F

Risk Register (Environmental)

Ref.	Impact pathway			Planned Controls to Manage Risk (as per Project Description, and elements of Standards / Codes of Practice	Initial Risk			Level of Certainty	Additional Controls Recommended to Reduce Risk	Residual Risk			Level of Certainty	Comment	Applicable Technical Report / EIS chapter
	Potential event (how the Project interacts with assets, values, uses and location. Include clear description of the cause)	**Environmental Factor / Receptor**	**Description of consequences** (Clearly understand what is the final impact. Describe whether it is construction, operation or decommissioning)		Consequence	Likelihood	Risk Rating			Consequence	Likelihood	Risk Rating			
1	Site establishment (including vegetation clearing and soil compaction) results in altered environment character and modification to ecological processes from construction of Project	Air quality	Dispersion of particulate matter in the air resulting in reduced air quality at nearby sensitive receptors or beyond the site boundary with impacts to human health, in particular PM10. Impacts from other particulate sizes (TSP) from dust fallout and deposition, including to flora and amenity at sensitive receptors.	Develop and implement a Air and Dust Management Plan. To include standard dust mitigation procedures including: - Chemical or crushed rock treatment of roads and use of water sprays - Continuous dust monitoring as required during preproduction and construction at site boundary and sensitive receptors	Minor	Unlikely	Low	Medium Level	- Implementation of additional management controls if exceedances occur - Operational procedures to include review of weather conditions and stop work if required	Minor	Unlikely	Low	Medium Level	Haul trucks are usually biggest source of impact, with wheel dust the primary source from haul trucks. The nearest sensitive receptor is about five kilometres away. The management response will depend on the size of the impact and sensitive receptors.	Appendix Q, Chapter 13 - Air
		Surface water	Erosion and sedimentation resulting from vegetation clearing, including land clearance in headwaters of Kerosene Camp Creek and Southern Basins. Degradation of surface water quality due to erosion of soils and landforms.	Develop and implement an Erosion and Sediment Control Plan (ESCP), including: - Use of buffer zones, sediment fences and sediment ponds to arrest the transport of water borne sediment from the site - Stage clearing of vegetation to minimise areas of bare ground and clear land only as required and in accordance with ESCP. Develop and implement a Mine Closure Plan, including progressive rehabilitation plans	Minor	Unlikely	Low	Medium Level	Staging of Construction to occur in dry season; Selection of equipment to reduce potential dust generation.	Minor	Unlikely	Low	Medium Level	Water borne erosion limited by relatively flat gradients within the Project area. Existing surface water has high sediment content currently. Rainfall events are infrequent across the year, based on historical watercourse data across 41 years.	Appendix I, Chapter 7 - Surface water
		Flora	Loss of sensitive vegetation outside known impact area, including reduction in riparian vegetation along watercourses and drainage channels.	Develop and implement a Biodiversity Management Plan (BMP), including: - Plans to minimise vegetation clearing where possible particularly within sensitive vegetation community - Buffer widths recommended by the Northern Territory Land Clearing Guidelines in riparian areas, where possible - Procedures for demarcating the limits of clearing, and no-go areas	Minor	Unlikely	Low	Medium Level	No additional controls	Minor	Unlikely	Low	Medium Level	Loss of riparian vegetation along section of Kerosene Camp Creek is considered, in the overall context, to be relatively insignificant	Appendix M, Chapter 9 - Flora
		Fauna	Loss of possible breeding, foraging and dispersal habitat for listed threatened species resulting in adverse effects to the survival of population of species. Including the impact on Black-footed Rock-wallaby, Great Desert Skink, Mulgara, Greater Bilby, Southern Marsupial Mole and Princess Parrot species.	Develop and implement a Biodiversity Management Plan (BMP) to minimise and mitigate clearing effects on the threatened species populations of the area. Including: - Avoid the known active warren for Great Desert Skink and for mulgara, implementing clearing during autumn when breeding has ended - Avoid clearing of the Borefields area during the winter/spring months when animals (particularly reptiles) are inactive in burrows or breeding	Minor	Unlikely	Low	Medium Level	Limit clearing to essential infrastructure corridor; Complete preclearing surveys to identify burrow habitat.	Minor	Unlikely	Low	Medium Level	Clearing will be localised, seems unlikely to have any significant direct impact on any of the threatened species or populations. The fauna as a whole is similarly likely to experience no significant effects from the clearing itself, with other impacts discussed below such as vehicle strike and the introduction of exotic predators likely to be more important for future management. Impacts from the clearing would likely be minimal, and not amenable to detection at the population level.	Appendix N, Chapter 9, 10 - Fauna
2	Site establishment (including vegetation clearing) results in physical disturbance of sites / objects of heritage significance, heritage items or places and/or sacred sites during construction of the Project	Historic and cultural heritage	Damage, destruction or removal of heritage items or sacred sites, including RWA8, which is a site of high scientific (archaeological) significance and a sacred site. Non compliance of legislative requirements.	Development and implement a Cultural Heritage Management Plan, including: - Buffer distances or fencing surrounding identified archaeological sites and/or sacred sites - Pre-clearing / disturbance visual investigations - Research plan for an appropriate recording and salvage program if requested - Consultation and engagement with Anmatyerr Traditional Owners and custodians AAPA Clearance certificate and CLC clearance certificates; Archaeological survey	Moderate	Unlikely	Medium	Medium Level	Permit will be sourced form NT Heritage prior to any removal or destruction. Work will be in accordance with agreed process with traditional owners.	Moderate	Unlikely	Medium	Medium Level	An agreed protocol will be in established prior to any ground disturbing activity in areas where know sites or artefacts may be located.	Appendix U, Chapter 16-Historic and cultural heritage
3	Disturbance of previously unidentified of sites / objects of heritage significance, artefacts, skeletal remain during construction activities	Historic and cultural heritage	Inadvertent damage, destruction or removal of heritage items or sites. Non compliance of legislative requirements.	Development and implement a Cultural Heritage Management Plan, including: - Pre-clearing / disturbance visual investigations - consultation and engagement with Anmatyerr Traditional Owners and custodians Develop and implement a Biodiversity Management Plan, including a Ground Disturbance Permit System; AAPA Clearance certificate; Archaeological survey	Minor	Unlikely	Low	Low Level	No additional controls	Minor	Unlikely	Low	Low Level		Appendix U, Chapter 16-Historic and cultural heritage
4	Construction of linear infrastructure (e.g. access tracks, water supply pipelines, powerlines etc) results in reduction in native vegetation and disturbance of habitat.	Flora	Loss of native vegetation allowing for weed establishment, along exposed edges and in cleared areas.	For all receptors: Development and implementation of a Weed Management Plan including measures to control existing weeds, and to stem the spread of new weeds including: - Vehicle and equipment wash down facilities and areas set up to minimise transport of weed material from weed impacted areas into clean areas. - Weed surveys and weed spraying programs as required	Minor	Unlikely	Low	Medium Level	Where construction material is sourced from areas outside the lease areas the area, will be checked for weeds prior to material being imported to the Nolans site.	Minor	Unlikely	Low	Medium Level		Appendix M, Chapter 9 - Flora
		Fauna	Habitat fragmentation, particularly for small ground-dwelling fauna, and the introduction and/or spread of exotic plants (weeds) adversely affecting habitat values and capacity of individuals and/ or population to persist		Minor	Unlikely	Low	Medium Level	No additional controls	Minor	Unlikely	Low	Medium Level		Appendix N, Chapter 9 - Fauna
5	Construction of linear infrastructure (i.e. utilities corridors and access roads) results in altered surface water flows	Surface water	Potential for cross drainage structures associated with linear infrastructure (utilities corridors, access roads) to impede or divert natural flow and/or increasing channel flow velocity. Includes pipelines, roads between the Mine Site and Processing Site crossing the upper reaches of Kerosene Camp Creek as well as access road from the Stuart Highway, which will cross the headwaters of a number of small creeks draining into the Southern Basins.	Appropriate consideration of surface water flow in design, placement of infrastructure and construction including: - Maintain natural surface water flows in minor watercourses by the use of floodways at creek crossings. - Adoption of appropriately sized culverts to maintain flows at major creek crossings. - Provision of suitable outlet scour protection measures.	Insignificant	Unlikely	Low	Medium Level	No additional controls	Insignificant	Unlikely	Low	Medium Level	Access road alignment generally along the ridge of the local terrain. Impact on surface water flows controlled by small area of catchment upstream of access roads, which will limit the anticipated typical flow. Low frequency of rainfall events within the project area. Use of floodway methodology where drainage is poorly defined to allow natural sheet flow.	Appendix I, Chapter 7 - Surface water

Ref.	Impact pathway			Planned Controls to Manage Risk (as per Project Description, and elements of Standards / Codes of Practice	Initial Risk			Level of Certainty	Additional Controls Recommended to Reduce Risk	Residual Risk			Level of Certainty	Comment	Applicable Technical Report / EIS chapter
	Potential event (how the Project interacts with assets, values, uses and location. Include clear description of the cause)	Environmental Factor / Receptor	Description of consequences (Clearly understand what is the final impact. Describe whether it is construction, operation or decommissioning)		Consequence	Likelihood	Risk Rating			Consequence	Likelihood	Risk Rating			
6	Diversion of Kerosene Camp Creek and alteration of waterway form	Surface water	Altered hydrological regime (increase in flows) in the western arm of Kerosene Camp Creek , downstream of the diversion channel outlet resulting in channel adjustments (widening) along this section of creek. Long term localised increased velocity and erosion downstream of the diversion during infrequent rainfall event. Loss of water (40% reduction in flows) to catchment downstream from the original creek alignment including loss of water to the diversion and to sediment basins on the mine site	Develop and implement a Biodiversity Management Plan (BMP), including: - Site planning to minimise vegetation clearing where possible - Compliance with approved vegetation clearance Development and implementation of a Weed Management Plan for mitigation measures to control existing exotic vegetation, and to stem the spread of others. Development and implementation of a Water Management Plan, including: - Runoff from disturbed areas will be diverted into sediment ponds and not discharged into the natural environment - Design outlet to have similar gradient to existing and reduce angle at which the diversion enters the natural channel Maintain installed rising stage samplers and gauging stations in creeks in and around Nolans to monitor surface flows and water quality in creeks.	Insignificant	Likely	Medium	Medium Level	- Geomorphological assessment of the diversion; - Engineered design of the outlet to the diversion to minimise change in velocity and associated scouring including to have similar gradient as downstream; - Monitor diversion outlet and repair/ make design changes to outlet if damage / scouring exceeds expectations, including installation of rip-rap	Insignificant	Possible	Medium	Medium Level	Channels are currently mobile. Diversion outlet Would adjust to changes from the diversion. In context of overall system, need to consider the consequence. Infrequent rainfall events. Short sharp flow events are characteristic of these creek systems Approx. 19.5 sq. km catchment loss (40% reduction ion flow) from old channel catchment area. Water diverted to new catchment area will increase, resulting in changes to flora and vegetation in the new catchment area.	Appendix I, Chapter 7 - Surface water
		Flora	Diversion of the old channel resulting loss of riparian vegetation in the diversion area, and impact on riparian vegetation downstream in the floodplain associated with the old channel of Kerosene Camp Creek (approx. 3 km length).		Minor	Unlikely	Low	Low Level	No additional controls	Minor	Unlikely	Low	Low Level	Water from Nolans Creek to the east will continue to flow into floodplain	Appendix M, Chapter 9 - Flora
		Fauna	Loss of riparian woodland and groundwater dependent ecosystems downstream of the diversion and within ML results in loss of habitat for dependent species.		Minor	Unlikely	Low	Medium Level	No additional controls	Minor	Unlikely	Low	Medium Level	Given the habitat distance from these impacts and lack of reliance on GDEs, none of the threatened species known or predicted to occur within the study area (Black-footed Rock-wallaby, Great Desert Skink, mulgaras, Greater Bilby, Southern Marsupial Mole and Princess Parrot) are likely to be directly impacted by diversion impacts.	Appendix N, Chapter 9 - Fauna
7	Transport of materials, machinery and vehicle movements and inappropriate waste management allows for introduction of new weeds and spread of existing weeds into new areas during construction and operation phases	Flora	Increased presence of weed species resulting in decline or modification of existing vegetation communities, including habitat quality.	Development of a Weed Management Plan to document mitigation measures to control existing weeds, and to stem the spread of others. To include: - Cleaning vehicles (washdown facilities) that are new to the site, to prevent the introduction of new weeds - Keeping vehicles to established tracks and roads, and limiting the use of vehicles off-road - Annual weed monitoring and mapping to identify hot spot areas - Weed control activities in consultation/partnership with Aileron / Napperby Station owners during borefield construction	Minor	Possible	Medium	Medium Level	No additional controls	Minor	Possible	Medium	Medium Level	Note the Nolans project will operate over an area that includes borefield of approx. 80 sq. km compared to pastoral leases that comprise 4,000 sq. km.	Appendix M, Chapter 9 - Flora
		Fauna	An increase in the incidence / spread of weed species leading to reduction in food plant availability and habitat of listed threatened species such that the population declines.		Moderate	Unlikely	Medium	Medium Level	No additional controls	Moderate	Unlikely	Medium	Medium Level		Appendix N, Chapter 9 - Fauna
8	Transport of materials, vehicle movements and inappropriate waste management allows for introduction or spread of pest species impacting on populations of threatened species	Fauna	An increase in the incidence of pest species, such as cats, foxes and potentially dingos, resulting in increased predation of listed threatened species, particularly of more vulnerable juveniles, with impact to the long-term size of the population.	Development and implementation of a Biodiversity Management Plan, including: - Application for a licence for Pest eradication/control program, targeting foxes, cats and rabbits across the Project area, and non-native rats and mice in accommodation camp area - Monitoring of feral fauna species numbers around the mine site Develop and implement Waste Management Plan, including measures to control food source for pests.	Moderate	Possible	Medium	Medium Level	Workforce education program to prevent feeding of dingos; Application for licence for dingo control;	Moderate	Possible	Medium	Medium Level		Appendix N, Chapter 9 , 10 - Fauna
9	Haulage and transport of material within the Project area, along haul roads within the mine site , and along access tracks; and general site movements over unsealed surfaces resulting in generation and dispersion of particulate or dust (TSP)	Air quality	Dispersion of particulate matter (predominantly TSP, with some PM10) in the air resulting in reduced air quality at the site boundary and/or at nearby sensitive receptors, with impacts to human health. Impacts from dust fallout and deposition, including to flora, and amenity at sensitive receptors	For all receptors: Develop and implement a Air and Dust Management Plan. To include standard dust mitigation procedures as required including: - Chemically treat haul roads or use inert crushed rock to minimise dust emissions - Use of water sprays on haul roads and unsealed surfaces - Implement road speed limits including lower speeds during highest of wind events Develop and implement an Erosion and Sediment Control Plan (ESCP), including: - Use of buffer zones, sediment fences and sediment ponds to arrest the transport of water borne sediment from the site	Moderate	Possible	Medium	Medium Level	No additional controls	Moderate	Possible	Medium	Medium Level	Haulage is typically the biggest dust source for mining operations. Haulage is within pit, from pit to ROM pad and to waste rock dump. Haul road material will be sourced from inert material, potentially off lease.	Appendix Q, Chapter 13 - Air
		Surface water	Degradation of surface water quality due to dust deposition, including elevated levels of particulate matter being deposited in headwaters of Kerosene Camp Creek and minor creeks draining into Southern Basins. Principally through deposition within flow paths with direct deposition in creeks limited due to small footprint relative to wide dispersion zone.		Insignificant	Possible	Low	Medium Level	Modelled air quality impacts to confirm likely levels of dust deposition	Insignificant	Possible	Low	Medium Level	Main potential mechanism is deposition within flow paths, however ability to transport to surface water channel constrained by limited rainfall. Creek diversion is planned to be south of prevailing wind direction form the main dust sources to minimise impact on active creek. Site runoff will be captured and monitored prior to release or recycle.	Appendix I, Chapter 7 - Surface water
		Flora	Dust deposition leading to disturbance / loss of general flora species and vegetation communities within the dispersion area.		Minor	Unlikely	Low	Medium Level	No additional controls	Minor	Unlikely	Low	Medium Level	At site boundary, dust deposition will be low (gms/m2/month). However impacts will be greater in vicinity of haul roads.	Appendix M, Chapter 9 - Flora
		Fauna	Loss or disturbance of fauna habitats due to dust deposition and decrease in water availability from degradation of surface water quality results in decline in size of population of listed threatened species.		Minor	Unlikely	Low	Medium Level	No additional controls	Minor	Unlikely	Low	Medium Level	At site boundary, dust deposition will be low (gms/m2/month). However impacts will be greater in the immediate vicinity of haul roads.	Appendix N, Chapter 9 , 10 - Fauna

Ref.	Impact pathway			Planned Controls to Manage Risk (as per Project Description, and elements of Standards / Codes of Practice	Initial Risk			Level of Certainty	Additional Controls Recommended to Reduce Risk	Residual Risk			Level of Certainty	Comment	Applicable Technical Report / EIS chapter
	Potential event (how the Project interacts with assets, values, uses and location. Include clear description of the cause)	**Environmental Factor / Receptor**	**Description of consequences** (Clearly understand what is the final impact. Describe whether it is construction, operation or decommissioning)		Consequence	Likelihood	Risk Rating			Consequence	Likelihood	Risk Rating			
10	Wind erosion mobilising dust from exposed surfaces, such as from pits, waste dumps, tailings and residue storage facilities, laydown areas, stockpiles, roads and sites of vegetation clearing	Air quality	Dispersion of particulate matter in the air (TSP and PM10), excluding radioactive material, resulting in reduced air quality at nearby sensitive receptors with impacts to human health. Impacts from dust fallout and deposition, including to flora, and amenity at sensitive receptors.	For all receptors: Develop and implement a Air and Dust Management Plan and Radiation Management Plan. To include standard dust mitigation procedures including: - Minimise open areas exposed to wind erosion - Topsoil striping to occur only during suitable wind and weather conditions - Minimise time between top soil stripping and construction/mining operations. Waste dump footprints will be developed as required to minimise dust. - Use of water sprays on haul roads, unsealed surfaces - Wet ore before crushing and design controls such as use of hooded crusher, covered conveyor and an enclosed HPRG. - Ongoing dust deposition monitoring program Develop and implement an Erosion and Sediment Control Plan (ESCP), including: - Use of buffer zones, sediment fences and sediment ponds to arrest the transport of water borne sediment from the site - Progressive stabilisation of cleared land as activities are completed to limit continued exposure of bare soils. - Progressive rehabilitation of waste dumps to minimise exposed material and dust generation.	Minor	Possible	Medium	Low Level	No additional controls	Minor	Possible	Medium	Low Level		Appendix Q, Chapter 13 - Air
		Radiation	Dispersion of radioactive dust via air mobilisation with impacts to human health and dispersion to environment. (non-human biota)		Moderate	Possible	Medium	Low Level	No additional controls	Moderate	Possible	Medium	Low Level		Appendix P, Chapter 12 - Radiation
		Surface water	Degradation of surface water quality due to dust deposition, including elevated levels of particulate matter and dust being deposited in headwaters of Kerosene Camp Creek and minor creeks draining into Southern Basins.		Insignificant	Possible	Low	Medium Level	No additional controls	Insignificant	Possible	Low	Medium Level	Main potential mechanism is deposition within flow paths, however ability to transport to surface water channel constrained by limited rainfall. Direct deposition in creeks will be limited due to small footprint relative to wide dispersion zone. Main risk is early in operational life when pit is shallow. Four main waste rock types have properties which will limit the generation of fine particles which will reduce likely dust generation. Weathering is generally very shallow in waste rock <20 m.	Appendix I, Chapter 7 - Surface water
		Flora	Inert dust deposition leading to disturbance / loss of general flora species and vegetation communities within the dispersion area.		Insignificant	Unlikely	Low	Medium Level	No additional controls	Insignificant	Unlikely	Low	Medium Level		Appendix M, Chapter 9 - Flora
		Fauna	Loss or disturbance of fauna habitats due to inert dust deposition and decrease in water availability from degradation of surface water quality results in decline in size of population of listed threatened species.		Minor	Unlikely	Low	Medium Level	No additional controls	Minor	Unlikely	Low	Medium Level		Appendix N, Chapter 9, 10 - Fauna
		Historic and cultural heritage	Impact to sacred sites and /or artefacts from build up of dust (deposition)	In addition to the above: Development and implement a Cultural Heritage Management Plan, including: - Consultation and engagement with Anmatyerr Traditional Owners and custodians	Minor	Unlikely	Low	Medium Level	No additional controls	Minor	Unlikely	Low	Medium Level	Only one notable site in close proximity to proposed infrastructure.	Appendix Q, Chapter 13 - Air
11	Drilling, blasting, excavation and materials handling at the Mine Site during operations results in dispersion of particulates and dust from the Mine Site	Air quality	Dispersion of particulate matter (excluding radioactive material) in the air from activity contained to the mine pit over typically limited time frames, resulting in reduced air quality at nearby sensitive receptors at or beyond the site boundary with impacts to human health.	For all receptors: Develop and implement a Air and Dust Management Plan and Radiation Management Plan. To include dust mitigation procedures specific to drilling, blasting and materials handling including: - Review of wind directions, wind speeds, etc Develop and implement an Erosion and Sediment Control Plan (ESCP), including: - Use of buffer zones, sediment fences and sediment ponds to arrest the transport of water borne sediment from the site	Minor	Unlikely	Low	Medium Level	No additional controls	Minor	Unlikely	Low	Medium Level	Blasting limited to daylight hours within pit and thereby constraining extent of potential pathways. Ore is reasonably soft so will required low powder factor, ore is also below water table at approx. 13 m. Four main waste rock types are hard and will tend not to produce fines when blasted.	Appendix Q, Chapter 13 - Air
		Radiation	Dispersion of radioactive dust or gas with impacts to human health and dispersion to environment resulting in exposures above the recognised dose constraint (non human biota)		Moderate	Rare	Low	Medium Level	Monitoring to confirm modelling predictions. Review emission controls and improve if necessary	Moderate	Rare	Low	Medium Level		Appendix P, Chapter 12 - Radiation
		Surface water	Degradation of surface water quality due to inert dust deposition, including elevated levels of particulate matter and dust being deposited in headwaters of Kerosene Camp Creek and minor creeks draining into Southern Basins.		Insignificant	Unlikely	Low	Medium Level	No additional controls	Insignificant	Unlikely	Low	Medium Level	Direct deposition in creeks will be limited due to small footprint relative to wide dispersion zone. Main potential mechanism is deposition within flow paths, however ability to transport to surface water channel constrained by limited rainfall with runoff likely to seep before flowing into channels. Kerosene Camp Creek diversion is south of predominant prevailing wind direction.	Appendix I, Chapter 7 - Surface water
		Flora	Inert dust deposition leading to disturbance / loss of general flora species and vegetation communities within the dispersion area.		Insignificant	Unlikely	Low	Medium Level	No additional controls	Insignificant	Unlikely	Low	Medium Level		Appendix M, Chapter 9 - Flora
		Fauna	Loss or disturbance of fauna habitats due to inert dust deposition and decrease in water availability from degradation of surface water quality results in decline in size of population of listed threatened species.		Insignificant	Unlikely	Low	Medium Level	No additional controls	Insignificant	Unlikely	Low	Medium Level	Rock wallaby population within 2 km of the pit but is generally confined to rugged ridges and hills.	Appendix N, Chapter 9, 10 - Fauna

Ref.	Impact pathway			Planned Controls to Manage Risk (as per Project Description, and elements of Standards / Codes of Practice	Initial Risk			Level of Certainty	Additional Controls Recommended to Reduce Risk	Residual Risk			Level of Certainty	Comment	Applicable Technical Report / EIS chapter
	Potential event (how the Project interacts with assets, values, uses and location. Include clear description of the cause)	Environmental Factor / Receptor	Description of consequences (Clearly understand what is the final impact. Describe whether it is construction, operation or decommissioning)		Consequence	Likelihood	Risk Rating			Consequence	Likelihood	Risk Rating			
12	Operation of concentrator (comminution and beneficiation circuits) at the Mine Site, resulting in dispersion of particulate, gas or dust.	Air quality	Dispersion of particulate matter (TSP and PM10) in the air resulting in reduced air quality beyond the site boundary or at nearby sensitive receptors with impacts to human health.	For all receptors: Develop and implement a Air and Dust Management Plan and Radiation Management Plan. To include standard dust mitigation procedures including: - Wet ore before crushing, use hooded crushers and an enclosed HPRG. - Sprays used on ore stockpiles (ROM and Low grade or long term) to limit dust generation. - Once ore is crushed the entire beneficiation process is wet so not dust generation. - Dust deposition gauges to monitor and audit the effectiveness of the Air and Dust Management Plan - Controlled emissions release via stack and scrubber Develop and implement an Erosion and Sediment Control Plan (ESCP), including: - Use of buffer zones, sediment fences and sediment ponds to arrest the transport of water borne sediment from the site	Minor	Rare	Low	Medium Level	No additional controls	Minor	Rare	Low	Medium Level	More concentrated so more radioactive material. Keep it wet to minimise dust. Some gases given off. Likely within a shed. Pumped out of a stack with a scrubber (potentially with carbon filter or fabric filter).	Appendix Q, Chapter 13 - Air
		Radiation	Dispersion of radioactive dust or gas with impacts to human health and dispersion to environment resulting in exposures above the recognised dose constraint		Moderate	Rare	Low	Medium Level	Monitoring to confirm modelling predictions. Review emission controls and improve if necessary	Moderate	Rare	Low	Medium Level		Appendix P, Chapter 12 - Radiation
		Surface water	Degradation of surface water quality due to dust deposition, including elevated levels of particulate matter and dust being deposited in headwaters of Kerosene Camp Creek and minor creeks draining into Southern Basins. Direct deposition in creeks will be limited due to small footprint relative to wide dispersion zone.		Minor	Unlikely	Low	Low Level	Site will be designed to capture surface runoff to small dams for monitoring/sediment control prior to release or recycle.	Minor	Unlikely	Low	Low Level		Appendix I, Chapter 7 - Surface water
		Flora	Dust deposition leading to disturbance / loss of general flora species and vegetation communities due to physical and chemical impacts within the dispersion area.		Minor	Rare	Low	Medium Level	No additional controls	Minor	Rare	Low	Medium Level	Beneficiation is a wet process after crushing, so limited dust dispersion. Processing site will also be at distance from flora / fauna species. Characterisation of waste rock indicates that there will little or no impacts resulting from chemical impacts.	Appendix M, Chapter 9 - Flora
		Fauna	Loss or disturbance of fauna habitats due to dust deposition and decrease in water availability from degradation of surface water quality results in decline in size of population of listed threatened species.		Minor	Rare	Low	Medium Level	No additional controls	Minor	Rare	Low	Medium Level	No permanent surface water sources at the site.	Appendix N, Chapter 9, 10 - Fauna
13	Operation of RE processing units, sulfuric acid plant and gas fired generators at the Processing Site results in dispersion of emissions	Air quality	Emission of fine particles and gaseous pollutants from the processing site, including SOx, NOx, CO, fluoride compounds and sulfuric acid. Dispersion resulting in reduced air quality at nearby sensitive receptors (> 5 km) with impacts to human health.	For all receptors: Design of all aspects of the rare earths plant to include emission controls (scrubbers) to minimise dispersion of emissions, including potentially: - Low NOx burners in design - Scrubbers installed to control sulfuric acid mist, as required - Specific controls for HF emissions	Minor	Rare	Low	Medium Level	No additional controls	Minor	Rare	Low	Medium Level	Sulfuric acid emissions and SO2 emissions from acid plant. Stack, not scrubbing, required. Health issue, but low risk given distances involved. More an issue for within few 100 m from stack. On site power station. CO and NOx with very low SOx due to natural gas as feed. Process controls to minimise NOx.	Appendix Q, Chapter 13 - Air
		Flora	Deposition leading to disturbance / loss of general flora species and vegetation communities due to physical and chemical impacts within the dispersion area.		Minor	Unlikely	Low	Medium Level	No additional controls	Minor	Unlikely	Low	Medium Level		Appendix M, Chapter 9 - Flora
		Fauna	Loss or disturbance of fauna habitats due to deposition results in decline in size of population of listed threatened species.		Minor	Unlikely	Low	Medium Level	No additional controls	Minor	Unlikely	Low	Medium Level		Appendix N, Chapter 10 - Fauna
14	Vehicle emissions and heavy equipment emissions results in impacts to air quality	Air quality	Emissions of CO, NOx, SOx, Particles and volatile organic compounds (VOC) released from combustion sources including earthmoving equipment, haul trucks and site vehicles. Dispersion resulting in reduced air quality beyond the site boundary or at nearby sensitive receptors with impacts to human health.	- Scheduled vehicle and heavy equipment maintenance as per Original Equipment Manufacturer (OEM) requirements - Diesel fuel to Australian standards (for S content)	Minor	Rare	Low	Medium Level	No additional controls	Minor	Rare	Low	Medium Level		Appendix Q, Chapter 13 - Air
15	Construction activities and mining operations, including earthworks (drilling, blasting, excavations, etc.), power station and other processing plant and equipment result in audible airborne borne noise at elevated levels	Fauna	Excessive noise levels resulting in disruption to nesting / roosting / foraging habitats or displacement of fauna into sub-optimal habitats, increasing their susceptibility to predation and competition.	For all receptors: Develop and implement operational work procedures for Drill & Blast and Earthworks to include the following: - Consideration of NT EPA Noise Guidelines for Development Sites in the Northern Territory noise management plan - Minimising noise wherever possible - Quiet equipment selection, including the selection of gas turbines unit - where required, equip gas turbines exhaust stacks with noise attenuator. - Scheduled maintenance as per OEM requirements - Broadband reversing alarms should be used for all site equipment, subject to meeting occupational health and safety requirements. - Procedure to limit high-impact noise to daylight hours only where possible (this will reduce the impact on nocturnal fauna, which includes most of the threatened species). - Any blast on site should be designed by a qualified contractor and include consideration of blasting noise and vibration limits Develop and implement a Biodiversity Management Plan (BMP) including: - Where possible, high-impact noise (e.g. blasting) to be limited to daylight hours	Minor	Unlikely	Low	Low Level	No additional controls	Minor	Unlikely	Low	Low Level		Appendix N, Chapter 9 - Fauna
		Community	Excessive noise levels at nearby sensitive receptors, including Aileron Roadhouse, project accommodation village and Annas Reservoir.		Minor	Unlikely	Low	Low Level	No additional controls	Minor	Unlikely	Low	Low Level		Appendix R, Chapter 14 - Noise and Vibration Assessment

Ref.	Impact pathway			Planned Controls to Manage Risk (as per Project Description, and elements of Standards / Codes of Practice	Initial Risk			Level of Certainty	Additional Controls Recommended to Reduce Risk	Residual Risk			Level of Certainty	Comment	Applicable Technical Report / EIS chapter
	Potential event (how the Project interacts with assets, values, uses and location. Include clear description of the cause)	**Environmental Factor / Receptor**	**Description of consequences** (Clearly understand what is the final impact. Describe whether it is construction, operation or decommissioning)		Consequence	Likelihood	Risk Rating			Consequence	Likelihood	Risk Rating			
16	Mining operations, including drilling, blasting and excavations result in ground borne vibration at elevated levels	Community	Excessive vibration levels at nearby sensitive receptors, including Aileron Roadhouse, project accommodation village and Annas Reservoir.	For all receptors: Develop and implement operational work procedures for Drill & Blast and Earthworks to include the following: - Use of smaller capacity vibratory rollers, where possible - Use of static rollers opposed to vibratory roller/compactors where possible - Vibration intensive activities during the least sensitive time periods, where possible - Operations sequenced so that vibration intensive activities do not occur simultaneously, where possible - Any blast on site should be designed by a qualified contractor and include consideration of blasting noise and vibration limits Develop and implement a Biodiversity Management Plan (BMP) including: - Where possible, high-impact noise (e.g. blasting) to be limited to daylight hours	Minor	Unlikely	Low	Low Level	No additional controls	Minor	Unlikely	Low	Low Level		Appendix R, Chapter 14 - Noise and Vibration Assessment
		Fauna	Excessive vibration levels resulting in disruption to nesting / roosting / foraging behaviour or displacement of fauna into sub-optimal habitats, increasing their susceptibility to predation and competition.		Minor	Unlikely	Low	Low Level	No additional controls	Minor	Unlikely	Low	Low Level		Appendix N, Chapter 9 - Fauna
		Historic and cultural heritage	Altered character of Aboriginal sacred sites or heritage places sites caused by vibration impacts (e.g. subsidence or modification to observed deposits and outcrops)		Insignificant	Unlikely	Low	Low Level	No additional controls	Insignificant	Unlikely	Low	Low Level	Noted that RWA8 is located 6 km from the pit and limited potential for impact. Nearest registered site is around 5km south of pit. Low powder factors anticipated. Geology in the mine area tends to be SE-NW trending which should disperse any vibration away from this site.	Appendix R, Chapter 14 - Noise and Vibration Assessment
17	Physical presence of project, including construction activities, and mining / processing operations, results in localised generation of artificial light at elevated levels	Fauna	Disruption to behaviours and potential displacement of species, in particular on nocturnal threatened fauna (e.g. Great Desert Skink, mulgara, bilby and mole).	Develop and implement a Biodiversity Management Plan (BMP) including a light reduction strategy during the detailed design phase to: - Limit artificial light to areas where it is essential - Turn off lights when not required - Avoid the flood of light into natural habitats and limit the escape of light into surrounding areas of fauna habitat - Ensure that artificial lighting is not directed upwards or laterally - Use lower rather than higher lighting installations - Use lower wavelengths of light wherever possible i.e. red/yellow lights - Use light intensities that are as low as possible without reducing safety or efficiency - Avoid painting large structures bright or reflective colours and minimise use of bright or reflective construction materials and finishes for large structures	Minor	Unlikely	Low	Low Level	No additional controls	Minor	Unlikely	Low	Low Level		Appendix N, Chapter 10 - Fauna
18	Progressive water table drawdown from groundwater extraction rates from the Southern basins borefield	Groundwater	Decline in availability of water to existing and/or future users within the Southern basin (i.e. bore water for communities of Alyuen, Laramba / Napperby). Less groundwater availability to surrounding landholders' bores	- Undertake hydrogeological investigations and predictive groundwater flow modelling; - Identify current and potential future users; - Monitoring program, including bores to assess impacts on water table; - Install groundwater monitoring bores and provide substitute water source from elsewhere for existing stock bores if required.	Moderate	Possible	Medium	Low Level	- Future recalibration of groundwater model, informed by historical operational data after several years of Project operations; - Alternative water supplies to supplement demand for directly impacted users, or change to borefield management if water table drawdown is demonstrated to be unacceptable; - Development and implementation of additional groundwater and surface water management strategies.	Moderate	Possible	Medium	Low level		Appendix K, Chapter 8 - Groundwater
		Flora	Decline in availability of water to ecosystems, including riparian vegetation associated with Day Creek with downstream impacts to Lake Lewis.	- Undertake hydrogeological investigations and predictive groundwater flow modelling; - Monitoring program, including bores to assess impacts on water table; - Development and implementation of groundwater and surface water management strategies	Moderate	Possible	Medium	Low Level	Future recalibration of groundwater model, informed by historical operational data after several years of Project operations	Moderate	Possible	Medium	Low level	Modelling can predict the rate of decline as well as extent of decline, therefore can assess likely ecosystem ability to respond to rate of change.	Appendix M, Chapter 9 - Flora Appendix K, Chapter 8 - Groundwater
		Historic and cultural heritage	Decline in water availability and/or damage to waterbodies of cultural significance, such as soaks, rockholes, waterholes and Ryan Well	- Undertake hydrogeological investigations and predictive groundwater flow modelling; - Development and implementation of groundwater and surface water management strategies	Minor	Unlikely	Low	Medium Level	- Future recalibration of groundwater model, informed by historical operational data after several years of Project operations; - Investigations of each features local conceptual model	Minor	Unlikely	Low		From the AAPA, numerous soaks, rockholes and a waterhole are noted. In addition to these (outside the AAPA area) the nearest known soaks / springs / rockholes and waterholes are at Anna's Reservoir Conservation Area, Allungra Waterhole, Arden Soak and Tinkarkie Soak, North 20 Mile Waterhole and near the Napperby Homestead - Beantree Waterhole.	Appendix U, Chapter 16 - Cultural heritage Appendix K, Chapter 8 - Groundwater
19	Water table drawdown in the Ti Tree or basins associated with Alice Springs water supplies from the cumulative effect of the Southern basins borefield and mine dewatering	Groundwater	Decline in availability of water to existing and or future users, including bores for agricultural users drawing from the Ti Tree basin.	- Undertake hydrogeological investigations and predictive groundwater flow modelling; - Monitoring program, including bores to assess impacts on water table; - Development and implementation of groundwater and surface water management strategies	Minor	Unlikely	Low	Low Level	Future recalibration of groundwater model, informed by historical operational data after several years of Project operations	Minor	Unlikely	Low	Low Level		Appendix K, Chapter 8 - Groundwater
20	Seepage from Tailings Storage Facility (TSF) at Mine Site, including failure of low permeability soil liner system	Groundwater	Seepage of tailings water containing metals at levels exceeding guideline thresholds, with localised contamination of groundwater and discharge to surface water.	- Installation of low permeability soil liner system; - Groundwater monitoring program; - Thickener on benefactor to reduce volume of entrained water entering the TSF; - Supernatant reclaim; - Testing to confirm chemical properties; - Tailings storage facility management and water discharge; - Ongoing AMD sampling and analysis; - Mine Management Plan; - Sediment and Erosion Control Plan; - Controlled and managed site drainage and release to adequately dilute fluoride; - Water cover to minimise dust generation until capped.	Minor	Likely	Medium	Low Level	- Seepage interception and collection system; - Avoid placement of future stock bores within close proximity	Minor	Likely	Medium	Low Level	• Low sulfur and significant contained neutralising capacity in likely tailings stream as tailing discharged as an alkaline waste stream following neutralisation around pH10. • Static and kinetic AMD and leachate testing to confirm mobility is underway. • Assumes that ongoing AMD validation monitoring is undertaken, and material classified, handled and placed according to the AMD Management Plan. • Additional AMD testing to be undertaken pre-production and during production. Sound understanding of the subsurface and location of shallow palaeochannels near both sites will enable prompt intervention if required.	Appendix L, Chapter 8 - Groundwater

Ref.	Impact pathway			Planned Controls to Manage Risk (as per Project Description, and elements of Standards / Codes of Practice	Initial Risk			Level of Certainty	Additional Controls Recommended to Reduce Risk	Residual Risk			Level of Certainty	Comment	Applicable Technical Report / EIS chapter
	Potential event (how the Project interacts with assets, values, uses and location. Include clear description of the cause)	**Environmental Factor / Receptor**	**Description of consequences** (Clearly understand what is the final impact. Describe whether it is construction, operation or decommissioning)		Consequence	Likelihood	Risk Rating			Consequence	Likelihood	Risk Rating			
21	Seepage from Water Leach, Neutralisation and Residue Storage Facilities (RSFs) at Processing Site, including failure of HDPE / low permeability soil liner system	Groundwater	Release to groundwater of leachate (e.g. elevated levels of radioactive material, metals), with localised contamination of groundwater exceeding guideline thresholds.	- HDPE / low permeability soil liner system, including double lined system, with seepage detection; - Groundwater monitoring program; - Thickener in beneficiation plant to reduce volume of entrained water; - Multi-stage neutralisation process (pH control); - Supernatant reclaim from tailings and residue disposal	Major	Unlikely	Medium	Low Level	Avoid placement of future stock bores within close proximity	Major	Unlikely	Medium	Low Level	The exact design of the RSF is yet to be finalised, however key design features to include; consideration of properties of storage materials (such as solubility of metals), practical life of liners, design of seepage collection system. Radiological consequences of lining failure have been modelled and quantified and modelled. Impacts shown to be negligible.	Appendix L, Chapter 8 - Groundwater
22	Seepage from Excess Process Liquor Evaporation Ponds at Processing Site, including failure of HDPE liner system	Groundwater	Release to groundwater of leachate (e.g. elevated levels of radioactive material, metals) with impacts to the Borefield - Southern groundwater basins from sodium sulfate evaporation pond (low level of radionuclides) and brine pond from RO Plant.	- HDPE / low permeability soil liner system, including double lined system, with seepage detection; - Groundwater monitoring program; - Thickener on benefactor to reduce volume of entrained water; - Multi-stage neutralisation process (pH control); - Supernatant reclaim	Major	Unlikely	Medium	Low Level	Seepage interception and collection system	Major	Unlikely	Medium	Low Level	The exact design of the evaporation pond is yet to be finalised, however key design features to include; consideration of properties of storage materials (such as solubility of metals), practical life of liners, design of seepage collection system.	Appendix L, Chapter 8 - Groundwater
23	Embankment failure of Tailings Storage Facility (TSF) containing beneficiation tailings at Mine Site	Surface water	Contamination of surrounding land and ephemeral waterways from uncontrolled release resulting in impact on ecosystem health. Waterways downstream of TSF are Kerosene Camp Creek, Nolans Creek and Woodeford River.	For all receptors: - Development and implementation of Water Management Plan; - Selection of appropriate ANCOLD risk category and adherence to relevant design standards for the provision of adequate storage capacity and freeboard allowance; - Embankment piezometers and survey pins, regular dam inspections; - Adherence to prescribed maximum operating level and retention of freeboard; - Monitoring program for phreatic levels within embankments	Moderate	Rare	Low	Medium Level	Biannual geotechnical inspection of TSF embankment	Moderate	Rare	Low	Medium Level	A Failure Impact Assessment has determined a Population at Risk of less than one and Potential Lives Lost of zero. This together with a medium 'severity of damage and loss' category the ANCOLD consequence category for the FTSF is 'Low'. Radiological impact assessment of wall failure concluded that radiological impacts would be minor.	Appendix I, Chapter 7 - Surface water
		Groundwater	Release of tailings water containing metals at levels exceeding guideline thresholds, with localised contamination of groundwater and discharge to surface water.		Moderate	Rare	Low	Low Level	Avoid placement of future stock bores within close proximity	Moderate	Rare	Low	Low Level		Appendix L, Chapter 8 - Groundwater
		Flora	Immediate inundation of flora within flow path of failed embankment, with secondary longer term impacts including potential vegetation loss associated with the contamination of surrounding land and ephemeral waterways from the uncontrolled release.		Minor	Rare	Low	Medium Level	No additional controls	Minor	Rare	Low	Medium Level		Appendix L, Chapter 8 - Groundwater
		Fauna	Loss or disturbance of fauna habitats due to inundation or degradation of surface water quality, including potential food chain accumulation of metals, results in decline in size of population of listed threatened species.		Minor	Rare	Low	Medium Level	No additional controls	Minor	Rare	Low	Medium Level		Appendix N, Chapter 10 - Groundwater
24	Embankment overtopping of Tailings Storage Facility (TSF) containing beneficiation tailings at Mine Site, leading to an uncontrolled release of liquor	Surface water	Contamination of surrounding land and ephemeral waterways from uncontrolled release resulting in impact on ecosystem health. Waterways downstream of TSF are Kerosene Camp Creek, Nolans Creek and Woodeford River. Loss of only liquor, not the tailings. Smaller of volume of material that is lost. Liquor is more dilute.	For all receptors: - Development and implementation of Water Management Plan; - Selection of most restrictive ANCOLD risk category and adherence to relevant design standards for the provision of adequate storage capacity and freeboard allowance. Selection of Probable Maximum Precipitation (PMP) for design, is maximum theoretical rainfall event; - Embankment piezometers and survey pins, regular dam inspections; - Adherence to prescribed maximum operating level and retention of freeboard	Moderate	Rare	Low	Medium Level	Biannual geotechnical inspection of TSF embankment	Minor	Rare	Low	Medium Level	Worst credible event is failure during a wet weather event, noting final embankment height of 25 metres. While tailings will result in high impact locally, any water would provide for flow into the receiving channel for wider mobilisation.	Appendix I, Chapter 7 - Surface water
		Groundwater	Release of tailings water containing metals at levels exceeding guideline thresholds, with localised contamination of groundwater and discharge to surface water.		Moderate	Rare	Low	Low Level	Avoid placement of future stock bores within close proximity	Moderate	Rare	Low	Low Level		Appendix K, Chapter 8 - Groundwater
		Flora	Immediate inundation of flora within flow path of overtopped embankment, with secondary longer term impacts including potential vegetation loss associated with the contamination of surrounding land and ephemeral waterways from the uncontrolled release.		Minor	Rare	Low	Medium Level	No additional controls	Minor	Rare	Low	Medium Level		Appendix M, Chapter 9 - Flora
		Fauna	Loss or disturbance of fauna habitats due to inundation or degradation of surface water quality, including potential food chain accumulation of metals, results in decline in size of population of listed threatened species.		Minor	Rare	Low	Medium Level	No additional controls	Minor	Rare	Low	Medium Level		Appendix N, Chapter 9, 10 - Fauna

Ref.	Impact pathway			Planned Controls to Manage Risk (as per Project Description, and elements of Standards / Codes of Practice	Initial Risk			Level of Certainty	Additional Controls Recommended to Reduce Risk	Residual Risk			Level of Certainty	Comment	Applicable Technical Report / EIS chapter
	Potential event (how the Project interacts with assets, values, uses and location. Include clear description of the cause)	**Environmental Factor / Receptor**	**Description of consequences** (Clearly understand what is the final impact. Describe whether it is construction, operation or decommissioning)		Consequence	Likelihood	Risk Rating			Consequence	Likelihood	Risk Rating			
25	Embankment failure or overtopping of Water Leach, Neutralisation and Phosphate Residue Storage Facilities (RSFs) at Processing Site, due to slope instability or extreme weather event	Surface water	Contamination of surrounding land and ephemeral waterways from uncontrolled release resulting in impact on ecosystem health. Waterways downstream of the residue storage facilities are minor creeks draining to the Southern Basins.	For all receptors: - Development and implementation of Water Management Plan; - Selection of appropriate ANCOLD risk category and adherence to relevant design standards for the provision of adequate storage capacity and freeboard allowance; - Embankment piezometers and survey pins, regular dam inspections; - Adherence to prescribed maximum operating level and retention of freeboard;	Major	Rare	Medium	Medium Level	No additional controls	Major	Rare	Medium	Medium Level	A Failure Impact Assessment or ANCOLD consequence categorisation is not known to have been carried out for RSFs. However, given remoteness of RSFs from Population at Risk the consequence category is likely to be similar to that determined for the TSF, i.e. low. The small scale of upstream catchments limits the carrying capacity of flood flows coinciding with a dam failure. Therefore, the environmental impact to the receiving environment is likely to be high immediately downstream of RSFs, diminishing with distance due to increased opportunity for degradation of contaminant load through deposition and dilution from increasing downstream catchment runoff. Radiological impacts minimal due to the relatively low concentration of radionuclides in solids and liquids fraction of residues.	Appendix I, Chapter 7 - Surface water
		Groundwater	Contamination of a significant groundwater resource. Impact on Southern basins and consequential impacts to water supply for existing and potential users (i.e. borewater for communities of Alyuen, Laramba / Napperby).		Major	Rare	Medium	Low Level	Avoid placement of future stock bores within close proximity	Major	Rare	Medium	Low Level	Water supply to Alyuen/Aileron is up groundwater gradient from plant tailings ponds. Bore in around 18km from plant site. Water supply to Laramba and Napperby Station is down gradient but around 45km away form plant site.	Appendix K, Chapter 8 - Groundwater
		Flora	Immediate inundation of flora within flow path of failed embankment, with secondary longer term impacts including potential vegetation loss associated with the contamination of surrounding land and ephemeral waterways from the uncontrolled release.		Major	Rare	Medium	Medium Level	No additional controls	Major	Rare	Medium	Medium Level		Appendix M, Chapter 9 - Flora
		Fauna	Loss or disturbance of fauna habitats due to inundation or degradation of surface water quality through released contaminants, results in decline in size of population of listed threatened species.		Moderate	Rare	Low	Medium Level	No additional controls	Moderate	Rare	Low	Medium Level		Appendix N, Chapter 9, 10 - Fauna
26	Embankment failure or overtopping of Water Leach, Neutralisation and Phosphate Residue Storage Facilities (RSFs) at Processing Site, due to slope instability or extreme weather event	Surface water	Contamination of surrounding land and ephemeral waterways from uncontrolled release resulting in impact on ecosystem health. Waterways downstream of the residue storage facilities are minor creeks draining to the Southern Basins.	For all receptors: - Development and implementation of Water Management Plan; - Selection of appropriate ANCOLD risk category and adherence to relevant design standards for the provision of adequate storage capacity and freeboard allowance; - Embankment piezometers and survey pins, regular dam inspections; - Adherence to prescribed maximum operating level and retention of freeboard;	Major	Rare	Medium	Medium Level	No additional controls	Major	Rare	Medium	Medium Level		Appendix I, Chapter 7 - Surface water
		Groundwater	Contamination of a significant groundwater resource. Impact on Southern basins and consequential impacts to water supply for existing and potential users (i.e. borewater for communities of Alyuen, Laramba / Napperby).		Catastrophic	Rare	Medium	Low Level	Avoid placement of future stock bores within close proximity	Catastrophic	Rare	Medium	Low Level		Appendix K, Chapter 8 - Groundwater
		Flora	Immediate inundation of flora within flow path of failed embankment, with secondary longer term impacts including potential vegetation loss associated with the contamination of surrounding land and ephemeral waterways from the uncontrolled release.		Major	Rare	Medium	Medium Level	No additional controls	Major	Rare	Medium	Medium Level		Appendix M, Chapter 9 - Flora
		Fauna	Loss or disturbance of fauna habitats due to inundation or degradation of surface water quality through released contaminants, results in decline in size of population of listed threatened species.		Moderate	Rare	Low	Medium Level	No additional controls	Moderate	Rare	Low	Medium Level		Appendix N, Chapter 9, 10 - Fauna
27	Overtopping of Excess Process Liquor Evaporation Ponds at Processing Site, due to extreme weather event or operational error	Surface water	Localised contamination of surrounding land and ephemeral waterways from uncontrolled release due to overtopping, resulting in impact on ecosystem health.	For all receptors: - Development and implementation of Water Management Plan; - Selection of appropriate ANCOLD risk category and adherence to relevant design standards for the provision of adequate storage capacity and freeboard allowance; - Embankment piezometers and survey pins, regular dam inspections; - Adherence to prescribed maximum operating level and retention of freeboard;	Major	Rare	Medium	Medium Level	No additional controls	Major	Rare	Medium	Medium Level	Evaporation ponds 2.5 m deep and typically slow flow rate from process plant, directed to one of the ponds.	Appendix I, Chapter 7 - Surface water
		Groundwater	Contamination of a significant groundwater resource. Impact on Southern basins and consequential impacts to water supply for existing and potential users (i.e. borewater for communities of Alyuen, Laramba / Napperby).		Catastrophic	Rare	Medium	Low Level	Avoid placement of future stock bores within close proximity	Catastrophic	Rare	Medium	Low Level		Appendix K, Chapter 8 - Groundwater
		Flora	Immediate inundation of flora within flow path of overtopped pond, with secondary longer term impacts including potential vegetation loss associated with the localised contamination of surrounding land and ephemeral waterways from the uncontrolled release.		Moderate	Rare	Low	Medium Level	No additional controls	Moderate	Rare	Low	Medium Level		Appendix M, Chapter 9 - Flora
		Fauna	Localised loss or disturbance of fauna habitats due to inundation or degradation of surface water quality through released contaminants, results in decline in size of population of listed threatened species.		Moderate	Rare	Low	Medium Level	No additional controls	Moderate	Rare	Low	Medium Level		Appendix N, Chapter 9 , 10 - Fauna

Ref.	Impact pathway			Planned Controls to Manage Risk (as per Project Description, and elements of Standards / Codes of Practice	Initial Risk			Level of Certainty	Additional Controls Recommended to Reduce Risk	Residual Risk			Level of Certainty	Comment	Applicable Technical Report / EIS chapter
	Potential event (how the Project interacts with assets, values, uses and location. Include clear description of the cause)	Environmental Factor / Receptor	Description of consequences (Clearly understand what is the final impact. Describe whether it is construction, operation or decommissioning)		Consequence	Likelihood	Risk Rating			Consequence	Likelihood	Risk Rating			
28	Wildlife ingestion or exposure to supernatant material at Mine Site or Processing Site	Fauna	Ingestion or exposure by wildlife, including Princess Parrot, of water with potential for elevated levels of salinity or metals, leading to fauna mortality.	- Perimeter fencing of storage facilities; - Monitor wildlife visitation and develop suitable management response	Moderate	Unlikely	Medium	Low Level	No additional controls	Moderate	Unlikely	Medium	Low Level		Appendix N, Chapter 9, 10 - Fauna
		Radiation	Radioactive emissions from operations leading to exposure to species off site resulting in affects on populations or population health	Develop and implement a Air and Dust Management Plan and Radiation Management Plan. To include standard dust mitigation procedures including: - Minimise open areas exposed to wind erosion - Minimise time between top soil stripping and construction/mining operations. Waste dump footprints will be developed as required to minimise dust. - Use of water sprays on haul roads, unsealed surfaces - Wet ore before crushing and design controls such as use of hooded crusher, covered conveyor and an enclosed HPRG. - Ongoing dust deposition monitoring program	Minor	Rare	Low	Medium Level	No additional controls	Minor	Rare	Low	Medium Level	Conservative modelling has shown that radiological impacts to flora and fauna from site emissions will be low	Appendix P, Chapter 12 - Radiation
29	Uncontrolled AMD seepage from in-pit and ex-pit AMD material at Mine Site, including pit walls, ROM pad or storage	Groundwater	Contamination of a groundwater resource, including acidity, salinity or metals.	- Testing to confirm chemical properties. Only trace AMD material identified in material likely to make up pit walls or be dewatered by mine drainage; - PAF encapsulation cells within ex-pit WRDs; - Dumps and fill areas profiled to shed and capture runoff; - Clean, dirty and contaminated water drainage systems; - Surface water management basins; - On completion of mining, pit will re-flood above the level of any significant AMD in the aquifers surrounding the pit, preventing further oxidisation; - AMD Management Plan, with regular review. Including ongoing AMD sampling and analysis; - Mine Management Plan; - Sediment and Erosion Control Plan; - Water Management Plan; - Selective materials handling and placement using mine schedule and geochemical model; - Controlled and managed site drainage and release; - Compaction of construction material and waste rock; - Rapid recovery of groundwater levels to prevent further PAF oxidisation and post mining	Minor	Unlikely	Low	Medium Level	No additional controls	Minor	Unlikely	Low	Medium Level	Low sulfur content and significant apparent neutralising capacity in most lithologies and waste streams. NAPP ranges between -225 kg/H2SO4 to 0.6 kg/H2SO4 with median and mean values of -13.9 kg/t H2SO4 and -27.3 kg/t H2SO4. Low total metals –Be, Ce, Eu, La, Mo, ND, PR, Sb, Se, Ta, Th, Ti, Tl, Hg had mean concentrations exceeding a GAI of 3 but low (TBA) content in groundwater suggests limited mobility. Leachate testing to confirm mobility is underway. Assumes that ongoing AMD validation monitoring is undertaken, and material classified, handled and placed according to the AMD Management Plan. Additional AMD testing to be undertaken pre-production and during production.	Appendix L, Chapter 8 - Groundwater
30	Waste rock dump cover material and/or design allowing for erosion and exposure of waste rock and excessive leachate generation	Groundwater	Contamination of a groundwater resource, including acidity, salinity or metals.	- Use of appropriate cover material; - Physical isolation of radioactive material by non-radioactive material; - Compaction of PAF waste in cell limiting infiltration; - Addition of ACM to PAF to neutralise leachate/runoff; - Provision for capture and treat via polishing pond and wetland (if required); - Cover materials resource assessment; - Cover trials to determine a suitable cover design; - Mine Management Plan; - Sediment and Erosion Control Plan; - Water Management Plan; - Controlled and managed site drainage and release; - Controlled placement of cover material; - Controlled and managed site drainage and release.	Insignificant	Unlikely	Low	Medium Level	No additional controls	Insignificant	Unlikely	Low	Medium Level	Preliminary assessment indicates suitable material available. Formal cover material resource assessment to be carried out as part of pre-production-detailed design work. Ongoing WRD cover materials testing and design trials required.	Appendix K, Chapter 8 - Groundwater
		Radiation	Rain water comes in contact encapsulated radioactive material resulting in mobilisation of radionuclides and their movement into the ecosystem		Insignificant	Rare	Low	Medium Level	No additional controls	Insignificant	Rare	Low	Medium Level		Appendix P, Chapter 12 - Radiation
31	'First flush' surge of stored oxidation products (AMD / NMD / SD) generated in mine storage facilities at Mine site (Waste Rock Dump, Long Term Stockpile, ROM Pad etc) over extended dry periods, discharging downstream	Surface water	Contamination of ephemeral waterways and subsequently groundwater from uncontrolled release resulting in impact on ecosystem health and/ or public water supply.	Sediment control ponds	Insignificant	Unlikely	Low	Medium Level	No additional controls	Insignificant	Unlikely	Low	Medium Level	First flush is not likely to occur based on chemistry of waste rock and climatic conditions	Appendix I, Chapter 7 - Surface water
		Groundwater	Release to groundwater of leachate (elevated levels of radioactive material). Contamination of a significant groundwater resource. Impact on Ti Tree groundwater basin and consequential impacts to water supply (domestic, agricultural)		Insignificant	Unlikely	Low	Low Level	No additional controls	Insignificant	Unlikely	Low	Low Level	Radionuclides aren't soluble in normal environmental conditions. Ti Tree Basin margin is 20km north of mine site. Pit will act as a groundwater sink changing groundwater flow direction around the pit.	Appendix K, Chapter 8 - Groundwater
32	Mine void post-closure results in a long term source of contaminated water with the potential to contaminate groundwater and surface water	Groundwater	After decommissioning the mine void modelled to act as a sink, concentrating salts/contaminants through evaporation. Impact to surrounding groundwater is non credible.	- Closure water balance; - Undertake hydrogeological investigations; - Undertake predictive groundwater flow modelling.	Moderate	Rare	Low	High Level	Monitoring and confirmation of the balance (calibration) to ensure the pit always behaves as a sink. This means that contaminated water is always flowing towards the pit.	Moderate	Rare	Low	High Level	Water balance model demonstrates evaporation is greater than surface water and groundwater seepage over time, with the mine void acting as a sink.	Appendix K, Chapter 8 - Groundwater
		Fauna	After decommissioning the mine void modelled to act as a sink, concentrating salts/contaminants through evaporation. Will be a hypersaline waterbody, with potential hazard to fauna.		Minor	Rare	Low	Medium Level	No additional controls	Minor	Rare	Low	Medium Level		Appendix N, Chapter 9 - Fauna
33	Uncontrolled release, spill or passive discharge of hydrocarbons or reagents (dry bulk or liquid bulk) at Mine site or Processing Site, including through inappropriate storage and handling	Groundwater	Contaminant to ground resulting in contamination of soils and groundwater resource. Worst credible consequence is loss of several hundred thousand litres of diesel to soil.	- Hazardous Substances Management Plan; - Self bunding storage for 110% of storage volume, per - Australian Standards; - No underground piping; - Site layout; - Bollards	Minor	Unlikely	Low	Medium Level	No additional controls	Minor	Unlikely	Low	Medium Level	Volumes are such that spills would experience high ratio of dilution should incidents occur during surface runoff events. Therefore, environmental impacts to the surface water environment would be localised and rare in occurrence due to infrequent runoff events.	Appendix K, Chapter 8 - Groundwater

Ref.	Impact pathway			Planned Controls to Manage Risk (as per Project Description, and elements of Standards / Codes of Practice	Initial Risk			Level of Certainty	Additional Controls Recommended to Reduce Risk	Residual Risk			Level of Certainty	Comment	Applicable Technical Report / EIS chapter
	Potential event (how the Project interacts with assets, values, uses and location. Include clear description of the cause)	Environmental Factor / Receptor	Description of consequences (Clearly understand what is the final impact. Describe whether it is construction, operation or decommissioning)		Consequence	Likelihood	Risk Rating			Consequence	Likelihood	Risk Rating			
34	Leak in concentrate slurry pipeline between Mine Site and Process Site or from beneficiation plant to TSF due to failure, physical impact or vandalism resulting in RE concentrate to ground.	Groundwater	Contaminant to ground from slurry pipeline resulting in contamination of soils and groundwater resource. Assessed on 6 hours of loss.	- Above ground pipeline within a bunded corridor; - Processing plant notification of disruption to flow; - Flow meters; - Pressure sensors; - Shift based visual inspections; - Design - spray deflectors on welded joints	Minor	Rare	Low	Low Level	No additional controls	Minor	Rare	Low	Low Level		Appendix K, Chapter 8 - Groundwater
		Surface water	Coincident with a rainfall event. Loss of control with dispersion of concentrate to surface water.	- Above ground pipeline within a bunded corridor; - Processing plant notification of disruption to flow; - Flow meters; - Pressure sensors; - Shift based visual inspections; - Design - spray deflectors on welded joints	Moderate	Rare	Low	Low Level	No additional controls	Moderate	Rare	Low	Low Level	Short duration event with relatively small volumes of material. Localised impact within corridor. Storage volumes within bunded corridor will far exceed rainfall and discharge quantities.	Appendix I, Chapter 7 - Surface water
35	Leak in sewage pipes from failure, physical impact or vandalism resulting in contaminant to ground or surface water. Comprises sewerage from the village, RE intermediate plant and concentrator / MSA pumped to sewage treatment plant adjacent to RE intermediate plant, via underground PVC pipelines within the road service corridors.	Groundwater	Contaminant to ground resulting in contamination of soils and groundwater resource.	Periodic visual inspections of pipeline corridors, occurring twice per shift	Minor	Rare	Low	Medium Level	No additional controls	Minor	Rare	Low	Medium Level		Appendix K, Chapter 8 - Groundwater
36	External bushfire, resulting in structural failures and release of process consumables, products or ignition of gas inventory.	Human health and safety	Personnel fatality or injury	For all receptors: Development and implementation of Fire Management Plan, including: - Maintenance of fire breaks around high-risk areas / activities - Active fire management and vegetation reduction program; - Erosion control in waterways, if fire should occur and results in loss of vegetation that otherwise stabilises soil/sediments. - Fire breaks; - Fire detection and suppression systems, fire extinguishers - and fire fighting training; - Emergency response procedures, team and equipment - Dedicated fire water system around infrastructure - All chemicals and reagents stored in secure compounds on hardstand areas; - Mine water trucks fitted with high pressure monitors and pumps for fire management	Catastrophic	Rare	Medium	Medium Level	No additional controls	Catastrophic	Rare	Medium	Medium Level		Appendix O, Chapter 11 - Human Health and Safety
		Flora	Disturbance or loss of vegetation with potential for change in vegetation composition, including simplification in structure and diversity.		Moderate	Rare	Low	Medium Level	No additional controls	Moderate	Rare	Low	Medium Level		Appendix M, Chapter 9 - Flora
		Surface water	Contamination of waterways from uncontrolled release of consumables, product and by-products resulting in decline of water quality and aquatic ecosystem health. Mechanism of dispersion predominantly airborne, with dust deposition / sedimentation in headwaters of Kerosene Camp Creek and minor creeks draining into Southern Basins.		Moderate	Rare	Low	Medium Level	No additional controls	Moderate	Rare	Low	Medium Level	Main potential mechanism is deposition within flow paths, however ability to transport to surface water channel constrained by limited rainfall. Direct deposition in creeks will be limited due to small footprint relative to wide dispersion zone. Likely time gap between bushfire and rainfall event due to seasonality, limiting potential mobilisation by flow in channel.	Appendix I, Chapter 7 - Surface water
		Fauna	Fragmentation or loss of habitat or food resources over a wide area, rendering habitats for listed threatened species unsuitable for periods of time. Potential for direct mortality and increase in predation for listed threatened species such as the mulgaras due to reduction in ground-layer vegetation cover.		Major	Rare	Medium	Medium Level	No additional controls	Major	Rare	Medium	Medium Level		Appendix N, Chapter 10 - Fauna
37	Vehicle incident associated with the transport of materials and personnel off-site on public roads, including vehicle to vehicle impact, single vehicle incidents (rollover, vehicle over the edge, vehicle impact with structure) and vehicle to pedestrian impacts. This includes road transport of consumables / products such as sulphur, calcium carbonate, caustic soda (sodium hydroxide), lime, hydrochloric acid, cerium carbonate, barium chloride, RE chloride. It also includes transport of personnel between site and the accommodation village. Causes include: - Human factors (operator non compliance, unfit for work, lack of awareness, third party errors etc.); - Environmental conditions (wet / slippery road, poor visibility, obstructions on road etc.); - Equipment factors (aged or damage, operating outside design limits, modifications to vehicles, poor design etc.)	Human health and safety	Consequences will vary depending on severity of impact between minor injury to fatality. Maximum reasonable consequence could be a multiple fatality event when multiple vehicles are involved or multiple personnel in the vehicle(s). The event may occur at any time throughout the life of the project.	For all receptors: - Audit of service provider during selection process to ensure competence and professionalism; - Transport study and associated management systems; - Journey management plans (including minimising travel during dusk / dawn); - Fitness for work management system including hours of work, drug & alcohol policy, medicals, fatigue management etc.); - Contractor management system; - Northern Territory road rules; - National Heavy Vehicle Regulator Scheme accreditation; - Speed limiting on heavy vehicles; - Arafura speed limit operating procedures for buses; - Arafura vehicle design specifications and associated procurement management; - Arafura vehicle maintenance program including pre-start inspections and routine maintenance; - Fit for purpose transport facilities e.g. ISO tank containers; - Community consultation and awareness program; - Police presence; - Bussing of personnel to / from accommodation village and regional centres; - Emergency response procedures, team and equipment; - Trained personnel to assist emergency response services;	Catastrophic	Unlikely	High	Low Level	- In vehicle monitoring systems (Arafura vehicles); - Accident/incident investigation protocols; - Quarterly road safety briefings	Catastrophic	Unlikely	High	Low Level		Appendix V, Chapter 17 - Transport
		Flora	Loss of containment of consumable or product, resulting in spill to roadside environment and disturbance or loss of vegetation due to smothering / inundation and localised contamination of surrounding land. Worst credible is associated with liquid hydrochloric acid and caustic soda.		Minor	Unlikely	Low	Medium Level	No additional controls	Minor	Unlikely	Low	Medium Level		Appendix M, Chapter 9 - Flora
38	Transport of materials and personnel on public roads during Project operations results in impacts on road network operations, impacting operational network capacity.	Transport	Increase in traffic volumes associated with transport of material between rail head and Project site, with additional demand accommodated by capacity of the road network.	Audit of service provider during selection process to ensure competence and professionalism; Traffic Impact Assessment and associated recommendations; Traffic Management Plans; Journey Management Plans; Stakeholder consultation and engagement, including NT Department of Transport; Arafura vehicle maintenance program including pre-start inspections and routine maintenance;	Insignificant	Possible	Low	Medium Level	Accident/incident investigation protocols.	Insignificant	Possible	Low	Medium Level		Appendix V, Chapter 17 - Transport

Ref.	Impact pathway			Planned Controls to Manage Risk (as per Project Description, and elements of Standards / Codes of Practice	Initial Risk			Level of Certainty	Additional Controls Recommended to Reduce Risk	Residual Risk			Level of Certainty	Comment	Applicable Technical Report / EIS chapter
	Potential event (how the Project interacts with assets, values, uses and location. Include clear description of the cause)	**Environmental Factor / Receptor**	**Description of consequences** (Clearly understand what is the final impact. Describe whether it is construction, operation or decommissioning)		Consequence	Likelihood	Risk Rating			Consequence	Likelihood	Risk Rating			
39	Transport of materials and personnel on public roads results in impacts on road network conditions. Including consideration of seasonal variability of road surface conditions.	Transport	Increase in traffic volumes, resulting in decline in condition of sealed and unsealed public roads, with adverse impact on safety of other road users	Audit of service provider during selection process to ensure competence and professionalism; Traffic Impact Assessment and associated recommendations; Traffic Management Plans; Journey Management Plans, including observed gross mass limits; Stakeholder consultation and engagement, including NT Department of Transport; Arafura vehicle maintenance program including pre-start inspections and routine maintenance;	Minor	Possible	Medium	Medium Level	Accident/incident investigation protocols.	Minor	Possible	Medium	Medium Level		Appendix V, Chapter 17 - Transport
40	Rail incident, including derailment, associated with the transport of materials by rail, resulting in loss of containment to the environment	Transport	Loss of containment of consumable or product, resulting in spill to environment and disturbance or loss of vegetation due to smothering / inundation and localised contamination of surrounding land.	Contractor management systems, including review of service provider during selection process to ensure competence and professionalism; Containerised product.	Moderate	Unlikely	Medium	Low Level	Emergency response procedure for loss of containment of Product, including competent personnel, equipment and coordination with emergency services; Accident/incident investigation protocols.	Moderate	Unlikely	Medium	Low Level		Appendix V, Chapter 17 - Transport
41	Transport of materials by rail restricts available capacity of shared railway resources, including Alice Springs intermodal terminal	Transport	Supply chain impacts to regional industry, resulting in inability to transport product and consequential impact on economic feasibility of businesses.	Stakeholder consultation and engagement, including NT Department of Transport and rail operator	Minor	Rare	Low	Medium Level	No additional controls	Minor	Rare	Low	Medium Level	Discussion with GWA has identified capacity on southbound movement, which will be main demand for Arafura in bringing down consumables	Appendix V, Chapter 17 - Transport
42	Mobile equipment incident on site including vehicle to vehicle impact, single vehicle incidents (rollover, vehicle over the edge, vehicle impact with structure) and vehicle to pedestrian impacts. This includes all operational areas: in pit, workshops, administration areas, processing plant etc. where vehicle movements are conducted during construction and day to day operations. Mobile equipment includes all vehicle types, including heavy vehicles (haul trucks, cranes, drill rigs, graders, etc.), medium vehicles (water trucks, delivery vehicles, forklifts, service trucks, buses, etc.) and light vehicles (utes, vans and cars). Causes include: - Human factors (operator or pedestrian non compliance, unfit for work, communication failures, lack of awareness etc.); - Environmental conditions (wet / slippery road, poor visibility, obstructions on road, congestion etc.); - Equipment factors (aged or damage, operating outside design limits, modifications to vehicles, poor design etc.)	Human health and safety	Consequences will vary depending on severity of impact between minor injury to fatality. Maximum reasonable consequence could be a multiple fatality event when multiple vehicles are involved or multiple personnel in the vehicle(s). The event may occur at any time throughout the life of the project.	Traffic Management Plan incorporating: -Vehicle design specifications and associated procurement management; - Vehicle maintenance program including pre-start inspections and routine maintenance; - Change management; - Segregation between vehicles and vehicles / pedestrians e.g. road access restrictions, dedicated walkways; - Site speed restrictions; - Equipment and task specific procedures / work instructions; - Equipment and task specific training and competency assessment (including ongoing refresher); - Dedicated laydown / hardstand areas; - Access restrictions to operational areas e.g. through the use of barricades; - High vis PPE; - Vehicle decals and flags, flashing lights - Road design to relevant standards; - Road maintenance program, including dust suppression; Fitness for work management system including hours of work, drug & alcohol policy, medicals, fatigue management etc.); Authorisation process for vehicles to enter site; Operations supervision; Emergency response procedures, team and equipment.	Catastrophic	Unlikely	High	Low Level	In vehicle monitoring systems; Proximity detection and alarms; Accident/incident investigation protocols.	Catastrophic	Unlikely	High	Low Level		Appendix O, Chapter 11 - Human Health and Safety
43	Personnel falling from height or into depth on site including mining, processing, maintenance and administration areas. This includes personnel falling while working at height (e.g. greater than 2 m). Examples include falling from scaffolding, personnel lifting devices (e.g. EWP, scissor lift), falling through flooring or an open hatch, falling while accessing & egressing machinery, walkways, ladders and fall from edge e.g. low or high wall. Includes vehicles (HV and LV) driving over bench edges, waste dump tip heads; This may occur during construction or operations where personnel undertake work at heights. Causes include: - Human factors (inappropriate selection or use of fall protection equipment, over reaching, failure to recognise height, unfit for work); - Environmental conditions (wet / slipper surface, poor visibility, trip hazards, uneven or unstable ground, poor visibility, unexpected start up of equipment, external impacts); - Equipment factors (poor design, worn / aged equipment, mechanical failure, missing protection systems, inappropriate equipment for the task)	Human health and safety	Consequences will vary depending on the height and location of the fall between minor injury to fatality. Maximum reasonable consequence would be a single fatality (multiple fatalities may occur e.g. failure of scaffold with multiple personnel on it, however the more reasonable outcome is assumed to be a single fatality). The event may occur at any time throughout the life of the project.	- Equipment design specifications and associated procurement management; - Equipment maintenance program including pre-start inspections and routine maintenance; - Fixed plant design to relevant standards; - Mobile plant design specifications for access/egress (no ladders). - Protective bunds around all pit bench edges, waste dump tip heads. - Fixed plant inspection and maintenance program including structural integrity inspections; - Engineered platforms for specific tasks; - Change management; - Work at heights procedure; - Work at heights training and competency assessment (including ongoing refresher); - Work at heights PPE (fall arrest / fall restraint) including rated anchor points; - Work at heights PPE inspection regime; - Scaffolding training and competency assessment; - Scaffold inspection and management program; - Fitness for work management system including hours of work, drug & alcohol policy etc.); - Operations supervision; - Emergency response procedures, team and equipment; - Designated view points at pit and surveying stations with guarding.	Major	Rare	Medium	Low Level	No additional controls	Major	Rare	Medium	Low Level		Appendix O, Chapter 11 - Human Health and Safety

Ref.	Impact pathway			Planned Controls to Manage Risk (as per Project Description, and elements of Standards / Codes of Practice	Initial Risk			Level of Certainty	Additional Controls Recommended to Reduce Risk	Residual Risk			Level of Certainty	Comment	Applicable Technical Report / EIS chapter
	Potential event (how the Project interacts with assets, values, uses and location. Include clear description of the cause)	**Environmental Factor / Receptor**	**Description of consequences** (Clearly understand what is the final impact. Describe whether it is construction, operation or decommissioning)		Consequence	Likelihood	Risk Rating			Consequence	Likelihood	Risk Rating			
44	Personnel exposed to a confined space incident e.g. engulfment, irrespirable or noxious atmosphere. Exposure in the confined space may occur as a result of the pre-existing environment or due to changes that occur while personnel are present. Confined space entry may be required during construction and during operations. Gases personnel may be exposed to include methane, carbon monoxide, NOx, SOx, ammonia, solvent fumes, smoke and fire suppression chemicals. Engulfment may occur as a result of unplanned exposure to solids, liquids or gases. Causes include failure to effectively isolate; structural failure within the confined space; failure to identify all hazards within the space; faulty equipment used within the space; chemical reactions; ingress of contaminants from external to the space, monitoring equipment failure, ventilation equipment failure; slips trips & falls.	Human health and safety	Consequences will vary depending on the situation and will range between injury to fatality. Maximum reasonable consequence would be a multiple fatality event as it is likely that more than one person will be within a confined space. The event may occur at any time throughout the life of the project, however is considered most likely during the operational phase.	- Confined space entry procedure and permit; - Confined space entry training and competency assessment including ongoing refresher; - Isolation procedure and associated training; - Restricted access to confined spaces (including signage); - Confined space register; - Pre-entry inspection; - Gas monitor for use during entry; - Adequate ventilation; - Spotter present; - Fitness for work management system including hours of work, drug & alcohol policy etc.); - Operations supervision; - Emergency response procedures, team and equipment.	Major	Rare	Medium	Low Level	No additional controls	Major	Rare	Medium	Low Level		Appendix O, Chapter 11 - Human Health and Safety
45	Personnel struck by ground failure, rock fall or flyrock event in mining operational areas. Includes material falling from high and low walls, dumps and ramps, falling from loaded trucks. Causes include: - Operational factors (blasting activities causing excessive vibration, poor blast design, poor digging practices, poor low / high wall / bench / dump design, failure to adequately monitor conditions, dropped material from excavator etc.) - Geological / geotechnical factors (underlying geology, variable material properties, excessive water ingress, seismic event, hydraulic conditions etc. Inadequate blast clearance zones.	Human health and safety	Consequences will vary depending on the size of material falling and how personnel are impacted (e.g. on foot or in vehicle) and will range between injury to fatality. Maximum reasonable consequence would be a single fatality event as it is unlikely that more than one person will be impacted by a failure. The event may occur at any time throughout the life of the project.	- Mine design (including review and sign-off processes); - Mine modelling & mapping (hydrogeological, geological, exploration data etc.); - Mine geological and geotechnical monitoring e.g. GPS tracking of faults, daily inspections, ground monitoring systems (prism, extensometers, radar, piezometer, survey); - Geotechnical hazard maps; - Trigger action response plans; - Mine drainage design and systems; - Water management plan; - Blasting design including blasting management and clearance; - Blast vibration monitoring; - Equipment and task specific procedures / work instructions; - Equipment and task specific training and competency assessment (including ongoing refresher); - FOPS on mobile equipment; - Access restrictions to pit ramps, slopes & crests; - Hazard reporting; - Operations supervision; - Emergency response procedures, team and equipment.	Major	Rare	Medium	Low Level	No additional controls	Major	Rare	Medium	Low Level		Appendix O, Chapter 11 - Human Health and Safety
46	Personnel in contact with an electrical source (low or high voltage) resulting in electrocution or arc flash burns. This includes all electrical sources on site where exposure may occur during construction or operations. Low voltage includes all electrical sources less than 1 kV, for example lighting, pumps, portable tools, welders, gen sets. High voltage includes fixed assets, overhead and underground cables greater than 1 kV AC or 1.5 kV DC. Exposure could occur for a variety of reasons including faulty equipment, equipment damage, excavation or penetration, when isolating power sources, during electrical maintenance, when installing electrical equipment or infrastructure, and during switching activities. Electricians can be exposed to electrical sources at substations, transformers, generators, local panels, cabling etc. Non electrical personnel can be exposed through extension cords, portable tools and distribution centres are considered in this assessment as well as contact with cabling from non-electricians such as digging up electrical cables and contact with overhead cabling.	Human health and safety	Consequences will vary depending on the type of contact and energy level associated with the equipment. This would include a range of minor injuries e.g. electric shock, through to electrocution or fatality from arc flash events. The maximum reasonable consequence would be a single fatality. The event may occur at any time throughout the life of the project.	- Electrical asset design specifications and associated procurement management (including extra low voltage used where possible, remote switching, arc flash containment); - Electrical equipment maintenance program including pre-start inspections and routine maintenance; - Electrical protection systems (earth leakage, earth continuity, RCD etc.); - Change management; - Electrical workers training and competency assessment (including ongoing refresher); - Equipment and task specific procedures / work instructions; - Equipment and task specific training and competency assessment (including ongoing refresher); - Penetration / dig permit; - Signage and demarcation of electrical cables; - Procedure for working in proximity to power lines; - Isolation procedure and associated training; - Arc flash PPE; - Switching sheets; - Access restrictions to electrical infrastructure (e.g. substations); - Operations supervision; - Emergency response procedures, team and equipment.	Major	Unlikely	Medium	Low Level	No additional controls	Major	Unlikely	Medium	Low Level		Appendix O, Chapter 11 - Human Health and Safety

Ref.	Impact pathway			Planned Controls to Manage Risk (as per Project Description, and elements of Standards / Codes of Practice	Initial Risk			Level of Certainty	Additional Controls Recommended to Reduce Risk	Residual Risk			Level of Certainty	Comment	Applicable Technical Report / EIS chapter
	Potential event (how the Project interacts with assets, values, uses and location. Include clear description of the cause)	**Environmental Factor / Receptor**	**Description of consequences** (Clearly understand what is the final impact. Describe whether it is construction, operation or decommissioning)		Consequence	Likelihood	Risk Rating			Consequence	Likelihood	Risk Rating			
47	Personnel struck by a dropped or swinging load during lifting by a lifting device or tipping a lifting device. Lifting devices may include: mobile cranes; overhead cranes; vehicle loading cranes; chain blocks; come-alongs; stands and jacks; equipment with jib attachments (e.g. forklifts, telehandlers). Rigging and restraint equipment that may be used with lifting devices include: ropes, slings chains, restraining devices, shackles, lifting frames and hooks. An incident could occur during a variety of activities including crane lifts, loading/unloading trucks, while transporting a load on a lifting device, while jacking a load into place or during multi-crane lifts. this includes construction and operations / maintenance activities. Causes include: - Human factors (inexperience, unauthorised use of lifting device, communication failures, incorrect equipment selection or use, unsecured loads etc.); - External & environmental factors (load collapse, external impact during lift, confined or restricted work area, uneven or unstable ground, poor environmental conditions / adverse weather etc.); - Equipment factors (poor design, equipment damage / failure etc.)	Human health and safety	Consequences will vary depending on the size of the load and how personnel are impacted and will range from an injury e.g. crushed hand or foot to a fatality. The maximum reasonable consequence would be a single fatality. The event may occur at any time throughout the life of the project.	- Lifting device design specifications and associated procurement management; - Lifting device maintenance program including pre-start inspections, routine and statutory maintenance; - Lifting gear (slings / ropes etc.) design specifications; - Lifting gear maintenance program including pre-start and routine inspections; - Change management; - Lifting activity (e.g. dogman, rigger, crane operator) training and competency assessment (including ongoing refresher); - Equipment and task specific procedures / work instructions; - Lift and critical lift plans; - Spotter for lifting activities; - Fit for purpose load restraint devices; - Access restrictions to lifting activities (signs and barricades); - Operations supervision; - Emergency response procedures, team and equipment.	Major	Unlikely	Medium	Low Level	No additional controls	Major	Unlikely	Medium	Low Level		Appendix O, Chapter 11 - Human Health and Safety
48	Personnel impacted by fire or explosion. This includes equipment and substance fire and explosions. This may occur during construction or operations. Mining operations fires would typically involve mobile equipment fires. Processing plant fires would typically involve fixed plant fires. This also includes the gas fired power generation plant and Amadeus Basin to Darwin high pressure gas pipeline. Causes include: - Electrical fires (penetration of cables, lightning strike, poor electrical equipment design, faulty wiring, overloading equipment, water / dust ingress, aged / damaged equipment etc.); - Hazardous substance fires or explosions e.g. diesel, LPG, natural gas (hot work in vicinity of flammable materials, static electricity, impact from machinery, leaking valves / pipes, poor transportation or storage, excavation into pipeline etc.); - Friction fires e.g. conveyors, pumps, fans (worn, aged or damaged equipment, loss of lubrication / poor maintenance etc.); - Mobile equipment fires (equipment failure, ingress of dust, poor design, inappropriate use, poor housekeeping etc.); - Operational or maintenance activities (poorly controlled hot work, introduced ignition sources etc.);	Human health and safety	Consequences will vary depending on the size and type of fire and extent of exposure. Personnel may be impacted by smoke, heat radiation from the fire or explosion overpressure. Consequences may range from smoke inhalation, minor burns through to fatality. The maximum reasonable consequence is a multiple fatality event as there is potential for multiple personnel to be impacted in a large fire or explosion event. The event may occur at any time throughout the life of the project.	- Fixed plant & mobile equipment design specifications and associated procurement management; - Fixed plant & mobile equipment maintenance program including pre-start inspections and routine maintenance; - Electrical protection systems; - Thermographic monitoring; - Change management; - Lightning arrestors; - Fire resistant & anti static equipment e.g. conveyor belts; - Dust suppression; - Housekeeping; - Procedure for transport and storage of hazardous substances; - Hazardous substance storage and handling system design specifications; - Isolation procedure; - Inspection and maintenance of hazardous substance storage systems; - Excavation / dig permit; - Gas pipeline design and SMS (AS 2884); - Signage and demarcation of gas pipeline; - Competent maintainers; - Hot work procedure and permit; - Fire breaks; - Fire detection and suppression systems, fire extinguishers and fire fighting training; - Fire management plan;	Catastrophic	Rare	Medium	Low Level	No additional controls	Catastrophic	Rare	Medium	Low Level		Appendix O, Chapter 11 - Human Health and Safety
49	Personnel impacted by an explosives incident during transport, handling, storage or use on site. Potential incidents include misfires, fly rock, person in proximity to a blast and unintended initiation of an explosion. Causes include: - Transport incidents (vehicle collision / impact, inappropriate transport e.g. incompatible materials, vehicle fire etc.); - Storage incidents (lightning strike, security failure, poor stock management, external impact, proximity of magazine to other hazards, external fires etc.); - Incidents during charging & firing (external impact to detonators, poor handling practices e.g. external ignition, stray current, poor mixing technique, digging into misfires, equipment / product failure, unintended access to blast zone, failure to establish sufficient exclusion zone, incorrect firing sequence / pattern / layout etc.)	Human health and safety	Consequences will vary depending on the type of exposure and proximity to the event. Personnel may be impacted directly by the explosives (overpressure effects), struck by fly rock or overcome by explosives fumes. Consequences may range from minor injury through to fatality. The maximum reasonable consequence is a single fatality as it is most likely to be a violation leading to a fatality event which would involve a single person. The event may occur at any time throughout the life of the project.	- Procedures for transport, storage and handling of explosives (in accordance with statutory requirements); - Competency and authorisation process for personnel to handle explosives; - Design standards for explosives transport vehicles and magazines; - Inspection and maintenance regime for explosives transport vehicles and magazine; - Explosives transport boxes; - Magazine location selected as far as possible away from personnel and operation areas; - Magazine access restricted to authorised personnel only; - Magazine stock management procedure including segregation, stock rotation etc.: - Explosives & shot firing equipment approved for mine use; Blast design; - Access restrictions for blasting activities; - Procedure for treating misfires including survey pick-up of misfires. - Operations supervision; - Emergency response procedures, team and equipment.	Major	Rare	Medium	Low Level	No additional controls	Major	Rare	Medium	Low Level		Appendix O, Chapter 11 - Human Health and Safety

Ref.	Impact pathway			Planned Controls to Manage Risk (as per Project Description, and elements of Standards / Codes of Practice	Initial Risk			Level of Certainty	Additional Controls Recommended to Reduce Risk	Residual Risk			Level of Certainty	Comment	Applicable Technical Report / EIS chapter
	Potential event (how the Project interacts with assets, values, uses and location. Include clear description of the cause)	**Environmental Factor / Receptor**	**Description of consequences** (Clearly understand what is the final impact. Describe whether it is construction, operation or decommissioning)		Consequence	Likelihood	Risk Rating			Consequence	Likelihood	Risk Rating			
50	Personnel impacted by a tyre or rim incident associated with mobile equipment. Incidents may occur during tyre maintenance activities, or while operating equipment with tyres and includes fire, explosion, dropped tyre and rapid air pressure release. Causes include: - Tyre fire or explosion (manufacturing defects, damage, hot work in vicinity of tyres, contact with electrical source, poor inflation management, vehicle overload / excessive travel, lightning strike, external heat source e.g. bushfire, vehicle fire etc.); - Pressure release / rim ejection (damaged rim pieces, tyre overloading, tyre not deflated prior to changing / poor tyre changing practices etc.); - Dropped tyre (tyre handler failure, restricted work area, unplanned movement of load, incorrect storage etc.)	Human health and safety	Consequences will vary depending on the type of exposure and proximity to the event. Personnel may experience projectile / pressure impacts due to tyre pressure release, burns or pressure impacts from tyre fires and crush injuries due to dropped tyres. Consequences may range from minor injury through to fatality. The maximum reasonable consequence is a single fatality. The event may occur at any time throughout the life of the project.	Tyres and Rims Management Plan including: - Tyre and rim design specifications and associated procurement management; - Tyre & rim inspection and maintenance regime including pre-start inspections and routine maintenance / change out; - No hot work on rim when tyre is fitted; - Signage & demarcation of electrical cables; - Procedure for working near overhead powerlines; - Tyre management standard; - Wheel change procedure; - Tyre fire procedure; - Tyre and rim safety procedure; - Fire extinguishers & suppression on mobile equipment; - TKPH monitoring of tyres; - Fit for purpose tyre handling equipment and dedicated tyre handling facility; - Mobile equipment operating procedures and operator competency; - Competency of tyre maintainer; - Tyre cage; - Emergency response procedures, team and equipment; - Operations supervision.	Major	Unlikely	Medium	Low Level	No additional controls	Major	Unlikely	Medium	Low Level		Appendix O, Chapter 11 - Human Health and Safety
51	Personnel exposed to a flood or inrush event into the pit or personnel exposed to flooding within the mine lease e.g. low lying vehicle crossings or dam failures. Includes natural occurring events (extreme weather), dam failure, major piping failure, connection to old workings or underground aquifers etc. Dams (tailings and residue storage facilities) include flotation tailings, water leach residue, neutralisation residue, phosphate residue, evaporation ponds. Causes include: - Natural event flooding (failure of drainage system insufficient sump / pump capacity, accessing flooded crossings etc.) - Ground water / aquifer interactions (failure to identify volume of water during planned breakthrough, unplanned breakthrough to aquifer etc.); - Dam / pond failure (wall erosion, inappropriate design, insufficient capacity etc.)	Human health and safety	Consequences will vary depending on the extent of material released and the material being released. Ground water and flooding events may result in injury e.g. due to slips, trips & falls through to fatality e.g. due to being trapped in a submersed vehicle / drowning. Dam failures may result in injury e.g. due to exposure to tailings products through to fatality from engulfment. The maximum reasonable consequence is a single fatality on the basis of the proximity of personnel to dams and anticipated volumes of material released.	- Drainage and pump system design; - Drainage and pump system inspection and maintenance regime; - Water management plan; - Trigger action response plans; - Weather monitoring; - Adverse weather procedure; - Mine design (including review and sign-off processes); - Mine modelling & mapping (hydrogeological, geological, exploration data etc.); - Tailings & residue storage facility level management plan; - Tailings & residue storage facility design including HDPE liner, basin drainage & leakage collection system; - Tailings & residue storage facility inspections including monitoring bores, embankment piezometers, embankment survey pins; - Operations supervision; - Emergency response procedures, team and equipment.	Major	Rare	Medium	Low Level	No additional controls	Major	Rare	Medium	Low Level		Appendix O, Chapter 11 - Human Health and Safety
52	Personnel struck by falling or dropped objects including structural failure. Dropped objects may include tools, RE material, pieces of equipment etc. Structures include buildings, concentrator, conveyors, bins, crushers etc. Objects may fall randomly, therefore person may or may not be in the area, others may fall as a result of operational activities. This includes material falling from conveyors / chutes etc. Causes include: - Falling equipment / components from structures (poor design, poor material selection, high winds, worn / aged / damaged e.g. due to vibration, impact, corrosion etc.); - Falling product / material (poor equipment design, conveyor overload / surge, blocked chutes, product build up over time, hang ups etc.) - Handled items / tools dropped when working above (unintentionally kicked or dropped objects, poor work area set up, poor stacking / restraining practices etc.)	Human health and safety	Consequences will vary depending on the size of the item that falls and the height from which it falls, ranging from an injury to a fatality. The maximum reasonable consequence would be a single fatality. The event may occur at any time throughout the life of the project.	- Structural and equipment design specifications; - Structural and equipment inspection and maintenance regime including corrosion control; - Housekeeping including regular wash down: - Process plant design e.g. weightometers, limit switches & interlocks, vibration monitoring, level sensors; - Catch trays / mesh above walkways; - Plant operational process control; - Adverse weather procedure; - Change management; - Restricted access / barriers in locations with risk of falling objects; - Hazard identification; - Tool belts & bags; - Tool restraint devices (lanyards, mats etc.); - Kickboards and mesh between handrails on elevated walkways; - Task specific procedures; - Operations supervision; - Emergency response procedures, team and equipment.	Major	Unlikely	Medium	Low Level	No additional controls	Major	Unlikely	Medium	Low Level		Appendix O, Chapter 11 - Human Health and Safety
53	Personnel caught in rotating or moving equipment. This may occur during construction or operations. Personnel may be exposed to fixed and mobile equipment on site including conveyors, motors, pumps, crushers, separators, screens, engine bays, drills etc. Causes include: - Guarding failures (failure to replace guards, bypassing guards, interlock failure, modifications to guards, defective / damaged guards etc.); - Isolation failure (non compliance, equipment failure, lack of isolation points, incorrect isolation etc.)	Human health and safety	Consequences will vary depending on the equipment personnel are drawn into and how they are drawn in, potentially resulting in entanglement and entrapment. This may lead to crush injuries e.g. fingers, amputation of limbs or fatality. The maximum reasonable consequence would be a single fatality. The event may occur at any time throughout the life of the project.	- Equipment design specifications and associated procurement management includes guarding & interlock requirements; - Equipment maintenance program including pre-start inspections and routine maintenance; - Fixed plant design to relevant standards; - Change management; - Guarding audits; - Isolation procedure and associated training; - Equipment and task specific procedures / work instructions; - Equipment and task specific training and competency assessment (including ongoing refresher); - Area layout and design to provide sufficient space; - Operations supervision; - Emergency stops / pull wires; - Emergency response procedures, team and equipment.	Major	Rare	Medium	Low Level	No additional controls	Major	Rare	Medium	Low Level		Appendix O, Chapter 11 - Human Health and Safety

Ref.	Impact pathway			Planned Controls to Manage Risk (as per Project Description, and elements of Standards / Codes of Practice	Initial Risk			Level of Certainty	Additional Controls Recommended to Reduce Risk	Residual Risk			Level of Certainty	Comment	Applicable Technical Report / EIS chapter
	Potential event (how the Project interacts with assets, values, uses and location. Include clear description of the cause)	**Environmental Factor / Receptor**	**Description of consequences** (Clearly understand what is the final impact. Describe whether it is construction, operation or decommissioning)		Consequence	Likelihood	Risk Rating			Consequence	Likelihood	Risk Rating			
54	Personnel impacted by a high pressure release (stored energy). This may occur during construction or operations. This includes high pressure release from pipes and storage vessels where personnel may be impacted either by fluid injection or struck by flying debris. Fluids may include grease, air, hydraulics, water, natural gas etc. Causes include: - Equipment factors (poor design e.g. incorrect material rating, poor installation, aged / damaged equipment, overpressure etc.); - Human factors (failure to effectively isolate, operating outside specifications etc.); - External factors (fire impact, external mechanical damage etc.)	Human health and safety	Consequences will vary depending on the pressure at time of release, proximity of personnel to the release and the material released. This may lead to fluid injection injuries if personnel are in close proximity or they may be struck by flying debris resulting in either an injury or fatality if the object is large enough or where it strikes the person. The maximum reasonable consequence would be a single fatality. The event may occur at any time throughout the life of the project.	- Equipment design specifications and associated procurement management - includes pressure rating, pressure relief, exclusion zones etc., based on relevant design standards; - Equipment maintenance program including pre-start inspections, routine maintenance and statutory pressure vessel inspections; - Change management; - Equipment and task specific procedures / work instructions; - Equipment and task specific training and competency assessment (including ongoing refresher); - Isolation procedure and associated training; - Hot work procedure and permit; - Fire detection and suppression systems, fire extinguishers and fire fighting training; - Operations supervision; - Emergency response procedures, team and equipment.	Major	Rare	Medium	Low Level	No additional controls	Major	Rare	Medium	Low Level		Appendix O, Chapter 11 - Human Health and Safety
55	Personnel drowning while working in or around liquid bodies. Liquid bodies include tailings and residue storage facilities (flotation tailings, water leach residue, neutralisation residue, phosphate residue, evaporation ponds), sumps, water ways, tanks, etc. Liquid bodies will be present in the pit, processing plant, tailings and residue storage areas, water and waste treatment plants. Causes include slips, trips and falls (e.g. due to slippery surface, uneven ground), ground failure at edge of storage facility, unintended vehicular entry into liquid bodies (pit sumps, TSF's), failure to identify liquid body (e.g. poor visibility) and handrail / edge protection failure.	Human health and safety	Consequences may include minor injuries e.g. due to trips and falls through to fatality (drowning). The maximum reasonable consequence would be a single fatality. The event may occur at any time throughout the life of the project.	- Adverse weather procedure; - Tailings & residue storage facility level management plan; - Tailings & residue storage facility design including HDPE liner, basin drainage & leakage collection system; - Tailings & residue storage facility inspections including monitoring bores, embankment piezometers, embankment survey pins; - Bunds around pit sump edges, TSF embankments; - Working in and around liquid bodies procedure; - Portable edge protection; - Restricted access to tailings & residue storage facility; - Sump / pit design including demarcation and barricading; - Sump / pit inspection and maintenance program; - Personal flotation device; - Rope ladders installed at intervals around ponds; - Life rings installed around liquid bodies; - Operations supervision; - Emergency response procedures, team and equipment.	Major	Rare	Medium	Low Level	No additional controls	Major	Rare	Medium	Low Level		Appendix O, Chapter 11 - Human Health and Safety
56	Personnel exposed to hazardous materials via all means e.g. ingestion, inhalation or skin contact. Materials include sulphur, lime, limestone, hydrochloric acid, HF, sodium hydroxide, sodium sulphate, sulphuric acid, barium chloride, sodium carbonate, chlorine, fire suppression chemicals, RE concentrate, tailings, sewage etc. Causes include: - Transport & storage releases (leaks from tanks, containers, piping, valves etc., incompatible storage, external impact to storage facility, transport vehicle collision, overfill etc.) - Handling, use & disposal (inappropriate use, isolation failure, inappropriate disposal, poor identification / labelling of materials, overflow or overpressure event etc.)	Human health and safety	Consequences will vary depending on the material personnel are exposed to, the means of exposure and the duration of exposure. Consequences range from: - irritation to skin, eyes and respiratory system e.g. due to exposure to sulphur, lime, limestone, sodium sulphate, barium chloride, sodium carbonate; - bronchitis and silicosis e.g. due to prolonged inhalation exposure to lime; - severe chemical burns and potentially fatality e.g., due to exposure to hydrochloric acid, sulphuric acid, and sodium hydroxide; - respiratory & heart failure and potentially fatality due to ingestion of barium chloride. The maximum reasonable consequence would be a multiple fatality, for example due to a catastrophic failure of the concentrated sulphuric acid tank. The event is most likely to occur during the operations phase of the project.	- Storage, handling and spill management requirements as specified in the Safety Data Sheets, ChemAlert database and legislative requirements for the transport and storage of dangerous goods; - Hazardous substance storage and handling system design specifications; - Inspection and maintenance of hazardous substance storage systems; - Spill kits; - Procedure for transport and storage of hazardous substances; - Equipment and task specific procedures / work instructions; - Equipment and task specific training and competency assessment (including ongoing refresher); - Isolation procedure and associated training; - Plant process control; - PPE (eye protection, breathing apparatus, gloves etc.); - Signage / labelling of equipment containing hazardous substances; - Site induction coverage;	Catastrophic	Rare	Medium	Low Level	No additional controls	Catastrophic	Rare	Medium	Low Level		Appendix O, Chapter 11 - Human Health and Safety
57	Personnel impacted by climatic extremes while working on site in adverse weather conditions. This includes high winds, lightning, storms, hail, heat, UV radiation etc. Personnel may be impacted by climate extremes through flying debris or structural collapse in high winds, struck by lightning or experience heat stress when working in hot conditions either due to the local climate or in hot plant areas.	Human health and safety	Consequences will vary depending on the type of exposure, where effects may range from dehydration, sunburn, injuries from being struck by items through to fatality due to heat stroke, struck by lightning or major building / structural failures. The maximum reasonable consequence would be a single fatality as it is considered unlikely for multiple people to be impacted by a single climatic event. The event may occur at any time throughout the life of the project.	- Structural and equipment design specifications including wind loading, ventilation, lagging of hot surfaces etc.; - Structural and equipment inspection and maintenance regime; - Fitness for work management system including hours of work, drug & alcohol policy, medicals, fatigue management etc.); - Lightning arrestors; - Lightning tracking and stop work and refuge procedures; - Weather monitoring; - Adverse weather procedure; - Trigger action response plans; - Lone and isolated workers procedure; - PPE - heat reducing clothing; - Heat stress / hydration monitoring; - Use of camel backs, electrolyte replacement drinks; - Scheduling work to avoid hottest time of day; - Communication protocols; - Housekeeping; - Operations supervision; - Emergency response procedures, team and equipment. - Site induction coverage;	Major	Rare	Medium	Low Level	No additional controls	Major	Rare	Medium	Low Level		Appendix O, Chapter 11 - Human Health and Safety

Ref.	Impact pathway			Planned Controls to Manage Risk (as per Project Description, and elements of Standards / Codes of Practice	Initial Risk			Level of Certainty	Additional Controls Recommended to Reduce Risk	Residual Risk			Level of Certainty	Comment	Applicable Technical Report / EIS chapter
	Potential event (how the Project interacts with assets, values, uses and location. Include clear description of the cause)	Environmental Factor / Receptor	Description of consequences (Clearly understand what is the final impact. Describe whether it is construction, operation or decommissioning)		Consequence	Likelihood	Risk Rating			Consequence	Likelihood	Risk Rating			
58	Engulfment of personnel in RE materials while working on site on stockpiles, ROM or around bins, hoppers, chutes etc. Personnel may be engulfed while on foot or in mobile equipment. Causes include: - Engulfment from bins, hoppers & chutes (equipment damage, isolation failure, external impact, process control failure, hang ups etc.) - Stockpile engulfment (unauthorised access, poor stockpile management, poor stockpile stability etc.)	Human health and safety	Consequences will vary depending on the volume of material in which personnel are engulfed and the ability to self rescue. The maximum reasonable consequence would be a single fatality. The event may occur at any time throughout the life of the project.	- RE materials storage systems design specifications; - RE materials storage systems inspection and maintenance regime; - Equipment and task specific procedures / work instructions; - Equipment and task specific training and competency assessment (including ongoing refresher); - Isolation procedure and associated training; - Plant process control; - Confined space entry procedure; - Stockpile & ROM management procedures and associated competency; - Dust suppression; - Stockpile design including angle of repose, drainage etc.; - Restricted access to stockpiles; - Area lighting; - Operations supervision; - Emergency response procedures, team and equipment.	Major	Rare	Medium	Low Level	No additional controls	Major	Rare	Medium	Low Level		Appendix O, Chapter 11 - Human Health and Safety
59	Personnel exposed to hazardous flora or fauna including snakes, spiders, mosquitoes, biting insects, bees, wasps, larger animals such as dingoes / wild dogs, wild pigs etc.	Human health and safety	Consequences will vary depending on the flora or fauna to which personnel come into contact and whether or not they have an allergic reaction to bites / stings. The maximum reasonable consequence would be a single fatality. The event may occur at any time throughout the life of the project.	- PPE - Safety boots, long pants etc.; - Induction covering risk; - Snake awareness training; - Vegetation management program; - Snake bites kits and associated first aid training; - Competent snake handlers; - Pest control program (insects, spiders, dingoes, etc.); - Lone and isolated workers procedure; - Communication protocols; - Operations supervision; - Emergency response procedures, team and equipment; - Site induction coverage;	Major	Rare	Medium	Low Level	No additional controls	Major	Rare	Medium	Low Level		Appendix O, Chapter 11 - Human Health and Safety
60	Unauthorised site access / security breach during construction and operation. This includes all unauthorised access to site and other restricted areas. Access may occur as an intended event or may be unintentional, in both circumstances those entering site will be in danger and may potentially put site personnel in danger. This also includes site personnel accessing site / restricted areas with the intention to cause harm, sabotage and protesters etc.	Human health and safety	Consequences will vary depending on the location of unauthorised access and the reason for access (e.g. if they are deliberately causing harm). Personnel may be exposed to many of the site hazards including mobile equipment movements, residue storage facilities, hazardous chemical etc. The maximum reasonable consequence would be a single fatality. Production losses of 1 week ? The event may occur at any time throughout the life of the project.	- Site security and access restrictions including signage and fencing; - Security management plan; - Additional access restrictions to high risk areas e.g. substations, explosives magazine; - Procedure for escorting visitors; - Contactor management system; - Media communication protocols / plan; - Employee assistance program; - Community engagement program; - Operator observations and reporting; - Emergency response procedures, team and equipment.	Major	Rare	Medium	Low Level	No additional controls	Major	Rare	Medium	Low Level		Appendix O, Chapter 11 - Human Health and Safety
61	Personnel exposed to increased noise levels during operation of the mine, processing plant and associated infrastructure. Noise sources include mobile equipment operations (e.g. engine noise, braking, exhaust, dozer tracks, hydraulics, horns etc.), alarms, dust extraction systems, crushers, screens, ventilation systems, blasting, pneumatic tools etc.	Human health and safety	Consequences of cumulative noise exposure will be an increased risk of industrial noise induced hearing loss (NIHL). The event may occur at any time throughout the life of the project.	- Equipment design specifications include noise limits and associated acoustic attenuation requirements etc.; - Sealed mobile equipment cabs with noise suppression; - Preventative maintenance program for cabins (seals, pressure, noise level test); - Hearing protection; - Hearing protection training; - Signage to indicate areas where hearing protection is required; - Mobile and fixed plant inspection and maintenance program; - Job rotation; - Fitness for work management system including hours of work, drug & alcohol policy, medicals, fatigue management etc.); - Equipment and task specific procedures / work instructions; - Equipment and task specific training and competency assessment (including ongoing refresher); - Noise monitoring program; - Worker audiometry testing; - Site induction coverage;	Major	Unlikely	Medium	Low Level	No additional controls	Major	Unlikely	Medium	Low Level		Appendix O, Chapter 11 - Human Health and Safety
62	Personnel exposure to whole body vibration during operation of mobile equipment in mining operations. This includes track and rubber tyre equipment activities such as ripping, pushing, tramming and hauling leading to repetitive jolts and jarring.	Human health and safety	Consequences of whole body vibration will ultimately be muscular skeletal disorders. The event is most likely to occur during the operational phase of the project.	- Vehicle design specifications and associated procurement management includes vibration criteria; - Vehicle maintenance program including pre-start inspections and routine maintenance; - Road design to relevant standards; - Road maintenance program, including dust suppression; - Fitness for work management system including hours of work, drug & alcohol policy, medicals, fatigue management etc.); - Job rotation; - Equipment and task specific procedures / work instructions; - Equipment and task specific training and competency assessment (including ongoing refresher);	Moderate	Unlikely	Medium	Low Level	No additional controls	Moderate	Unlikely	Medium	Low Level		Appendix O, Chapter 11 - Human Health and Safety

Ref.	Impact pathway			Planned Controls to Manage Risk (as per Project Description, and elements of Standards / Codes of Practice	Initial Risk			Level of Certainty	Additional Controls Recommended to Reduce Risk	Residual Risk			Level of Certainty	Comment	Applicable Technical Report / EIS chapter
	Potential event (how the Project interacts with assets, values, uses and location. Include clear description of the cause)	**Environmental Factor / Receptor**	**Description of consequences** (Clearly understand what is the final impact. Describe whether it is construction, operation or decommissioning)		Consequence	Likelihood	Risk Rating			Consequence	Likelihood	Risk Rating			
63	Personnel exposed to increased risks due to the remote location of the site and / or undertaking lone and isolated work. This includes individuals undertaking unsupervised work or working in an isolated area. Includes any incident where time for response is increased due to insufficient access to communications and monitoring networks as well as emergency, health and vehicle breakdown services. Personnel conducting remote or isolated work may include exploration crews (drillers, geologists etc.), surveyors, shot firers, pump crew, supervisors and environmental specialists, third party contractors (electrical personnel, fitters etc.). The remote location of the site increases the risk to personnel due to the increased time for emergency response, potential communication failures and black spots, long travel distances etc.	Human health and safety	Although the initial injury may not be immediately life threatening, there is potential for the situation to escalate due to the distance and time it takes for medical aid. The maximum reasonable consequence would be a single fatality. The event may occur at any time throughout the life of the project.	- Fitness for work management system including hours of work, drug & alcohol policy, medicals, fatigue management etc.); - Weather monitoring; - Adverse weather procedure; - Trigger action response plans; - Lone and isolated workers procedure/protocols; - Journey management plans; - Communication protocols; - Communication equipment suitable for the area and activity; - Vehicles fitted with recovery equipment, first aid kits, water supply etc; - Emergency response procedures, team and equipment; - Man down alarms.	Major	Rare	Medium	Low Level	No additional controls	Major	Rare	Medium	Low Level		Appendix O, Chapter 11 - Human Health and Safety
64	Manual handing injuries during manual work conducted on site across the operations. Personnel may sustain injuries due to poor lifting technique, poor workplace and work station layout, incorrect working posture and position, extended duration or frequency of task, over reaching or extending when handling a load, loads moved excessive distances, lifting loads that are too heavy or bulky, tools and equipment unavailable, poor work environment e.g. slippery surfaces, confined or restricted work areas.	Human health and safety	Manual handling injuries may include back injuries such as injuries to nerves, bones, joints and soft tissue hernias, ruptured discs and torn back muscles. Other consequences may include sprains of ligaments, strains of muscles or tendons, tendonitis, spondylolisthesis, carpel tunnel syndrome and Repetitive Strain Injury (RSI). The maximum reasonable consequence would be musculoskeletal effects to bones and soft tissue structures. The event may occur at any time throughout the life of the project.	- Manual handling training; - Plant and equipment design specifications include manual handling / ergonomic requirements; - Fit for purpose lifting aids; - Change management; - Equipment and task specific procedures / work instructions; - Equipment and task specific training and competency assessment (including ongoing refresher); - Fitness for work management system including hours of work, drug & alcohol policy, medicals, fatigue management etc.); - Job rotation; - Area layout and design to provide sufficient space; - Operations supervision; - Site induction coverage;	Moderate	Unlikely	Medium	Low Level	No additional controls	Moderate	Unlikely	Medium	Low Level		Appendix O, Chapter 11 - Human Health and Safety
65	Radiation exposure to personnel on site. Exposure may occur through the following routes: - via direct gamma 'shine' or direct irradiation from large masses of low specific activity material or smaller masses of high specific activity material; - via inhalation of long-lived alpha-emitting radionuclides (U, Th, Ra, Po) in airborne ore dust, process dust, product dust, or tailings dust; - via inhalation of short-lived radon decay products (radon and thoron daughters)	Radiation	Worst credible consequence to human health and safety of workers, is the potential for measurable increase to radiation exposure, up to 20 mSv per year associated with workers in the mine.	- Compliance with relevant legislative requirements as provided by the Australian Radiation Protection and Nuclear Safety Agency; - Radiation Management Plan (RMP) (including Regulator approval); - Radioactive Waste Management Plan (RWMP) (including Regulator approval); - Plant and process design specifications include radiation exposure considerations including automation where possible, minimising maintenance times to allow quick change out, shielding of specific equipment etc.; - Building design specifications include radiation exposure considerations including ventilation requirements; - Operations procedures include radiation exposure considerations; - Access restrictions to areas of higher radiation levels; - Dust suppression systems e.g. roads, stockpiles, tipping points, conveyors, crushers etc.; - Dust collection systems and scrubbers; - Mobile equipment design specifications include filtered air conditioned air supply (HEPA filters); - Radiation monitoring program; - Job rotation; - Radiation Safe Work Permit; - PPE - respiratory protection; - Personnel wash facilities and mobile equipment wash bays; - Site induction coverage	Moderate	Rare	Low	Low Level	Monitoring program will identify any changes from original assumptions, with review and implementation of additional suitable planned controls.	Moderate	Rare	Low	Low Level	With the proposed controls it is not anticipated that worker exposure will reach (or exceed) the national worker dose limit of 20 millisieverts per year. Maximum reasonable exposure level may be frequent (daily) exposure at minor concentrations less than 10% of occupational exposure limits however there may be infrequent exposure at low concentrations greater than 10% but still less than 50% of occupational exposure limits. This is supported by the historical evidence from other Australian sites that record annual doses of approximately 5% to 10% of occupational exposure limits. At these low concentrations, it is expected there would be negligible impact on human health.	Appendix P, Chapter 12 - Radiation
66	Public radiation exposure as a result of emissions from the Project. Exposure may occur through the following routes: - via direct gamma 'shine' or direct irradiation from large masses of low specific activity material or smaller masses of high specific activity material; - via inhalation of long-lived alpha-emitting radionuclides (U, Th, Ra, Po) in airborne ore dust, process dust, product dust, or tailings dust; - via inhalation of short-lived radon decay products (radon and thoron daughters) - via ingestion of radionuclides in foods	Radiation	Worst credible consequence to human health and safety of public located at nearby off-site receptor, is the potential for measurable increase to radiation exposure, up to 1 mSv per year.	- Compliance with relevant legislative requirements including the Code of Practice on Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing, 2005 (RPS #9) and Code of Practice for Safe Transport of Radioactive Materials 2008 (RPS #2); - Radiation Management Plan (RMP); - Radioactive Waste Management Plan (RWMP); - Plant and process design specifications to minimize emissions - Dust suppression systems e.g. roads, stockpiles, tipping points, conveyors, crushers etc.; - Dust collection systems and scrubbers; - Dust deposition monitoring.	Insignificant	Rare	Low	Low Level	No additional controls	Insignificant	Rare	Low	Low Level	Modelling conducted for EIS shows doses less than 10% of public limit at public sensitive receptors	Appendix P, Chapter 12 - Radiation
67	Off site radiation dose via the consumption of local bush foods (plant or animal) which have been exposed to elevated levels of radiation through air emissions or surface or groundwater dispersion.	Radiation	Worst credible consequence to human health and safety of traditional owners and their families, is the potential for measurable increase to radiation exposure, above 1 mSv per year (average) or above 5mSv/y in any one year	- Bunded pipeline, designed for 6 hour capacity at maximum flow rate; - Process shutdown; - Pressure sensors; - Flow meters; - Design - deflector screens on welded joints	Insignificant	Rare	Low	Medium Level	Monitoring program will identify any changes from original assumptions, with review and implementation of additional suitable planned controls.	Insignificant	Rare	Low	Medium Level	Conservative radiological impact indicates that potential ingestion doses are low	Appendix P, Chapter 12 - Radiation

Ref.	Impact pathway			Planned Controls to Manage Risk (as per Project Description, and elements of Standards / Codes of Practice	Initial Risk			Level of Certainty	Additional Controls Recommended to Reduce Risk	Residual Risk			Level of Certainty	Comment	Applicable Technical Report / EIS chapter
	Potential event (how the Project interacts with assets, values, uses and location. Include clear description of the cause)	**Environmental Factor / Receptor**	**Description of consequences** (Clearly understand what is the final impact. Describe whether it is construction, operation or decommissioning)		Consequence	Likelihood	Risk Rating			Consequence	Likelihood	Risk Rating			
68	Unintentional or emergency release of radioactive gases or residues	Radiation	Worst credible consequence is rupture or split in line between the RE Intermediate process plant and the RSF, with loss of slurry material. Maximum discharge is assumed to be over a 6 hour period.	- Competent development and assessment of radionuclide balance; - Radiation Management Plan (RMP); - Radioactive Waste Management Plan (RWMP); - Personnel wash facilities and mobile equipment wash bays;	Insignificant	Possible	Low	Medium Level	Controlled clean up; Material deposited to RSF	Insignificant	Possible	Low	Medium Level		Appendix P, Chapter 12 - Radiation
69	Limited understanding of radionuclide deportment results in radioactive elements concentrating and partitioning in the processing circuits, waste storage facilities and waste storage facility seepage / discharges	Radiation	Worst credible consequence is unintended or unknown exposure to workers, at levels of less than 5 mSv	- Compliance with relevant legislative requirements including the Code of Practice on Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing, 2005 (RPS #9) and Code of Practice for Safe Transport of Radioactive Materials 2008 (RPS #2); - Radiation Management Plan (RMP); - Radioactive Waste Management Plan (RWMP); - Plant and process design specifications to minimise emissions; - Operations procedures include radiation exposure considerations; - Dust suppression systems e.g. roads, stockpiles, tipping points, conveyors, crushers etc.; - Dust collection systems and scrubbers; - Radiation monitoring program;	Minor	Unlikely	Low	Medium Level	No additional controls	Minor	Unlikely	Low	Medium Level	Processing plant radionuclide deportment characterisation has been completed and reported	Appendix P, Chapter 12 - Radiation
70	Radiation exposure to non human biota as a result of emissions from the Project. Exposure may occur through deposition of long-lived alpha-emitting radionuclides (U, Th, Ra, Po) in airborne ore dust, process dust, product dust, or tailings dust	Radiation	Worst credible consequence is impact to populations of listed threatened species or domestic stock, with radiation exposure exceeding the trigger level (of 10 uGy/h).	- Compliance with relevant legislative requirements including the Code of Practice on Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing, 2005 (RPS #9) and Code of Practice for Safe Transport of Radioactive Materials 2008 (RPS #2); - Radiation Management Plan (RMP); - Radioactive Waste Management Plan (RWMP); - Plant and process design specifications include radiation exposure considerations including automation where possible, minimising maintenance times to allow quick change out, shielding of specific equipment etc.; - Operations procedures include radiation exposure considerations; - Dust suppression systems e.g. roads, stockpiles, tipping points, conveyors, crushers etc.; - Dust collection systems and scrubbers; - Radiation monitoring program;	Insignificant	Rare	Low	Medium Level	No additional controls	Insignificant	Rare	Low	Medium Level	Note that for stock, the mine lease area is destocked. Assessment conducted for EIS and impacts shown to be negligible	Appendix P, Chapter 12 - Radiation
71	Off site radioactive contamination due to plant and/or equipment contaminated with ore or process materials leaving the site while still contaminated.	Radiation	Radioactive contamination outside of operation resulting in minor dose to the public	Develop and implement a Radiation Management Plan, including requirements for wheel wash, physical inspections, procedures to ensure that nothing leaves site without a radiation check.	Insignificant	Possible	Low	Medium Level	No additional controls	Insignificant	Possible	Low	Medium Level		Appendix P, Chapter 12 - Radiation
72	Excessive radiation exposure to construction workers, prior to operations, due to outcropping ore	Radiation	Radiation exposure to construction workers exceeding the member of the public limit	Develop and implement a Radiation Management Plan, including monitoring during construction, identification of radiation exposures (from monitoring), where exposures may be high, workers may be designated as radiation workers (i.e.; added surveillance and monitoring); Inductions for construction workforce	Minor	Possible	Medium	Medium Level	Sample monitoring of a number mine site construction workforce to validate low exposure predictions.	Minor	Possible	Medium	Medium Level		Appendix P, Chapter 12 - Radiation
73	Build up of radionuclide concentrations in the pit lake sediments	Radiation	Elevated concentration of radionuclides in pit lake water resulting in build-up of concentrations	Radionuclide concentration modelling	Insignificant	Rare	Low	Medium Level	No additional controls	Insignificant	Rare	Low	Medium Level	Radionuclide concentration would be physically unable to exceed the predicted maximum concentration which is the radionuclide concentration divided by the precipitant concentration (or salt concentration). Conservative assumption is that all dissolved radionuclides in groundwater entering the pit are precipitated with the salts.	Appendix P, Chapter 12 - Radiation
74	Closure designs not developed in detail to enable appropriate closure execution, resulting in significantly higher closure cost above closure provisioning.	Mine closure	Insufficient closure cost provision resulting in inability to execute closure plan. Delays or inability to achieve effective rehabilitation by Project proponent, (e.g. closure design or materials not adequate causing erosion, or contaminated seepage resulting in non sustainable ecosystems and downstream effects). Delays in achieving rehabilitation criterion and or relinquishment and could be period of several years.	- Conceptual closure plan developed for the project at start-up. - Annual review of concept plans with updated estimates of disturbance with associated rehabilitation estimates. - Regular monitoring of identified key environmental aspects of operation that are potentially most problematic during operation and at closure i.e. tailings, waste rock, seepage to ensure these aspects are fully understood and accounted for in all closure designs and proposals.	Major	Unlikely	Medium	Medium Level	- Increase level detail in closure designs during operations (detailed design level 5yrs prior to closure) - Prepare decommissioning and rehabilitation plan - WRD/TSF constructed in stages with progressive rehab where appropriate	Major	Unlikely	Medium	Medium Level		Appendix W, Chapter 18 - Rehabilitation, Decommissioning and Closure
75	Closure plan not accepted by Dept. of Mines and Energy (DME), including due to lack of stakeholder acceptance, resulting in delays to Project approvals and requirement for more extensive rehabilitation.	Mine closure	Requirement for much more extensive closure plan (e.g. request to provide more detail in plans / depth/design of cover and/or revegetation). Worst credible consequence is inability to relinquish the site to the government post-closure for return to agreed land use, with ongoing environmental impacts	Develop and implement a continuous stakeholder engagement and communications plan for informing local and regional communities and other stakeholders of closure planning processes including agreeing on post-mining land uses, closure objectives, completion criteria and implementation strategies, and include in Closure Plan.	Major	Rare	Medium	Low Level	- Continued stakeholder engagement throughout LOM - Regular update of closure plan throughout LOM	Minor	Unlikely	Low	Low level		Appendix W, Chapter 18 - Rehabilitation, Decommissioning and Closure
76	Poor management of waste materials during operations leads to closure plans being unachievable or costly.	Mine closure	Delays to effective rehabilitation by Project proponent, including through erosion, or contaminated seepage resulting in non sustainable ecosystems and downstream effects. Delays associated with cost overruns could be period of several years.	- Undertake a closure materials balance based on the mine plan and closure design; - Review the long-term dump schedule in relation to the long-term closure plan; - Operational controls on mine waste management (i.e.; waste classification); - Competent operational management personnel and systems	Moderate	Unlikely	Medium	Low Level	Progressive rehabilitation of landforms during operations to limit area of active disturbance and provide proofing of closure designs through field performance (e.g. six WRDs proposed, some could be rehabilitated during operational phase, particularly any visible outer faces)	Moderate	Unlikely	Medium	Low level		Appendix W, Chapter 18 - Rehabilitation, Decommissioning and Closure

Ref.	Impact pathway			Planned Controls to Manage Risk (as per Project Description, and elements of Standards / Codes of Practice	Initial Risk			Level of Certainty	Additional Controls Recommended to Reduce Risk	Residual Risk			Level of Certainty	Comment	Applicable Technical Report / EIS chapter
	Potential event (how the Project interacts with assets, values, uses and location. Include clear description of the cause)	**Environmental Factor / Receptor**	**Description of consequences** (Clearly understand what is the final impact. Describe whether it is construction, operation or decommissioning)		Consequence	Likelihood	Risk Rating			Consequence	Likelihood	Risk Rating			
77	Unexpected early closure of the Project, including due to delays or falling commodity prices.	Mine closure	Delays to effective rehabilitation by Project proponent, including through erosion or contaminated seepage resulting in non sustainable ecosystems and downstream effects. Potentially exacerbated by closure designs not yet developed in detail at time of early closure.	- Long term offtake arrangements for clients; - Strategic long term investors; - Preliminary closure plan; - Commit to developing/refining closure designs through operations; - closure materials topsoils etc. stockpiles at start-up of operations; - WRD/TSF designs conservative and limited impact should they enter early closure as closure concept does not significantly change; - Progressive rehabilitation; - Bonds held by NT Government requires 110% of estimated closure cost reviewed and provided annually.	Moderate	Unlikely	Medium	Medium Level	- Develop detailed closure designs; - Update closure costs estimate every 3 years - Prepare decommissioning and rehabilitation plan; - WRD/TSF constructed in stages with progressive rehabilitation where appropriate; - Care and Maintenance Plan, for short term stop to operations	Moderate	Unlikely	Medium	Medium Level		Appendix W, Chapter 18 - Rehabilitation, Decommissioning and Closure
78	Insufficient funds / bonds for Project closure activities, including due to inadequate closure plan designs, poor assumptions or failure to recognise impact of changes to operations on closure plans	Mine closure	Delays to effective rehabilitation, with unremediated Project site potentially acting as source of ongoing environmental hazard. Worst credible consequence is involuntary administration, with NT Government to complete remediation with bonds shortfall and consequential budgetary impact.	- Robust closure costs estimate with realistic assumptions; - Closure plan/designs planned to be refined during operations; - Closure costs estimate revised annually; - Closure plans audited by regulator prior to approval; - Bonds held as bank guarantee or cash in NT	Moderate	Rare	Low	Medium Level	- Progressive rehabilitation planned which enables reduction in liability during operations and identification of closure design issues.	Moderate	Rare	Low	Medium Level		Appendix W, Chapter 18 - Rehabilitation, Decommissioning and Closure
79	Rehabilitation activities or constructed landforms not conforming or performing to design due to ineffective implementation of design or poor rehabilitation execution or design failure.	Mine closure	Environmental damage caused during rehabilitation works and delays to effective rehabilitation, with unremediated Project site potentially acting as source of ongoing environmental hazard.	- Prepare preliminary closure plan; - Develop detailed designs and tender documents for closure activities during operations and prior to closure works; - Prepare Decommissioning and Rehabilitation plan; - Employ closure project manager; - Undertake inspections & monitoring	Moderate	Rare	Low	Medium Level	- Review plan and design performance and amend as required; - Undertake rework on rehabilitation	Moderate	Rare	Low	Medium Level		Appendix W, Chapter 18 - Rehabilitation, Decommissioning and Closure
80	Contaminated sites not adequately remediated, including Water Leach, Neutralisation and Residue Storage Facilities (RSFs) or Excess Process Liquor Evaporation Ponds, Mill, fuel farms or consumable storage areas.	Mine closure	Delays to effective rehabilitation by Project proponent, including through erosion, or contaminated seepage resulting in non sustainable ecosystems and downstream effects. Delays associated with cost overruns could be period of several years. Inability to relinquish, leading to damage to reputation, not able to get bond, ongoing enviro damage	- Reporting of spills; - Contaminated sites register; - Contaminated sites report; - Contaminated sites rehabilitation designs; - Closure plan. Operator is responsible for site until demonstration that able to meet agreed closure objectives and criteria	Major	Unlikely	Medium	Medium Level	Undertake further sampling/monitoring to accurately define level and extent of any ground contamination and improve volumetric estimates.	Major	Unlikely	Medium	Medium Level		Appendix W, Chapter 18 - Rehabilitation, Decommissioning and Closure
81	Failure of post-closure TSF cover and batters, leading to erosion, contaminated seepage loss of material to the environment	Mine closure	Erosion and dispersion of particulate matter via air, surface, or groundwater flows, with resultant downstream effects on dependant ecosystems.	- Refine the engineering design for all TSF cover designs including evaluation of suitable materials; - Modelled scenarios for loss of cover to assess potential impacts	Moderate	Rare	Low	Medium Level	- Complete cover design trials at site prior to implementation; - Monitor cover performance and adjust design parameters as required.	Moderate	Rare	Low	Medium Level		Appendix W, Chapter 18 - Rehabilitation, Decommissioning and Closure