative. Potential primary sources of hazardous materials would be the TSF, the process water dam and uncontrolled discharges of contaminated water.

The Proponent identified birds attracted to large waterbodies, such as the TSF, as the main fauna to be exposed to hazardous material but predicted that birds would be deterred by the noisy mine activities and more attracted to the nearby Jervois Dam. In addition, the Proponent would design the TSF to discourage wildlife. Mine site infrastructure would be designed to prevent uncontrolled discharges of contaminated water into the environment (refer to section 5.3 of this Report for further detail).

The Proponent identified a number of other activities that have the potential to result in fauna mortalities such as entrapment of fauna within mine pits and drill holes, drowning in dams and electrocution in transmission lines.

The NT EPA supports the Proponent's commitments in the draft Biodiversity Management Plan to report all threatened fauna species killed or harmed as a result of the Proposal, to investigate the incident and to rectify any safety issues. However, the NT EPA recommends that all threatened fauna injuries and deaths should be recorded and records made available to the relevant regulator on request. In addition, if threatened fauna species are harmed/killed, not only should safety issues be rectified, but also management and mitigation measures for the protection of that threatened species should be assessed and, if necessary, implemented (Recommendation 18).

Indirect impacts

Habitat degradation

The Proposal would result in changes to hydrological processes that could indirectly impact on riparian woodland and groundwater dependent ecosystems (GDEs) such as groundwater dependent vegetation and subterranean fauna. In riparian areas within the groundwater drawdown cone, the changes in the surface water and groundwater hydrology might have a cumulative impact on the riparian vegetation.

The Proponent's flora and fauna surveys identified deep-rooted trees within the mine site, which may be facultative groundwater dependent vegetation. It is uncertain if, when and how much these trees rely on groundwater. Recent studies in central Australia (Cook & Eamus 2018) identified that the critical maximum depth for groundwater dependent vegetation is 20m (previous studies suggested 15m), indicating that the deep rooted trees found at the mine site may be able to reach groundwater resources within the fractured rock aquifer (12-30m). Therefore, the impact of the predicted groundwater drawdown is uncertain. Likewise, the impact of the proposed changes in surface water flows on riparian vegetation is unknown and largely depends on the trees reliance on groundwater resources. There could be a potentially significant cumulative effect from the predicted changes in surface water and groundwater hydrology. As a precautionary approach, the NT EPA makes Recommendation 19, requiring the Proponent to undertake vegetation health monitoring.

Recommendation 19

That approvals and decisions for the Proposal have conditions that require the Proponent to prepare and implement a Vegetation Health Monitoring and Management Plan to the satisfaction of the relevant regulator, on advice from the Department of Environment and Natural Resources, prior to mining. The Plan should include:

- **a detailed baseline map of all riparian vegetation and groundwater dependent vegetation communities potentially impacted by the Proposal, including riparian vegetation along Unca Creek downstream of the Jervois Dam and *Eucalyptus camaldulensis* and *Corymbia opaca* trees in the cone of drawdown associated with mine dewatering and groundwater extraction**
- **methods and procedures for monitoring vegetation health and condition using measurable attributes appropriate for semi-arid vegetation communities**
- **a program to detect significant vegetation stress potentially attributable to the Proposal and assess whether there has been adverse impact (significant alteration beyond natural variation)**
- **a vegetation management trigger-response framework**
- **corrective action measures to be implemented if triggers are exceeded**
- **requirements for regular reporting including a detailed summary of monitoring, analysis of results, contingency actions undertaken and an evaluation of the effectiveness of the program.**

Reports should be provided to the relevant regulator and placed on the websites of (as applicable) the Proponent, the Operator and the relevant regulator.

The predicted groundwater drawdowns may also impact on subterranean fauna, such as stygofauna, which have been found in unconfined aquifers within the Proposal area and elsewhere in central Australia. Based on current knowledge of stygofauna, there is low potential for suitable habitat to be present in the fractured rock beneath the mine site, while the Georgina Basin carbonate aquifer of the proposed borefield is more likely to meet those requirements defined by Hose et al. (2015). A stygofauna survey of 10 bores in the borefield area found one copepod specimen. The significance of this finding was not investigated in the EIS.

The Proponent's modelling predicts drawdown of 2m to occur within approximately 110km of the proposed bore field after 10 years of mining operations. This zone represents a very small proportion of the extensive Georgina Basin, in addition to which there is a low probability of endemic species being associated with this specific location, so the modelled drawdown is unlikely to result in a significant reduction of habitat for endemic stygofauna species.

The NT EPA considers it is unlikely that the Proposal would lead to a significant impact on stygofauna. However, verification of groundwater modelling should continue for the life of the mine and, if a significant deviation from modelling is detected, the potential impacts associated with the variance should be reconsidered and referred to the NT EPA where there is potential for a significant impact to the environment.

Introduction and spread of weeds

Several weeds, including three weeds of national significance, *Tamarix aphylla* (Athel pine), *Cylindropuntia fulgida var. mamillata* (coral cactus) and *Parkinsonia aculeata* (Parkinsonia), were recorded at the site and are known to occur in the bioregion. The NT EPA advises that the Proponent is required under the Weeds Management Act 2001 to eradicate all Class A weeds, such as Athel pine and coral cactus, within the Proposal area and Statutory Weed Management Plans apply.

The proposed activities would be likely to introduce and spread weeds in the region if not managed appropriately. The introduction and spread of weeds could significantly impact

on the region's biodiversity, including sensitive and significant vegetation types, by competing for resources and intensifying fire regimes through increased fuel loads. This may lead to a significant change in vegetation composition and habitat degradation and loss. The Proponent has committed to implementing weed hygiene, monitoring and management measures to manage the risks of weed infestation.

Changes to fire regime

Changes to the frequency and intensity of the fire regime could result in changes to the composition and floristic diversity of vegetation. The establishment of the Project is expected to result in increased fire control in the area, and the Proponent would implement the Bushfire Management Plan (Draft EIS Section 5 Appendix 5B) to avoid and manage the risks and impacts from fire.

Summary

The NT EPA considers that the direct impacts from vegetation clearing are unlikely to be significant as the vegetation types are well represented in the region. The NT EPA also considers that potential indirect impacts to vegetation from weeds and fire are unlikely to be significant, if they are appropriately managed in accordance with standard management plans.

Competition or predation from introduced fauna

Field surveys recorded four introduced fauna species, domestic cattle (*Bos taurus*), house mouse (*Mus musculus*), rabbit (*Oryctolagus cuniculus*) and feral cat (*Felis catus*). Feral cats and rabbits are listed as 'key threatening processes' to biodiversity under the EPBC Act due to their impact on wildlife and the landscape (TSSC 2009). Threat Abatement Plans exist for cats (DoEE 2015) and rabbits (DoEE 2016).

Feral animals have the potential to cause significant impact to biodiversity and habitat quality. New activities in remote areas, such as this Proposal, have the potential to introduce new exotic animals, and spread and increase existing populations of exotic animals by providing increased habitat and food.

The Proponent's Biodiversity Management Plan (BMP) proposes to avoid the introduction of exotic animals by inspection of all machinery prior to entering the Proposal area. Within the Proposal area, the BMP proposes to discourage exotic fauna by maintaining a clean, rubbish-free environment and to undertake pest animal monitoring. Feral animal control strategies (e.g. baiting, trapping) would be implemented in accordance with relevant standards to maintain low abundance of declared animals.

The NT EPA supports the Proponent's measures to prevent, monitor and control exotic and feral animals within the Proposal area.

Impacts to fauna habitat quality

Notwithstanding that the Proponent has committed to preparing a voluntary offset strategy to compensate for impacts to sensitive vegetation, the permanent diversion of a ~1.7km section of the Unca Creek channel would result in the short to medium term severance of the wildlife corridor provided by Unca Creek and its riparian vegetation. This would likely impact habitat quality and connectivity. Riparian vegetation would eventually re-establish following rehabilitation along the new channel and this would likely provide a reconnection of the habitat through a functional vegetated link, restricting the duration of impact to the short to medium term.

The NT EPA supports the Proponent's commitment to identify, monitor and asses any impacts or changes to habitat quality as part of its Biodiversity Management Plan, however considers that the monitoring program should be revised to include an

appropriate level of detail in accordance with Recommendation 20. There may be opportunities to integrate the fauna habitat quality monitoring program with the vegetation health monitoring program and the offset strategy.

Recommendation 20

That approvals and decisions in relation to the Proposal include conditions that require the Proponent to provide an updated Biodiversity Management Plan prior to authorisation. The updated Plan shall include:

- **methods for monitoring changes in fauna habitat quality related to the Unca Creek channel diversion and groundwater drawdown**
- **methods and criteria that will be used to identify hollow bearing trees**
- **methods on how appropriate habitat for fauna will be determined**
- **methods to measure parameters such as presence of dieback; tree condition; regeneration; dust accumulation on foliage; thinning of ground cover; plant establishment, growth, diversity and cover; weed density and distribution; and feral fauna abundance**
- **the number, distribution and size of monitoring sites, sampling frequency, methods to collect baseline data and selection of control/reference sites**
- **a strategy for management and monitoring of potential impacts to the grey falcon**
- **a strategy for management and monitoring of potential impacts to the Australian painted snipe.**

The updated Plan should be prepared and implemented in consultation with the Department of Environment and Natural Resources Flora and Fauna Division, and approved by the relevant regulator.

Cumulative impacts - Decline of threatened flora and fauna

Sedge (Bolboschoenus caldwellii)

The endangered (TPWC Act) perennial sedge *Bolboschoenus caldwellii* prefers damp soils adjacent to permanent or semi-permanent water and was recorded from a bore overflow on Jervois Station in 1985, which seemed more of an outlier to the NT population in the Dulcie Ranges south-west of Alice Springs (Kerrigan & Albrecht 2006). Suitable habitat within the Proposal area may occur in the vicinity of Jervois Dam and overflowing production bores, but field surveys did not locate the species at Jervois Dam. Based on the species distribution range, the time since the species was recorded at Jervois Station and the negative survey results of potential habitat. The NT EPA concludes that the likelihood of occurrence of *B. caldwellii* is low and therefore the likelihood of a potential impact on this species is low.

Australian painted snipe (Rostratula australis)

The Australian painted snipe (*Rostratula australis*) is a wader bird of around 250mm in length that occurs in shallow, vegetated freshwater swamps, claypans or inundated grasslands. *Rostratula australis* feeds mainly at night on a diet of seed and invertebrates at the water's edge and on mudflats, and nests on the ground. It is listed as endangered under the EPBC Act and vulnerable under the TPWC Act.

In the NT, *R. australis* has been recorded on the Barkly Tablelands, at Lake Woods and Sturt Plateau, but may occur on any shallow ephemeral wetlands in central, southern or northern parts of the NT (Taylor et al. 2013). There are no known sites where *R. australis* is resident or regular in occurrence, suggesting the species may be nomadic (Lane & Rogers, 2000). A single female *R. australis* was recorded in March 2012 at the Jervois Dam, which provides suitable habitat when water is present (NT Fauna Atlas 2015). There is a high likelihood that this species may occur within the Proposal area when there is water in the Jervois Dam (Draft EIS Appendix C7).

The Proposal would involve additional inundation of about 20ha of vegetation around the perimeter of the Jervois Dam due to the proposed dam upgrade to increase capacity. The wetland vegetation at Jervois Dam would re-establish following completion of the upgrade and therefore any potential impacts to *R. australis* are likely to be short term.

The NT EPA supports the Proponent's commitment to implement the Biodiversity Management Plan (Supplement Appendix C-1) which includes a component for monitoring and management of potential impacts to *R. australis* from the proposed activities. The NT EPA considers that the Proponent should include additional detail in the Biodiversity Management Plan on the proposed program and methods for monitoring impacts to *R. australis* during mine construction and operation, and that the monitoring program should include corrective actions to be completed in the event that declines or impacts to the species are identified.

The NT EPA makes Recommendation 20 requiring the Proponent to prepare and implement the revised Biodiversity Management Plan to the satisfaction of the Flora and Fauna Division of the Department of Environment and Natural Resources.

Black-footed rock wallaby (Petrogale lateralis)

The black-footed rock-wallaby (*Petrogale lateralis*) is a moderately-sized macropod that belongs to a currently undescribed subspecies from the MacDonnell Ranges (Pavey 2006). It is listed as vulnerable under the EPBC Act. The Jervois Range is at the eastern extent of the *P. lateralis* range, with a small section included in the far north-western area of the EL in the vicinity of Jervois Dam. Targeted surveys in potential habitat did not find the species. Due to the availability of suitable habitat and distant proximity to the closest recent record (45km east in 1987), there is a low to moderate likelihood of *P. lateralis* occurring in the Proposal area.

Should it be found to occur in the vicinity of the mine, increased vehicle movements associated with mining activities would increase the risk of road strike that could potentially kill or injure individual *P. lateralis.* Under the proposed draft Biodiversity Management Plan, all threatened fauna species killed or harmed as a result of the Proposal would be reported but only measures to rectify safety issues would be implemented as a consequence. The NT EPA proposes Recommendation 18 to ensure adequate prevention, mitigation and monitoring measures would be implemented for the protection of threatened fauna species. Other potential impacts to *P. lateralis* from the Proposal include an increased risk of predation by introduced animals (e.g. feral cat)

Overall, the NT EPA considers that the potential reduction in habitat from the Proposal is of a small scale would be unlikely to have a significant impact on any regional populations of *P. lateralis* that occupy the Jervois Range. Other potential indirect impacts on this species are likely to be effectively avoided or mitigated by the implementation of the updated Biodiversity Management Plan as outlined in Recommendation 20.

Curlew sandpiper (Calidris ferruginea)

The Curlew sandpiper *(Calidris ferruginea)* is a small to medium sized shorebird that is present in Australia during the non-breeding season from late August to April. *Calidris ferruginea* is listed as critically endangered under the EPBC Act and as vulnerable under

the TPWC Act. In Australia, *C. ferruginea* inhabits coastal and brackish lagoons, intertidal mud and sand flats, estuaries, saltmarshes and occasionally inland freshwater wetlands (Ward 2012a).

The closest record of this species to the Proposal area is 265km south-west of the Proposal area at the Alice Springs wastewater treatment plant. Due to the availability of suitable habitat at the Jervois Dam and the proximity of the closest known record of the Curlew sandpiper, there is a moderate likelihood that this species may occur in the Proposal area during the non-breeding months (late August to April). While *C. ferruginea* may be present at times within the Proposal area, it is considered unlikely that there would be a significant impact on this visiting migratory bird species

Grey falcon (Falco hypoleucos)

The grey falcon (*Falco hypoleucos*) is a medium sized, compact, pale falcon that is found in low densities through much of the arid and semi-arid areas of Australia (Ward 2012b). Most records from the NT are from the southern regions. Suitable habitat was identified along Arthur Creek. The species was recorded within a 20km buffer of the pipeline in 2003 and has a high likelihood of occurring in the pipeline and borefield area and a moderate likelihood of occurring in the mine site area.

Potential impacts to *F. hypoleucos* could occur as a result of the removal of nesting trees or ground roosting sites. The Proponent proposes to manage these impacts through avoiding the clearing of large trees and the inspection of potential nests prior to clearing. The NT EPA considers that further detail about the methods and criteria used to identify nesting tree should be provided by the Proponent as part of the Biodiversity Management Plan (Recommendation 20).

Red goshawk (Erythrotriorchis radiatus)

The red goshawk (*Erythrotriorchis radiatus*) is a bird of prey that occurs across much of northern Australia. It is listed as vulnerable under both the EPBC Act and the TPWC Act. *E. radiatus* is known to have a home range of up to 200km^2 and the preferred habitat is tall open eucalypt forest and riparian areas (Woinarski 2006). *E. radiatus* nests in large trees within 1km of permanent water. The closest records of *E. radiatus* to the Proposal area are 380 - 390km west on the Stuart Highway. Field surveys found marginally suitable habitat for the species in the Jervois Dam seepage area and the northern section of the pipeline near Arthur Creek. Given the availability of marginal habitat, there is a low likelihood that this species may occur in the Proposal area. The NT EPA considers that with implementation of the Proponent's Biodiversity Management Plan, risks to the red goshawk as a result of the Proposal are considered negligible.

Pipeline construction impacts

Linear trenching for construction of the 50km pipeline would likely present specific entrapment risks to fauna. While the Proponent has partially addressed this risk, the NT EPA considers that additional management measures are required to meet animal welfare requirements and avoid fauna injury or mortality during trenching activities.

Recommendation 21

That approvals and decisions in relation to the Proposal include conditions that require the Proponent to prepare and implement a Trench Inspection Procedure, to the satisfaction of the relevant regulator, in consultation with the Department of Environment and Natural Resources.

5.5.5 Conclusion against the NT EPA objective

With the implementation of relevant management plans and recommendations identified above, the NT EPA considers that the Proposal could be conducted in such a manner that its objective for terrestrial flora and fauna is likely to be met.

5.6 Social, economic and cultural surroundings

5.6.1 Environmental objective

Protect the rich social, economic, cultural and heritage values of the Northern Territory.

5.6.2 Environmental values

Social and economic values

The Central Desert Region of Central Australia has a human population of about 4,200 of which 84% identify as Aboriginal (ABS 2016). The region is sparsely populated with large pastoral leases and remote Aboriginal communities and homelands. The nearest community to the Proposal is the Orrtipa-Thurra community (population ~100) located about 15km to the south-west of the Proposal area (30km by road). Maperte outstation is located about 17km north-east of the proposed mine site and while not currently occupied, may be used from time to time (Supplement section 3.11.7). Atitjere (Harts Range), located about 160km west of the Proposal area on the Plenty Highway, is an Aboriginal community with a population between 220 and 460 people (Draft EIS Appendix C-9).

Gemtree Caravan Park is located about 246km west of the Proposal on the sealed section of the Plenty Highway. This caravan park provides services for people travelling along the Plenty Highway and to and from surrounding Aboriginal communities.

The major regional community centre of Alice Springs, 380km south-west of the Proposal area by road, services the regional population of 41,000. Alice Springs has a population of about 25,000, with an Aboriginal population of about 18% and a low unemployment rate (<2%) in comparison to Darwin and the rest of Australia.

The region is home to Eastern Arrernte people and people of the Alyawarra and Anmatyerre (Draft EIS Appendix C-9) who have a long history of occupation in the region. Interviews conducted for the Draft EIS indicated that people maintain strong connections with their land, culture and traditions (Draft EIS Section 5.1 Appendix 5G). The region is remote with a lower socioeconomic status in comparison to most other regions in the NT, and is considered to be the third most socioeconomically disadvantaged of the 17 local government areas in the NT (Draft EIS Appendix C9).

The main economic activity in the area is the pastoral industry of beef cattle grazing. The Lucy Creek and Jervois homesteads are located approximately 24km north and 35km south of the Project respectively.

Cultural and heritage values

The cultural and heritage values of the Proposal area and broader region are largely associated with Aboriginal history, spirituality and culture. There is also some heritage value associated with historical mining.

Archaeological sites

Five archaeological sites, four background scatters and 41 isolated artefacts of Aboriginal origin were recorded within the proposed mine site area during the 2018 survey. Of the five archaeological sites identified, three were classified as minor quarries where quartz was used to produce stone artefacts. One site was described as a quarry site where quartzite was extracted to make stone tools. The final site was described as a

minor lithic scatter. These archaeological sites were rates as having low and low-medium archaeological significance (Draft EIS Appendix C8).

An additional 16 archaeological sites and 99 isolated artefacts of Aboriginal origin were identified during survey of the water pipeline and borefield in 2019. Most of these sites were rated as of low archaeological significance with the exception of one site located on the southern side of the cattle yards near the mine which was assessed as of low-medium archaeological significance. This site consists of a high percentage of large single platform cores and core tools. The low-medium rating was given due to its rarity and potential ability to provide valuable information on the past human occupation of the area (Supplement Appendix A8).

Sacred sites

Sacred sites protected under the Northern Territory Aboriginal Sacred Sites Act 1989 occur in the vicinity of the Proposal area. There are also Aboriginal burial places in the vicinity of the Proposal area that are protected under the NT Heritage Act 2011 and the Criminal Code Act 1983.

Heritage

There are no declared heritage places within the Proposal area. Field surveys recorded 62 historical features which relate to the previous mining, exploration and pastoral activities within the Proposal area. However, with the exception of one site that was rated as having a low to medium significance, all sites are considered to have a low heritage significance.

5.6.3 Potential impacts

Social and economic impacts

The following changes to the social and economic surroundings may occur as a result of implementation of the Proposal and could lead to positive and/or adverse outcomes for stakeholders and/or community members:

- increased local employment and training, particularly of Aboriginal people
- increased economic activity in the region
- increased heavy traffic in the region, with potential impacts on road safety, road infrastructure, tourism activity and community amenity
- improved local infrastructure (roads, telecommunications, education) or community events
- potential for impact to the supply and quality of water resources
- reduced community cohesion due to altered social and economic surroundings
- potential cumulative impacts arising from five major projects within the central Australia region.

Cultural and heritage impacts

The following impacts to cultural and heritage surroundings may occur as a result of the Proposal:

- potential impacts to any sacred sites protected under the Northern Territory Aboriginal Sacred Sites Act 1989
- potential impacts to any Aboriginal archaeological sites protected under the Heritage Act 2011
- degradation of cultural values.

5.6.4 NT EPA assessment

Social and economic assessment

The Proponent has identified and assessed the potential impacts outlined above and provided a Social Impact Management Plan (SIMP) as part of the EIS (Draft EIS Section 5.G). The SIMP recognises that the Proposal will create change in the region and locality and outlines the measures that will be implemented to maximise positive outcomes and minimise adverse impacts arising from these changes.

Key potential positive outcomes of the Proposal identified by stakeholders are job creation and training for local Aboriginal people and short-term business opportunities in the region. The Proponent has committed to prioritising the local market in recruitment and procurement processes to help achieve these outcomes. The recruitment strategy would focus on locals, and where skills are required from elsewhere, those employees would be encouraged to relocate to the region.

Increased local employment and training

The Proponent expects the Proposal to generate up to 360 direct jobs during construction and about 300 jobs during the 10 year operational phase. The workforce is likely to be largely sourced from Alice Springs. Consultation for the EIS identified that Alice Springs has a resilient workforce and capacity to provide workers for the regional mining industry (Draft EIS, Appendix C-9). More locally, the EIS identified that there is a sense of enthusiasm and anticipation in Orrtipa-Thurra and Atitjere about future job opportunities, as there are limited jobs in the area and high unemployment among residents.

The social impact assessment prepared for the EIS (Draft EIS Appendix C9) acknowledged the barriers to engaging local Aboriginal people in employment. These include educational disadvantage, family and cultural obligations, lack of work-readiness and industry experience, and potential unwillingness to work at a mine. The Proponent has committed to conduct workforce planning to reduce these structural and cultural barriers. The NT EPA considers that it will be important for the Proponent to be conscious of the observations made in the social impact assessment in efforts to maximise opportunities for employment and participation for local Aboriginal people. The Proposal has the potential to improve the socio-economic status of local residents for the duration of the Proposal.

The SIMP outlines a range of methods that will be implemented to maximise benefits and minimise negative impacts associated with training and employment. These include developing an Aboriginal employment and training plan, working with local employment and training providers, arranging training courses that are suited to local people, provision of suitable jobs, and developing policies to provide a safe and welcoming workplace for Aboriginal people. The Proponent also intends to collaborate with other companies undertaking major resource projects in the region on training programs and employment opportunities.

The NT EPA considers that for the benefits to be realised, it will be important for the Proponent to continue engaging meaningfully with the local community. The Proponent would need to manage expectations and implement the management measures and commitments listed in the SIMP and provide ongoing support to workers, including accommodating cultural and family obligations.

Increased economic activity

The Proponent estimates revenue of $2,390 million generated. Capital cost of the initial construction phase is estimated at $189.5 million. Operating costs will be $127.7 million when the Proposal is fully operational at Year 3. A total of $413 million in royalties and corporate taxes will be paid over the life of the Proposal.

Implementation of the Proposal has the potential to provide economic benefits in the region. This could be through increased business at community stores (Orrtipa-Thurra and Atitjere), sales of local artwork, sale of fuel and other supplies at the Jervois Station store, and the use of local pastoral stations for some services and minor works. There could be enterprise opportunities for Orrtipa-Thurra and Atitjere to provide services to mining, however this may require external support to be realised.

Further afield, there is potential for economic benefits in Alice Springs associated with the Proposal. Consultation for the EIS identified that there is a strong expectation that this will be realised through service and supply opportunities to local businesses. The NT EPA notes that for these benefits to be realised, it will be critical for the Proponent to maintain good communication to maximise the engagement of local businesses and to work with the business community to package and promote tenders which are suited to the local capacity (Draft EIS Appendix C9).

Increased heavy vehicle traffic

Processed copper and lead/zinc concentrate would be transported to Alice Springs for transfer to rail for export from Darwin and/or Adelaide ports. The Proponent estimated that during mining operations there would be up to 50 triple road train movements per day (or about one movement in each direction per hour) between the mine site and Alice Springs for about 47 weeks of the year. The Proponent's modelling for the Draft EIS predicted a worst-case increase in background traffic of 35% on the Stuart Highway and 56% on the Plenty Highway between 2018 and 2030 (Draft EIS section 4.7.3.3). This increase in industrial traffic could lead to potential impacts on road safety for other road users, road infrastructure, community amenity, and tourism activity.

During consultation for the social impact assessment, stakeholders including pastoralists, tourism industry representatives and the police expressed concern about the impact of mining trucks on the condition of the 200km dirt road section of the Plenty Highway (Draft EIS Appendix C-9). The Proponent acknowledged that Proposal-related traffic could contribute to the degradation of road condition, and this could increase road maintenance costs and decrease road safety (Supplement Appendix A9). The Proponent noted that the Northern Territory Government is responsible for regularly maintaining the public dirt roads, and has committed to consulting with the Department of Infrastructure Planning and Logistics (DIPL) on these issues. The Proponent will also address these concerns by implementing its Traffic Management Plan, communicating with stakeholders, and effective training and management of employees (Draft EIS Appendix C-9).

In response to advice and submissions received on the Draft EIS, the Proponent's supplementary report (Supplement Appendix A9) on traffic included a road safety audit, a high level assessment of road condition, and a Traffic Management Plan. DIPL advised that this would require further revision to meet the requirements of a traffic impact assessment in accordance with the *Guidelines to Traffic Management Part 12* (Austroads 2019). To reduce the impact of increased traffic from the Proposal, the Proponent committed to implementing best practice traffic management measures, including staggering heavy vehicle movements to and from the site, implementing speed restrictions for each section of the haul route, and restricting heavy vehicle operation in wet weather conditions (Supplement Appendix A9).

The supplementary report recommended that the Proponent and its transport provider work with DIPL to review the findings of the road safety audit and prioritise the implementation of upgrades to roads that will be used for Proposal-related traffic. The NT EPA recognises that upgrades are likely to occur over time such that other road users may initially be negatively impacted, however will likely eventuate in a more rapid improvement of road condition and safety than would otherwise occur without implementation of the Proposal, which would ultimately benefit other road users.

The NT EPA notes that the Proponent would be required to provide an updated traffic impact assessment and Traffic Management Plan for review and approval by DIPL prior to commencement of the Proposal. The NT EPA considers the Traffic Management Plan and proposed mitigation measures, including haulage speed restrictions, a process for public feedback and complaints, and ongoing liaison with the DIPL regarding road usage and truck movements to be appropriate to minimise impacts to road users and communities. The NT EPA supports the Proponent's commitment to implement these measures for the duration of the Proposal and to continue its engagement with DIPL and the community on traffic matters.

There is also potential for Proposal-related traffic to impact on community amenity through the generation of dust and noise, however the NT EPA considers this impact is unlikely to be significant. The nearest sensitive receivers to the haul route include the Gemtree Caravan Park (200m from the sealed Plenty Highway), Jervois homestead and Atitjere community (about 800m and 1km respectively from the unsealed Plenty Highway). The Proponent's air and noise modelling report (Draft EIS Appendix C-3) noted that traffic-related dust and noise impacts can be minimised. For noise, this could be achieved by maintaining vehicles and using appropriate driving practices such as avoiding the use of air brakes near residential areas. For dust, this could be achieved by applying a chemical dust suppressant to the sections of road closest to Jervois homestead and Atitjere, if found to be necessary. Due to the mine site's distance from the nearest sensitive receptors and surrounding land uses, impacts from dust, noise, or other matters as they relate to amenity are expected to be temporary and minor, provided the Proponent implements the management measures committed to in the EIS.

Submissions received on the Draft EIS and feedback from stakeholders during the social impact assessment raised concerns about a potential impact on tourism due to any reduction in road safety or community amenity associated with Proposal-related traffic. The Proponent recognised the importance of the tourism industry in the locality and region, and in particular, the potential impacts to visitor numbers to the Gemtree Caravan Park. The Proponent considered that implementation of the Traffic Management Plan and road safety strategy would effectively minimise impacts of Proposal related heavy vehicles on tourist traffic. The NT EPA supports the Proponent's commitment to communicate with key tourism stakeholders for the duration of the Proposal, particularly during peak tourist periods, to minimise potential negative impacts of mine related traffic.

The NT EPA considers the Traffic Management Plan and associated mitigation measures, including speed restrictions along the haul route, a process for public feedback and complaints, and ongoing liaison with the DIPL regarding road usage and road maintenance, to be appropriate to minimise impacts to road users and communities. The NT EPA supports the Proponent's commitment to implement these measures for the duration of the Proposal and to continue liaising with DIPL and the community on traffic issues.

Improved local infrastructure and community events

There would likely be upgrades to local road infrastructure associated with implementation of the Proposal that would be developed by the Proponent or other service providers. In addition to the upgrading of the Plenty Highway to a sealed road as part of the Outback Way Program (Supplement Appendix A9 section 9.3), upgrades are likely to also include improved telecommunications signals in the vicinity of the mine site, and upgrade of either the Orrtipa-Thurra or Lucy Creek airstrip. These have the potential to provide social, safety and economic benefits to other users including pastoralists, the community, tourists, government services and workers visiting communities.

The SIMP includes the development of a community sponsorship plan which would facilitate the granting of funds to local community events or infrastructure projects. The

distribution of community benefits (as part of the confidential ILUA) derived from the Proposal could also result in new community infrastructure to benefit local communities. The Proponent's SIMP recognises the importance of working with the community and the Central Land Council to help prioritise how sponsorship and infrastructure could best benefit the community.

Potential impacts to supply and quality of water resources

The social impact assessment (Draft EIS Appendix C-9) highlighted the strong values held by people in central Australia and the Northern Territory in regards to water resources and their protection from any impacts arising from resource extraction industries. Potential impacts to water resources from the Proposal are discussed in sections 5.2 and 5.3 of this Report.

The Proposal will require 1,200ML of water per year to be sourced from the existing Jervois Dam and a borefield to be developed 20km north of the Proposal on Lucy Creek Station. The proposed extraction of water for the Proposal is within capacity of the aquifer and water table drawdown on the nearest sensitive receptors (Lucy Creek domestic water supply and stock watering bores) are unlikely to exceed 3m. This drawdown will not reduce water availability for these users.

The Proponent proposes to manage and mitigate concerns regarding impacts to water through the strategies nominated in the Environmental Management Plan. These include open, transparent and ongoing communication about hydrological studies and monitoring, water sourced for the Proposal and impacts of drawdown on pastoral bores, soaks and other beneficial uses. The NT EPA is of the view that good communication and stakeholder involvement will help reduce any perceived impacts to water resources.

Reduced community cohesion

The EIS indicated there is potential for reduced community or social cohesion and resilience as a result of the Proposal. The Proponent considered that impacts could arise from a range of issues including mobilisation of the workforce and paid work, not meeting expectations for local employment, conflict or complaints within the community, reduced feelings of safety or wellbeing and displacement of other economic sectors (Draft EIS Section 4.7; Appendix C-9).

The Proponent identified a number of management measures to prevent impacting community cohesion including good communication and an alcohol-free mine site. Community complaints would be monitored, reported and improvement measures implemented where necessary to resolve issues, in accordance with the Proponent's complaints management system. The NT EPA notes that the Proponent and the Orrtipa-Thurra community have developed a MOU for maintaining good relations between the Proponent and the community and mitigating negative impacts associated with the Proposal. The NT EPA stresses that effective mitigation will require the Proponent to continually liaise with and meaningfully address issues with the community, the Central Land Council and with Police.

Potential cumulative impacts arising from five major projects within the central Australia region

Stakeholder engagement conducted for the Draft EIS raised concerns about the potential cumulative impacts of five major resource projects being developed in central Australia potentially at the same time (TNG Limited's Mount Peake Project, Verdant Minerals Limited's Ammaroo Phosphate Project, Arafura Resources' Nolans Project, Tellus Holdings' Chandler Facility and the Proposal). The Proponent recognised that while this would likely increase employment opportunities and economic benefits (as discussed above), it could potentially place pressure on workforce availability and services in the region. To manage this risk, the Proponent committed to engaging with

other Proponents to investigate the need for sequencing work activities and taking account of cumulative impacts, as well as ongoing stakeholder engagement and a good communication strategy. The NT EPA considers that with implementation of the Proponent's proposed controls, potential cumulative impacts of concurrent development of several projects are manageable and are not likely to result in a significant impact to the community.

Summary

Implementation of the Proposal would result in changes to the economic and social surroundings of the Proposal. As discussed above, these can result in positive outcomes for the community and other stakeholders. To maximise benefits and minimise adverse impacts it is paramount to have meaningful and effective communication between the Proponent, the community and other stakeholders. The Proponent has committed to the development of a Communication Strategy which will be specific and include methods for proactive and open communications with relevant and affected stakeholders (Supplement page 115).

To maximise positive outcomes and minimise adverse impacts arising from changes to the social and economic surroundings as a result of implementation of the Proposal, the NT EPA makes Recommendation 22 for continual engagement with and reporting to stakeholders and the community.

Recommendation 22

That prior to commencement of the Proposal, the Proponent must, to the satisfaction of the relevant regulator:

- **develop and implement a Community and Stakeholder Engagement Plan providing for:**
    - **information on recruitment to maximise local employment and training opportunities and to manage impacts on demand for local workers**
    - **publication of a community complaints telephone contact number and email to allow community members to contact the Proponent in the event of any issues or concerns**
    - **development and implementation of a complaints management procedure that requires complaints to be recorded, investigated and abatement measures to be carried out if required, for handling community complaints and grievances for the duration of the Proposal**
    - **effective ongoing stakeholder engagement and consultation on key mining operations (such as hydrological studies) and agreed post-mining closure, rehabilitation, land uses and access**
    - **a commitment to prioritise local businesses in procurement processes and to identify and implement actions for additional benefits for the affected communities**
- **update the Social Impact Management Plan for approval by the relevant regulator, and then update it regularly during construction and operation. The Social Impact Management Plan is to be informed by details of the matters outlined in the Traffic Management Plan and the Community and Stakeholder Engagement Management Plan listed above**

- **publish a social impact management report prior to commencement of construction and then annually during operation of the Proposal. The report is to detail the effectiveness of the Social Impact Management Plan measures to manage the social impacts and benefits of the Proposal. The report will also detail the effectiveness of community and stakeholder engagement.**

The reports should be provided to the relevant regulator and placed on the websites of (as applicable) the Proponent, the Operator and the relevant regulator.

Cultural heritage assessment

Potential impacts to any sacred sites

The Aboriginal Areas Protection Authority (AAPA) has issued two Authority Certificates to the Proponent in relation to the Proposal. Certificate C2016/155 covers EL25429 and identifies one recorded site within in a restricted works area and four burial sites. Certificate C2019/030 covers the proposed borefield and pipeline outside of EL25429 and identifies sacred sites, restricted works areas and burial sites adjacent to the proposed pipeline route (Supplement Appendix A-8). These locations should be clearly understood and avoided by the Proponent during the course of works for the Proposal. The NT EPA considers that if the Proponent complies with the conditions of applicable Authority Certificates, it is unlikely that sacred sites would be impacted.

Potential impacts to any archaeological or heritage sites

There is potential for impacts to cultural and heritage values if earthworks or vehicle movements occur at the location of any archaeological sites. The Proponent prepared a Cultural Heritage Management Plan as part of the archaeological assessment conducted for the Draft EIS, and incorporated further mitigation measures in the Environmental Management Plan. These include avoiding identified sites where possible, maintaining a register of the sites, and educating employees on their protection. Mine planning has already taken into account the location of known archaeological sites and they have been fenced to avoid inadvertent damage. If avoidance of all sites is not feasible, a permit to disturb will be sought from the NT Minister for Tourism, Sport and Culture under section 72 of the NT Heritage Act 2011. The Proponent has also committed to consult with native title holders regarding the management of archaeological material prior to the issuing of any permits to disturb a site (Supplement page 88).

It is possible that previously undetected archaeological sites occur in the Proposal area, and these could be impacted inadvertently during implementation of the Proposal. If detected, the control strategies outlined in the Cultural Heritage Management Plan will be implemented. These strategies include an assessment of the site, the alteration of activities to avoid the site if possible, and if that is not feasible an application will be made for a permit to salvage the site.

There is also some potential for impacts to archaeological sites due to trespass. To mitigate this risk, access restrictions will be placed on the public and while on site, employees will be required to remain onsite at all times to avoid trespassing on culturally significant areas. A Workers Code of Conduct will be developed by the Proponent to address legal obligations of personnel to avoid trespassing on culturally significant areas.

The NT EPA notes the relatively low significance of heritage sites in the Proposal area. In consideration of the Proponent's commitment to avoidance and mitigation measures, any impacts on heritage values associated with archaeological or heritage sites is unlikely to be significant.

Degradation of cultural values

The social impact assessment conducted for the Draft EIS identified that any damage to sacred sites or other significant sites could cause a loss of cultural and spiritual connections to country, and this could have physical consequences for local people. Additionally if Aboriginal employees are not able to attend cultural activities, this could have negative impacts on culture. There is also potential for cultural offence to occur if employees do not accommodate cross-cultural differences.

The Proponent would manage these risks through ongoing liaison and communication, the Orrtipa-Thurra community MOU, cross cultural staff inductions and workers code of conduct. The NT EPA notes the SIMP includes provisions for future engagement with relevant Aboriginal stakeholders and supports the Proponent's commitment to ensure any traditional cultural activities are not impacted by the Proposal, including ensuring that Traditional Owners have reasonable access to all cultural or significant sites on its mineral leases.

There is also potential for Aboriginal cultural values of land and water to be impacted if the environmental objectives for other factors are not met. The NT EPA considers that this can be avoided or minimised by addressing and meeting the requirements for the other environmental factors as discussed in this Report.

5.6.5 Conclusion against the NT EPA objective

With the implementation of relevant management plans and recommendations identified above, the NT EPA considers that the Proposal could be conducted in such a manner that its objective for social, economic and cultural surroundings is likely to be met.

6 Whole of environment considerations

6.1 Closure and rehabilitation

6.1.1 Pipeline corridor rehabilitation

The EIS describes a broad strategy for progressive and final rehabilitation of the 48.5km water supply pipeline corridor. Details of the diameter of the pipeline and corridor width are not provided in the EIS. The Proponent stated that it would determine these details at the detailed design stage. The EIS states that there is minimal clearing (1ha) required for pipeline construction as the corridor is largely within areas of existing disturbance including station roads and tracks. The Proponent's strategy for pipeline rehabilitation includes progressive backfilling of the trench, replacement of topsoil and seeding if necessary to establish vegetative cover. Pipeline construction is anticipated to take about one month based on installation of up to 2km of pipeline per day.

The NT EPA considers that land in the pipeline corridor should be rehabilitated to a state that is similar to its pre-disturbance condition following construction, and to a standard that is suitable for its final land use and acceptable to landholders.

Recommendation 23

As soon as practicable and within six months (or a longer period agreed in writing with the relevant regulator) of completion of the water supply pipeline, the Proponent or Operator must:

- **reshape all disturbed land in the pipeline corridor to a stable landform similar to that of surrounding undisturbed areas**
- **ensure that all disturbed land in the pipeline corridor is reinstated to the pre-disturbed land condition**

- **take all reasonable and practicable measures to:**
    - **re-establish surface drainage lines**
    - **reinstate the top layer of the soil profile**
    - **promote establishment of vegetation of the same species and density of cover to that of the surrounding undisturbed areas**
- **ensure that the maintenance requirements of rehabilitated land in the pipeline corridor are no greater than that required for the land prior to disturbance**
- **ensure that the water quality of any water courses intersecting the pipeline corridor meets criteria for subsequent uses and does not have potential to cause environmental harm**
- **commence a program of rehabilitation monitoring and reporting for three years after completion of pipeline construction, or until demonstration by an independent suitably qualified person, that rehabilitation objectives have been met. Rehabilitation monitoring reports must be submitted to the relevant regulator at least annually until rehabilitation objectives have been met.**

The NT EPA has made Recommendation 7 to ensure the pipeline does not result in impacts to waterways and Recommendation 21 to minimise impacts to fauna during pipeline construction.

6.1.2 Mine closure and rehabilitation

The Proponent's conceptual Mine Rehabilitation and Closure Plan (MRCP) provided in the EIS generally satisfies the NT EPA's information requirements as outlined in the TOR. The conceptual MRCP states that the purpose of mine closure and rehabilitation is to return the land as close as is reasonably possible to its pre-disturbance condition, i.e., resilient, self-sustaining native vegetation of local provenance suitable for use by Traditional Owners and as habitat for flora and fauna. It lists closure objectives for discrete aspects of the Proposal including human health, landforms, flora and fauna, water, and infrastructure and waste. Many of these closure objectives are high level and generally accord with what are termed in the Integrated mine closure: good practice guide (ICMM 2019) as closure principles. In contrast, the ICMM (2019) guide states that closure objectives provide concrete, site-specific and typically measurable statements of what closure activities or measures aim to achieve.

There is a high level of flexibility in the EIS regarding operation and closure of landforms such as mine pits, underground portals and shafts, and waste rock and tailings storage facilities. This is reflected in the Proposal's conceptual closure objectives allowing for the option of mine waste storage both above-ground and in mine voids, and the retention of open pits in the landscape. It is apparent that the extent to which mine voids (open pits or underground workings) may be backfilled and progressively rehabilitated would depend on the detailed mining schedule and the economic viability of backfilling, which will be determined during the detailed planning stage.

While the EIS variously references backfilling of pits, the Supplement clearly indicates in response to a submission from ALEC that backfilling of open pits will not be part of mine rehabilitation 'unless there are statutory requirements to do so'. The Proponent proposes to 'strive to backfill the Bellbird North Open Pit, where waste from the Bellbird South Open Pit is available at the time this pit void is available to fill. The Supplement states that backfilling of other voids (Reward and Southern Bellbird) would 'result in the underground access at each resource being removed' and 'the option to later remove

the waste rock dumps back to the open pit voids…could potentially sterilise future resources'.

The conceptual MRCP in the Draft EIS referred to the possibility that PAF waste from underground would be preferentially disposed of in underground voids and used as backfill. Similarly, the Proponent's stated preference for tailings disposal was to paste backfill into underground workings to reduce the tailings surface management requirement, and to return tailings to the mine void at closure.

The Groundwater Impact Assessment Supplement acknowledges that subaqueous disposal of PAF waste is the most secure option for controlling sulfide oxidation and AMD, and states that long term options for disposal of PAF waste rock could include in-pit or underground disposal below water table levels and selective underground disposal of PAF as part of backfill. However, it then states that the feasibility of this disposal method would depend on long term groundwater recovery and pit water levels, and the volume of PAF mine materials that could be accommodated below these levels. It concludes that pit-lake water levels are not predicted to recover substantially and therefore, placement of PAF waste rock underground along with cement backfill is preferred to surface disposal.

Preliminary waste characterisation indicates that only small quantities of PAF waste material are likely to be generated and require disposal. The EIS indicates that the PAF material oxidation rate or reactivity is relatively low. Therefore, it could be stored temporarily above ground while voids become available for paste backfill disposal. The EIS asserts that the hydraulic conductivity of underlying groundwater aquifers is low limiting the extent of potential contamination beyond the mine voids. Further, the Proposal area is in the semi-arid climatic zone with low annual rainfall, however, rainfall events can be intense. Therefore, the NT EPA considers that PAF waste rock from both open pit and underground mining could be disposed of within underground voids, even if temporary and well managed above-ground storage is required.

This waste storage option would lead to improved environmental outcomes by reducing the overall inventory of waste and particularly the problematic waste stored above-ground where it would be prone to erosion, reducing the potential for oxidation of sulfides if stored below groundwater levels, and therefore avoiding the potential for AMD to impact on surface waterways and groundwater distant from the Proposal area.

The NT EPA supports the Proponent's preference to return tailings to the pit void at closure (Draft EIS Appendix 5H). The Proponent's comments in the Supplement regarding resource sterilisation and, in response to ALEC's submission, that 'complete backfilling is not actually best practice (i.e. it may force further disturbance of encapsulated wastes)', suggest that there is a high probability that the Proponent's TSF rehabilitation option will result in the tailings remaining above ground. Any permanent storage of tailings above-ground in the long term will need to meet strict closure objectives and completion criteria to ensure PAF tailings and AMD from tailings do not migrate into the environment or contaminate Unca Creek.

The NT EPA recognises that a final decision on closure options needs to be informed by an adequate and transparent evaluation of the benefits, risks and costs of all options. The NT EPA considers that the Proponent should be required to undertake further evaluation of all mine closure options as part of MRCP development to demonstrate to the relevant regulator and the NT EPA that the selected closure option delivers superior post-closure environmental outcomes over other feasible options, and any residual risks and liabilities have been reduced to an acceptable level. Because planning for effective closure is a crucial part of mine operation planning, the detailed MRCP should be provided to the NT EPA following the detailed planning stage to give assurance that the site is likely to meet the NT EPA's objectives for all relevant environmental factors post-closure.

The NT EPA considers that there should be no ongoing costs borne by the community and government in future in relation to post-mining land use. Any residual liabilities relating to the agreed land use for the Proposal area should be identified and agreed to by the key stakeholders.

Recommendation 24

That approvals and decisions for the Proposal have conditions that require the Proponent to backfill tailings and potentially acid-forming waste rock into mine voids, unless otherwise approved by the relevant regulator.

PAF waste rock that is to be returned to mine voids should be stored temporarily in a safe, stable and non-polluting manner.

Subject to the outcomes of Recommendation 13 in this Report, tailings stored in the TSF should be backfilled to pit voids for long term storage.

The Proponent intends to incorporate progressive rehabilitation into the mine schedule in the detailed planning stage and during operation to meet its trajectory towards mine closure. The EIS indicates that rehabilitation of Rockface underground areas is planned for year 8 of operation while Stage 1 Bellbird rehabilitation is planned to commence in year 10.

In the interim, the Proponent intends to rehabilitate disturbed areas and/or areas no longer required during operations by:

- deep ripping areas of compacted soil
- re-profiling ripped or stockpiled soil
- respreading topsoil
- contour furrowing or ripping respread areas
- revegetation from seed stock in respread topsoil
- revegetation from direct seeding or planting.

Rehabilitation trials on disturbed areas are proposed to evaluate the effectiveness of revegetation techniques, including spreading of stripped and stored topsoil, spreading of mulch from cleared vegetation, active seeding and planting of nursery-established native plants. The Proponent intends to collect seed from the local area throughout the life of mine. The MRCP indicates that general procedures to maximise the potential for revegetation from seed stock in topsoil will be followed but does not provide any such procedures. The timeline for rehabilitation trials and refinement of the rehabilitation plan is yet to be developed.

While the proposed life of mine is estimated to be 10 years and there is a relatively long lead time until closure, effective rehabilitation strategies need to be developed as early as possible during mine operations to maximise the success of progressive rehabilitation, particularly in the event of unexpected early closure and/or care and maintenance. The NT EPA acknowledges that there is difficulty in rehabilitation of vegetation similar to pre-mining conditions in semi-arid landscapes where local environmental factors, such as limited rainfall and high evaporation rates, influence rehabilitation success. Site-specific closure criteria should be developed in consideration of the National standards for the practice of ecological restoration in Australia (Standards Reference Group 2018) taking into account existing ecosystem attributes such as occurrence of threats (e.g. degree of contamination, invasive species), physical site conditions, species composition, structural diversity, fire regime, ecosystem functionality and external exchanges (e.g. habitat connectivity).

The NT EPA considers that a detailed rehabilitation plan needs to be developed to the satisfaction of the relevant regulator and the NT EPA within the early stages of commissioning and prior to the commencement of mining.

Recommendation 25

Prior to the commencement of mining, the Proponent must prepare an updated Mine Rehabilitation and Closure Plan (MRCP), that demonstrates the closure option has been determined based on a thorough and transparent evaluation of the benefits, risks and costs of all options. The MRCP should demonstrate that the chosen closure option delivers a superior environmental outcome to other options, measured against the principles of Ecologically Sustainable Development. The MRCP should be approved by the relevant regulator with advice from the NT EPA. This updated Plan must:

- **contain approved Closure Objectives that provide concrete, site-specific and typically measurable statements of what closure activities or measures aim to achieve**
- **address all aspects of rehabilitation and mine closure, including post-mining land use and rehabilitation objectives as agreed with stakeholders, landform designs, schedules for rehabilitation, completion criteria and monitoring of rehabilitation success**
- **demonstrate that there would be no ongoing costs borne by the community and government in future in relation to post-mining land use**
- **include site-specific closure criteria taking into account external threats, physical conditions of the site, species composition, structural diversity and ecosystem functionality of the revegetation, external exchanges and landscape integrity, and an overall condition of the final landform and rehabilitated ecosystems that is similar to the pre-mining condition**
- **include details of the rehabilitation trials and investigations that would inform appropriate landform covers and target ecosystems for all areas to be rehabilitated**
- **provide for ongoing monitoring and maintenance of the site post-mining, in accordance with an approved monitoring and maintenance program that includes a trajectory to achieving closure criteria, until closure criteria are achieved and the site has been relinquished**
- **include details of reporting requirements to the relevant regulator on the performance of progressive rehabilitation works to inform decision-making to ensure successful post-mining rehabilitation**
- **include provisions for independent external audits by suitably qualified and experienced auditors of the development and implementation of the plan at least annually following commencement of operations, at closure and prior to relinquishment of the mineral lease**
- **include investigation of the long-term settling process of tailings and waste rock to inform construction of appropriate landform covers**
- **require independent periodic external audits by suitably qualified and experienced auditors approved by the relevant regulator of any backfilling of mine voids including the backfill design, geotechnical information, placement, compaction, drainage and settlement of**

material layers and placement of any PAF material below the lowest expected groundwater level.

7 Conclusion

The NT EPA has considered the Proposal by KGL Resources Limited to develop the Jervois Base Metal Project. The NT EPA's assessment of the Proposal identified potentially significant environmental impacts and risks associated with the environmental factors of terrestrial flora and fauna, terrestrial environmental quality, inland water environmental quality, hydrological processes and social, economic and cultural surroundings.

The NT EPA considers that, subject to the implementation of the 25 recommendations in this Assessment Report and the commitments and safeguards listed by the Proponent in the EIS, the Proposal can be implemented and managed in a manner that is likely to meet the NT EPA's objectives and avoid significant or unacceptable environmental impacts and risks.

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Appendix 1 - Assessment of the NT EPA's environmental factors

The NT EPA assessed the environmental impact of the Proposal in line with its environmental factors and objectives (NT EPA, 2018a). The following table presents environmental factors for the Proposal which, based on current knowledge, were assessed as not significant. The NT EPA considers it unlikely that implementation of the Proposal would have a significant impact on these factors and they can be managed to meet the NT EPA's environmental objective.

Environmental Factor	Assessment of the potential impacts on the environmental factor	Evaluation of why the factor is not a key environmental factor
LAND		
Landforms	There are no distinctive physical landforms in the area of the Proposal.	It is unlikely that implementation of the Proposal will impact on landforms.
WATER		
Aquatic Ecosystems	Implementation of the Proposal could result in impacts to ephemeral aquatic ecosystems through changes in surface water hydrology and water quality.	There are few environmental values associated with aquatic ecosystems in the vicinity of the Proposal as natural surface waters are short-lasting following rain events (Supplement section 3.8.3). However, while there are no records of aquatic fauna in the area, it is considered likely that fish and aquatic invertebrates would occur in watercourses in or downstream from the Proposal area following good rainfall (Supplement section 4.4.1). These aquatic fauna could be impacted by the Proposal-related changes to hydrological processes (e.g. diversion of Unca Creek, expansion of Jervois Dam) and potential changes to inland water environmental quality. If the Proposal is implemented in a manner that the NT EPA's objectives for hydrological processes and inland water environmental quality are met, it is unlikely that it would result in significant impacts to aquatic ecosystems in the vicinity of the Proposal area or downstream from it.
AIR		

Environmental Factor	Assessment of the potential impacts on the environmental factor	Evaluation of why the factor is not a key environmental factor
Air quality and greenhouse gases	1. Air quality Implementation of the Proposal would result in the generation of dust and combustion products from land clearing, construction and mining activities, and vehicle and equipment movements. 2. Greenhouse gas emissions Implementation of the Proposal would result in emission of greenhouse gases from land clearing, combustion of diesel for onsite power generation and operation of mining equipment and vehicles.	1. Air quality The Proponent's assessment of air emissions concluded air quality impacts would be mainly associated with particulates (dust) during construction and diesel combustion products (incl. nitrogen oxides, carbon monoxide and particulates) during operation. Predicted air quality results indicated that concentrations would be significantly below the relevant ambient air quality criteria at the nearest receptors to the mine site (Maperte at 16km and Orrthipa-Thurra at 17km). The NT EPA supports the Proponents commitment to additional dust sampling stations to measure on-site dust levels. This would confirm effectiveness of the proposed dust management strategies, which would include regular watering and grading of haul roads, speed limits, gravel, staged clearing and timely rehabilitation. A Dust Management Plan would be developed and implemented. The NT EPA considers that potential impacts could be avoided, mitigated or managed through the implementation of dust control measures as part of the Mining Management Plan that would be regulated under the MM Act. Dust will also be generated by Proposal-related traffic on unsealed sections of the Plenty Highway, however the nearest receptors are at sufficient buffering distance: Jervois Homestead at 800m and Atitjere Community at 1km. 2. Greenhouse gas emissions The Proponent estimated that clearing of 246ha of native vegetation (Acacia shrubland) would result in greenhouse gas (GHG) emissions of 3,954tCO_2-e. The largest contributions to GHG emission would come from operational equipment (43,269tCO_2-e) and power generation (22,859tCO_2-e) with a total of 66,139tCO_2-e produced per year and a total of 992,085tCO_2-e over the life of the Proposal (15 years) (Supplement Appendix A-7). In response to public comments regards reduction of GHG, the Proponent committed to 20-30% renewable energy sources (solar) which would result in approximately 8-12% less GHG emissions compared to the Proposal without a renewable energy component. The NT EPA calculated that the annual total estimated GHG emissions from the Proposal (66139tCO_2-e) equate to 0.4% of the total emissions produced in the NT in 2017 and 0.01% produced in Australia in 2017 (DOEE 2019a, DoEE 2019b).

Environmental Factor	Assessment of the potential impacts on the environmental factor	Evaluation of why the factor is not a key environmental factor
		With an annual GHG emission above 25,000tCO_2-e the project would require reporting under the National Greenhouse and Energy Reporting Act 2007. The NT EPA supports the Proponent's commitments to improve energy efficiency and reduce air emissions throughout the life of the Proposal, including investigations into solar power alternatives for the site telecommunication system, and fuel efficiency and energy conservation practices.
PEOPLE AND COMMUNITIES		
Human health	Implementation of the Proposal could have implications for the health of members of the public due to increased traffic on public roads, access to hazardous landforms (e.g. pits, shafts) or materials at the mine site, or through changes in social, economic and cultural surroundings.	The NT EPA has assessed the potential impacts on people from increased traffic and other changes to the social, economic and cultural surroundings in section 5.6 of this Report. The Proponent identified that the risk of falls into mine pits or shafts would be managed by restricting public access to the site, hazard reporting and implementation of an emergency management plan during operations. In relation to hazardous materials or contamination, the Proponent concluded that there are limited complete exposure pathways and therefore a limited risk to human health (Supplement Appendix A6). Hazards to the public following closure will be addressed through the mine closure process discussed in section 6.1 of this Report.

Appendix 2 – Principles of Ecologically Sustainable Development

Under the NT EPA Act 2012, ecologically sustainable development (ESD) means using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quantity of life now and in the future can be increased.

In December 1992, the Territory Government endorsed the 'National Strategy for Ecologically Sustainable Development' and agreed, along with all other States and Territories, to the 'Intergovernmental Agreement on the Environment' (IGAE) (Australian Government 1992).

The NT EPA uses the four principles contained in the IGAE to demonstrate that it has considered ESD in its assessment of the Proposal and in its fulfilment of its objectives under the NT EPA Act.

ESD Guiding principle	NT EPA assessment
The precautionary principle *Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.* *In application of this precautionary principle, decisions should be guided by:* *a) careful evaluation to avoid, where practicable, serious or irreversible damage to the environment; and* *b) an assessment of the risk-weighted consequences of various options.*	In considering this principle, the NT EPA notes that Hydrological processes, Inland water environmental quality, Terrestrial environmental quality, Terrestrial flora and fauna, and Social, economic and cultural surroundings could be significantly impacted by the Proposal. The assessment of impacts to these factors is provided in this report. The EPA notes that the Proponent has identified measures to avoid or minimise impacts. The EPA has considered these measures during its assessment. The Proponent's investigations, and proposed characterisation and/or monitoring programs for construction and operation phases, into the physical, biological, social and cultural environment provided sufficient certainty to enable assessment of a majority of the risks and potential impacts and to identify measures to avoid or minimise those risks and impacts. Some uncertainty remains regarding the Proposal's contribution to cumulative impacts and residual impacts and risks, particularly in the post closure stage. Therefore the NT EPA has made recommendations to ensure residual risk is accounted for in closure planning, and that the NT EPA provide advice on the closure plan prior to approval by the regulator and prior to commencement of mining. To address uncertainty as a result of assumptions about the resilience of riparian vegetation to recover from reduced water flows after 10 years of proposed mine operations, the NT EPA makes recommendations 3 and 5 to ensure that any impacts to hydrological processes from the Proposal are monitored, measured, reported and managed to protect water and ecological values including beyond the 10 year life of mine. This quantification would provide some basis for calculating the residual costs associated with an unacceptable impact, and allow such cumulative impacts to be accounted for in future development in the region. From its assessment of the Proposal, the NT EPA concludes that if its recommendations are implemented and managed as approval conditions of the Proposal, significant or unacceptable environmental impacts and risks are likely to be avoided.
The principle of intergenerational equity	The relatively short life of mine (10 years) of the Proposal coupled with long term closure and rehabilitation outcomes (>50 years) creates potential for significant disparity of intergenerational equity. The NT EPA acknowledges that the Proponent

ESD Guiding principle	NT EPA assessment
The present generation should ensure that the health, diversity and productivity of the environment is maintained and enhanced for the benefit of future generations.	may improve this disparity through commitments by the Proponent to local jobs and training (particularly for members of the Orrthipa-Thurra community) and direct benefits to local and regional businesses. In response to submissions on the Draft EIS, the Proponent committed to using a combination of diesel and solar power generation (70-80% diesel and 20-30% solar) which would result in an 8-12% reduction in greenhouse gas emissions. NT EPA supports the proposed use of renewable energy as a power supply alternative to traditional diesel power generation and considers this approach to be more compatible with this ESD principle of intergenerational equity. The NT EPA recognised the potential for the final pit voids to have ongoing management costs, post closure and/or post relinquishment, which would likely be borne by the community and government. The NT EPA recommended that unless the Proponent can demonstrate that leaving a pit lake would still allow the Closure Objectives and principles of ESD to be met, the pit voids should ultimately be backfilled. From its assessment of the Proposal, the NT EPA concluded that, provided its recommendations are imposed as conditions on the implementation of the Proposal, environmental values will be protected and the health, diversity and productivity of the surrounding environment will be maintained for the benefit of future generations.
The principle of the conservation of biological diversity and ecological integrity *Conservation of biological diversity and ecological integrity should be a fundamental consideration*.	In considering this principle, the NT EPA notes that the Proposal would result in impacts and risks to Hydrological processes, Inland water environmental quality, Terrestrial environmental quality and Terrestrial flora and fauna. In assessing the Proposal, the NT EPA has considered these impacts and risks and taken into consideration measures proposed by the Proponent to avoid and minimise impacts to the affected values. The Proposal's impacts to sensitive and significant vegetation are predicted to be temporary, however there are uncertainties in this assessment. The NT EPA

ESD Guiding principle	NT EPA assessment
	recommended any impacts to downstream riparian vegetation that can be reasonably attributed to the mine, are to be rehabilitated or accounted for (in demonstrating a regional community and environmental benefit of the final closure option) if the Proposal is approved. This would allow the unanticipated residual impacts to be remediated or compensated. The NT EPA has concluded that, provided its recommendations in this Report are imposed as conditions, the Proposal would not compromise the biological diversity and ecological integrity of the affected areas.
Principles relating to improved valuation, pricing and incentive mechanisms *a) Environmental factors should be included in the valuation of assets and services.* *b) The polluter pays principles – those who generate pollution and waste should bear the cost of containment, avoidance and abatement.* *c) The users of goods and services should pay prices based on the full life-cycle costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste.* d) *Environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structure, including market mechanisms, which enable those best placed to maximise benefits and/or minimize costs to develop their own solution and responses to environmental problems.*	In considering this principle, the NT EPA acknowledges that the Proponent would take responsibility for preventing, managing and mitigating any adverse environmental impacts during all stages of the Proposal including clearing, construction, operation, decommissioning, closure and rehabilitation. The NT EPA notes that this responsibility includes: (a) valuing the Proposal's water resources (b) accounting for the costs of the residual risks associated with the Proposal's final landforms (WRDs, TSF and pit lakes) (c) preventing, managing and mitigating waste and pollution, including contamination of soils, groundwater and surface waters through accidental spills, uncontrolled discharges and tailings seepage (d) ensuring rehabilitation and closure are consistent with agreed outcomes, public scrutiny (reporting) without ongoing unacceptable liability to the Territory.